

Reigate & Banstead Borough Council, Mole Valley District Council and Tandridge District Council

Level 1 Strategic Flood Risk Assessment

Final Report
December 2017





MoleValley District Council



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Revision History

Revision Ref / Date Issued	Amendments	Issued to
Draft v1.0 / 7th June 2017		Rosanna Sterry (Reigate and Banstead Borough Council) Deborah Miles (Mole Valley District Council) Vivienne Riddle (Tandridge District Council) Nick Philpott (Environment Agency)
Final Draft v2.0 / 11th August 2017	Updates to report follow comments and discussion with project partners	Rosanna Sterry (Reigate and Banstead Borough Council) Deborah Miles (Mole Valley District Council) Vivienne Riddle (Tandridge District Council) Nick Philpott (Environment Agency)
Final Report v3.0 / 6th October 2017	Updated in response to DTC consultation with stakeholders.	Rosanna Sterry (Reigate and Banstead Borough Council) Deborah Miles (Mole Valley District Council) Vivienne Riddle (Tandridge District Council) Nick Philpott (Environment Agency)
Final Report v4.0 / 25th October 2017		Rosanna Sterry (Reigate and Banstead Borough Council) Deborah Miles (Mole Valley District Council) Vivienne Riddle (Tandridge District Council)
Final Report v4.0 / 5th December 2017	Updated consultee list	Rosanna Sterry (Reigate and Banstead Borough Council) Deborah Miles (Mole Valley District Council) Vivienne Riddle (Tandridge District Council)



Contract

This report describes work commissioned by Reigate & Banstead Borough Council, on behalf of Reigate & Banstead Borough Council, Mole Valley District Council and Tandridge District Council February 2017. Alistair Clark, Richard Pardoe and Max Brambani of JBA Consulting carried out this work.

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Purpose

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Acknowledgements

JBA Consulting would like to thank Rosanna Sterry of Reigate and Banstead Borough Council, Deborah Miles of Mole Valley District Council, Vivienne Riddle of Tandridge District Council and Nick Philpott at the Environment Agency for their assistance in preparing this report.

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Executive Summary

Introduction

This joint Strategic Flood Risk Assessment (SFRA) 2017 document replaces the existing individual Level 1 SFRAs originally published by Mole Valley District Council (MVDC) in 2009, Reigate and Banstead Borough Council (RBBC) in 2012 and by Tandridge District Council (TDC) in 2015. It forms part of the evidence base for the new Local Plans being prepared by the councils.

The SFRA is a planning tool that will assist the Councils in their selection and development of sustainable development sites away from vulnerable flood risk areas in accordance with the NPPF and its associated Planning Practice Guidance on Flood Risk and Coastal Change.

The report has been prepared to replace the work that was included in the previous SFRAs and to provide appropriate supporting evidence for the three authorities' Local Plans. The Local Plans will set out a vision and framework for development across the area, and will be used to inform decisions on the location of future development and the preparation of sustainable policies for the long-term management of flood risk.

SFRA objectives

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

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

At this stage, Level 1 SFRA has been prepared for the three Councils.

SFRA outputs

- Appraisal of all potential sources of flooding, including Main River, Ordinary Watercourse, surface water, groundwater and sewer flooding
- Updated review of historic flooding incidents
- Mapping of location and extent of functional floodplain
- Reporting on the standard of protection provided by existing flood risk management infrastructure
- An assessment of the potential increase in flood risk due to climate change
- Areas at risk from other sources of flooding, for example reservoirs
- Recommendations of the criteria that should be used to assess future development proposals and the development of a Sequential Test and sequential approach to flood risk

Summary of Level 1 Assessment

The SFRA has considered all sources of flooding including fluvial, surface water, groundwater, sewers and reservoirs within the study area.

Fluvial flood risk is shown to generally be confined to the Main River floodplains such as the River Mole and its tributaries and the Eden Brook. Overall fluvial flood risk is in close proximity to watercourses, with a few areas of more extensive floodplain associated with the Burstow Stream.

Surface water flooding is shown to correlate with small watercourses and urban areas throughout the Councils' areas. Groundwater flood risk is shown to vary across the area with areas of increased groundwater risk around Horley, Lower Kingswood, Walton on the Hill, Whyteleafe and parts of Leatherhead, with recent groundwater flooding occurring in Caterham and Whyteleafe in 2014.

The effect of climate change has been assessed. In most catchments, the extent of Flood Zone 3 is not likely to increase significantly with climate change. Climate change is predicted to result in more frequent and extreme rainfall events, increasing the frequency and severity (depth/hazard) of flooding from fluvial and surface water sources.



Detail in section 5 is given on how flood risk is assessed for planning using the Flood Zones and explains the Sequential Approach. It outlines the sources of national and local flood risk mapping data, information and evidence that has been available for use in this SFRA.

Guidance for planners and developers

Section 6 introduces guidance aimed at both planners and developers. The guidance should be read in conjunction with the NPPF and flood risk guidance from the Environment Agency. The guidance addresses: requirements for development in each of the Flood Zones, making development safe, river restoration and enhancement as part of development, dealing with existing watercourses and assets, developer contributions to flood risk improvements, dealing with surface water runoff and drainage, wastewater, water quality and biodiversity.

Use of SFRA data

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

The SFRA should be periodically updated as appropriate when new information on flood risk, flood warning or new planning guidance or legislation becomes available. New information on flood risk may be provided by Surrey County Council, the Highways Authority, Thames Water, Southern Water and the Environment Agency.

Next steps

It is important to remember that information on flood risk is being updated continuously. As the Councils move forward with their Local Plans, they must use the most up to date information in the Sequential Test, and developers should be aware of the latest information for use in Flood Risk Assessments.

The Flood and Water Management Act (2010), the Localism Act (2011) and the National Planning Policy Framework (2012) all offer opportunities for a more integrated approach to flood risk management and development. As they are in the relatively early stages of developing a Local Plan, the Councils have a real chance to make sure development provides improvements to flood risk overall and enhancements to the river environment.

Planning policies should focus on supporting the lead local flood authority (LLFA) in ensuring that all developments build SuDS into their design and ensure that, right from the concept stage, master planning integrates SuDS and makes space for water within the site design.



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Abbreviations / Glossary

Term	Definition	
AEP	Annual Exceedance Probability	
AStGWF	Areas Susceptible to Groundwater Flooding	
Brownfield	Previously developed parcel of land	
CaBA	Catchment Based Approach - community-led partnerships working to improve water environments	
СС	Climate change - Long term variations in global temperature and weather patterns caused by natural and human actions.	
CFMP	Catchment Flood Management Plan- A high-level planning strategy through which the Environment Agency works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk.	
CIRIA	Construction Industry Research and Information Association	
Defra	Department for Environment, Food and Rural Affairs	
Designated Feature	A form of legal protection or status reserved for certain key structures or features that are privately owned and maintained, but which make a contribution to the flood or coastal erosion risk management of people and property at a particular location.	
DG5 Register	A water-company held register of properties which have reported sewer flooding due to hydraulic overload, or properties which are 'at risk' of sewer flooding more frequently than once in 20 years.	
EA	Environment Agency	
EIA	Environmental Impact Assessment	
EU	European Union	
FEH	Flood Estimation Handbook	
Flood defence	Infrastructure used to protect an area against floods as floodwalls and embankments; they are designed to a specific standard of protection (design standard).	
Flood Risk Area	An area determined as having a significant risk of flooding in accordance with guidance published by Defra and WAG (Welsh Assembly Government).	
Flood Risk Regulations	Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management.	
Floods and Water Management Act (FWMA)	Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods, the aim of which is to clarify the legislative framework for managing surface water flood risk in England.	
Fluvial Flooding	Flooding resulting from water levels exceeding the bank level of a Main River	
FRA	Flood Risk Assessment - A site-specific assessment of all forms of flood risk to the site and the impact of development of the site to flood risk in the area.	
FRMP	Flood Risk Management Plan	
FZ	Flood Zones	
GI	Green Infrastructure – a network of natural environmental components and green spaces that intersperse and connect the urban centres, suburbs and urban fringe	
Greenfield	Undeveloped parcel of land	

Term	Definition	
На	Hectare	
HELAA	Housing and Economic Land Availability Assessment - a technical study which is used to assist in the monitoring of whether there is an adequate supply of deliverable housing land. It informs the planning policy process in terms of identifying land that is suitable, available and achievable for housing and economic development uses over the plan period.	
Indicative Flood Risk Area	Nationally identified flood risk areas, based on the definition of 'significant' flood risk described by Defra and WAG.	
IDB	Internal Drainage Board	
JBA	Jeremy Benn Associates	
LFRMS	Local Food Risk Management Strategy	
LLFA	Lead Local Flood Authority - Local authority responsible for taking the lead on local flood risk management	
LPA	Local Planning Authority	
mAOD	metres Above Ordnance Datum	
Main River	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers	
NFM	Natural Flood Management	
NPPF	National Planning Policy Framework	
OFWAT	Water Services Regulation Authority	
Ordinary Watercourse	All watercourses that are not designated Main River. Local authorities or, where they exist, IDBs have similar permissive powers as the Environment Agency in relation to flood defence work. However, the riparian owner has the responsibility of maintenance.	
OS NGR	Ordnance Survey National Grid Reference	
PFRA	Preliminary Flood Risk Assessment	
Pluvial flooding	Flooding as a result of high intensity rainfall when water is ponding or flowing over the ground surface (surface runoff) before it enters the underground drainage network or watercourse, or cannot enter it because the network is full to capacity.	
PPG	National Planning Policy Guidance	
PPS25	Planning and Policy Statement 25: Development and Flood Risk – superseded by the NPPF and PPG	
RoFSW	Risk of Flooding from Surface Water mapping, which replaces the uFMfSW	
Resilience Measures	Measures designed to reduce the impact of water that enters property and businesses; could include measures such as raising electrical appliances.	
Resistance Measures	Measures designed to keep flood water out of properties and businesses; could include flood guards for example.	
Return Period	An estimate of the interval of time between events of a certain intensity or size, in this instance it refers to flood events. It is a statistical measurement denoting the average recurrence interval over an extended period of time.	
RFCC	Regional Flood and Coastal Committee	
Risk	In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring, and the consequence of the flood.	
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban	

Term	Definition	
	drainage system.	
SFRA	Strategic Flood Risk Assessment	
SHLAA	Strategic Housing Land Availability Assessment - The Strategic Housing Land Availability Assessment (SHLAA) is a technical piece of evidence to support local plans and Sites & Policies Development Plan Documents (DPDs). Its purpose is to demonstrate that there is a supply of housing land in the LPA area which is suitable and deliverable.	
SoP	Standard of Protection - Defences are provided to reduce the risk of flooding from a river and within the flood and defence field standards are usually described in terms of a flood event return period. For example, a flood embankment could be described as providing a 1 in 100-year standard of protection.	
Stakeholder	A person or organisation affected by the problem or solution, or interested in the problem or solution. They can be individuals or organisations, includes the public and communities.	
SuDS	Sustainable Drainage Systems - Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques	
Surface water flooding	Flooding as a result of surface water runoff because of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or watercourse, or cannot enter it because the network is full to capacity, thus causing what is known as pluvial flooding.	
SWMP	Surface Water Management Plan - The SWMP plan should outline the preferred surface water management strategy and identify the actions, timescales and responsibilities of each partner. It is the principal output from the SWMP study.	
The Councils	Refers to the three commissioning authorities; Mole Valley District Council, Reigate and Banstead Borough Council and Tandridge District Council	
uFMfSW	Updated Flood Map for Surface Water	
WFD	Water Framework Directive	

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1 Introduction

1.1 Introduction

Mole Valley District Council, Reigate and Banstead Borough Council and Tandridge District Council are undertaking the preparation of individual Local Plans (LPs) for each of their areas. Part of this process is preparing an evidence base which will support the policies and allocations included in the Local Plans. Given the number of watercourses that flow between the neighbouring council areas the Councils have elected to commission a joint Level 1 Strategic Flood Risk Assessment, which will provide a consistent approach to assessing flood risk across the area. This joint Level 1 Strategic Flood Risk Assessment is one piece of the evidence base, which will help to inform policy development and the selection of site allocations for further assessment and inclusion within the individual LPs. The RBBC Local Plan covers the period from 2012 to 2027, MVDC from 2018 to 2033 and TDC from 2013 to 2033.

The report has been prepared to update the content that was included in the previous SFRAs, and will provide appropriate supporting evidence to assist the Councils in informing the production of their Local Plans. The 2017 SFRA update will be used to inform decisions on the location of future development, the preparation of sustainable policies for the long-term management of flood risk from all sources and will be used to inform planning applications on sites that are not allocated as part of the Local Plans.

1.2 Purpose of the Strategic Flood Risk Assessment

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

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

This Strategic Flood Risk Assessment (SFRA) 2017 replaces the Level 1 SFRAs published by Reigate and Banstead Borough Council¹ (2012), Mole Valley District Council (2012)², and Tandridge District Council (2016)³. The report has been prepared to replace the content that was included in these previous SFRAs and to provide appropriate supporting evidence for the emerging Local Plans.

The 2017 SFRA update will be used in decision making, to inform the process for location of land for future development and the preparation of sustainable policies for the long-term management of flood risk. Figure 1-1 shows the area covered by this SFRA, broken down into the three Council areas.

¹ Strategic Flood Risk Assessment, Reigate and Banstead Borough Council (2012). Accessed online at:

http://www.reigate-banstead.gov.uk/downloads/file/200/reigate_and_banstead_strategic_flood_risk_assessment_2012 on: 26/04/2017

² Strategic Flood Risk Assessment, Mole Valley District Council (2012). Accessed online at:

https://www.molevalley.gov.uk/media/pdf/c/r/SRFA_-_Updated_Jnauary_2012.pdf, on: 26/04/2017

³ Strategic Flood Risk Assessment, Tandridge District Council (2015). Accessed online at:

https://www.tandridge.gov.uk/Portals/0/Documents/Planning%20and%20building/Planning%20strategies%20and%20policies/Local% 20plan/Evidence%20base%20and%20technical%20studies/Strategic-Flood-Risk-Assessment-October-2016.pdf, on: 26/04/2017



Figure 1-1: Boundaries of the three Councils

The key objectives of the preparation of the 2017 SFRA are:

1. To take into account the latest flood risk policy

To ensure the SFRA is up to date with key changes to policy and guidance that have occurred since the existing SFRAs were published in 2012 and 2015, which include:

- Changes to legislation and guidance, both relating to flood risk and planning policy, such as the National Planning Policy Framework (NPPF) (2012)⁴
- Recent guidance published in April 2015⁵ regarding the role of lead local flood authorities (LLFAs) local planning authorities (LPAs) and the Environment Agency (EA) with regards to SuDS approval
- Changes to technical guidance, for example Defra's Non-statutory technical standards for sustainable drainage systems⁶ (March 2015), NPPF Planning Practice Guidance replacing PPS25 and PPG25, and CIRIA SuDS Manual C753 (2015)⁷

⁴ National Planning Policy Framework, UK Government (2012). Accessed online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf on 15/05/2017

⁵ Further changes to statutory consultee arrangements for the planning application process - Government Response to Consultation, UK Government, (2015). Accessed online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/429166/Final_Statutory_Consultee_Consultation_Res ponse.pdf on: 26/05/2017

⁶ Non-statutory technical standards for sustainable drainage systems, DEFRA (2015). Accessed online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf on: 26/05/2017

⁷ SuDS Manual C753, CIRIA (2015). Accessed online at:

http://www.ciria.org/Resources/Free_publications/SuDS_manual_C753.aspx on: 26/05/2017

- Latest guidance on climate change allowances for flood risk assessments released by the Environment Agency in February 2016⁸
- 2. Take into account the latest flood risk information and available data including:
- Updated fluvial flood modelling
- Availability of the Risk of Flooding from Surface Water (RoFSW) map
- 3. To provide a comprehensive set of maps including, but not limited to
- fluvial flood risk, including functional floodplain and climate change;
- surface water risk;
- groundwater risk; and
- flood warning coverage.

1.3 SFRA outputs

To meet the objectives, the following outputs have been prepared:

- Appraisal of all potential sources of flooding, including Main River, Ordinary Watercourse, surface water and groundwater.
- Updated review of historical flooding incidents.
- Mapping of location and extent of functional floodplain.
- Reporting on the standard of protection provided by existing flood risk management infrastructure.
- An assessment of the potential increase in flood risk due to climate change.
- An assessment of areas at risk from other sources of flooding, for example surface water or reservoirs.
- An assessment of existing flood warning and emergency planning procedures, including an assessment of safe access and egress during an extreme event.
- Recommendations of the criteria that should be used to assess future development proposals and the development of a Sequential Test and sequential approach to flood risk.

1.4 Approach

1.4.1 General assessment of flood risk

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

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

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

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

⁸ Flood risk assessments: climate change allowances, Environment Agency (2017). Accessed online at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances, on: 26/05/2017

The flood risk management hierarchy is summarised Figure 1-2

Figure 1-2: Flood Management Hierarchy



1.4.2 Technical assessment of flood hazards

Flood risk within the Councils' areas has been assessed using results from detailed computer models supplied by the Environment Agency and existing broad scale Environment Agency Flood Zone mapping. The following detailed models inform the flood risk information within the study area:

- Environment Agency fluvial (river) models
 - o Burstow Modelling Study 2011
 - o Lower Mole 2009
 - o Middle Mole 2007
 - Upper Mole 2006
 - Redhill Brook and Salfords Stream 2014
 - o Medway 2017
- Environment Agency surface water (rainfall) models
 - Risk of Flooding from Surface Water Map (2016)
- JBA Consulting Groundwater flood risk
 - o Risk of flooding from groundwater using groundwater records and models

1.5 Consultation

As part of the "duty to cooperate" set out in the Localism Act 2011 (see section 2.3), the following parties (external to the Councils) have been consulted during the preparation of this version of the SFRA:

Surrey County Council (as LLFA)	Greater London Authority	
Crawley Borough Council	Environment Agency	
Croydon Council	Thames Water	
Elmbridge Borough Council	Southern Water	
Epsom and Ewell Borough Council	Upper Medway Drainage Board	
Guildford Borough Council	Sutton and East Surrey Water	
Horsham District Council	South East Water	
Mid Sussex District Council	Historic England	
Sutton Borough Council	Natural England	
Waverley Borough Council	Surrey Wildlife Trust (on behalf of the	
London Borough of Bromley Council	Surrey Nature Partnership)	
Sevenoaks District Council	Coast to Capital LEP	
Wealden District Council		
East Sussex County Council		
West Sussex County Council		

1.6 SFRA user guide

Table 1-1: SFRA report contents

Section	Contents
1. Introduction	Provides a background to the study, defines objectives, outlines the approach adopted and the consultation performed.
2. The Planning Framework and Flood Risk Policy	Includes information on the implications of recent changes to planning and flood risk policies and legislation, as well as documents relevant to the study.
Level 1 Strategic Flo	ood Risk Assessment
3. How flood risk is assessed	Provides an overview of flooding and risk, Flood Zones, and what they mean.
4. Understanding flood risk in the three Authorities' areas	Gives an introduction to the assessment of flood risk and provides an overview of the characteristics of flooding affecting the area. Provides a summary of responses that can be made to flood risk, together with policy and institutional issues that should be considered.
5. The Sequential, risk based approach	Describes the Sequential approach and application of Sequential and Exception Tests. Describes the modelling and data used for the assessment. Outlines mapping that should be used for the Sequential and Exception Tests
6. FRA requirements and guidance for developers	Identifies the scope of the assessments that must be submitted in FRAs supporting applications for new development. Provides guidance for developers and outlines conditions set by the LLFA that should be followed.
7. Surface water management and SuDS	Advice on managing surface water runoff and flooding
8. Flood warning and emergency planning	Outlines the flood warning service in the Councils' areas and provides advice for emergency planning, evacuation plans and safe access and egress.
9. Strategic flood risk solutions	Summary of strategic flood risk solutions.
10. Development Management recommendations	Sets out recommendations for considering and assessing flood risk in the Councils' areas.
Summary and re	ecommendations
11. Summary	Reviews Level 1 SFRA and provides recommendations



2 The Planning Framework and Flood Risk Policy

2.1 Introduction

The overarching aim of development and flood risk planning policy in the UK is to ensure that the potential risk of flooding is taken into account at every stage of the planning process. This section of the SFRA provides an overview of the planning framework, flood risk policy and flood risk responsibilities. In preparing the subsequent sections of this SFRA, appropriate planning and policy amendments have been acknowledged and taken into account.

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

2.2.1 Flood Risk Regulations, 2009

The Flood Risk Regulations (2009) are intended to translate the current EU Floods Directive into UK law and place responsibility upon all LLFAs to manage local flood risk. Under the Regulations, the responsibility for managing flood risk from rivers, the sea and reservoirs lies with the Environment Agency. However, responsibility for managing flood risk from Ordinary Watercourses, surface water and groundwater rests with LLFAs. Surrey County Council is the LLFA for the area covered by this SFRA.

Figure 2-1 illustrates the steps that have been taken by LLFAs to implement the requirements of the EU Directive in the UK via the Flood Risk Regulations.



Figure 2-1: Flood Risk Regulation Requirements

Following the process above, and in accordance with the Regulations, LLFAs had the task of preparing a Preliminary Flood Risk Assessment (PFRA) report. The current PFRA that is applicable to the study area was published by Surrey County Council in 2011⁹.

The Surrey PFRA is a high-level screening exercise and considers floods which have significant harmful consequences for human health, economic activity, the environment and cultural heritage. The Regulations require the LLFA to identify significant flood risk areas. The threshold for designating significant flood risk areas is defined by Defra and the PFRA is the process by which

⁹ Preliminary Flood Risk Assessment, Surrey County Council (2011). Accessed online at: https://www.surreycc.gov.uk/_data/assets/pdf_file/0004/16753/PFRA.pdf, on: 26/04/2017

these locations can be identified. Of the ten national indicative Flood Risk Areas (IFRAs) that were identified by the Defra/Environment Agency, the Councils' administrative areas lie within the London IFRA.

Accordingly, the PFRA reports on significant past and future flooding from all sources except from Main Rivers and reservoirs, which are covered by the Environment Agency, and sub-standard performance of the adopted sewer network (covered under the remit of Thames Water and Southern Water).

In line with the Flood Risk Regulations (2009) each stage of the planning cycle must be reviewed every 6 years and updated if required, to this end the Environment Agency and Defra issued guidance to the LLFAs in January 2017 which set out the approach to review and where required, update their PFRAs and flood risk areas. The LLFA review of the flood risk areas was due for completion in June 2017 and the EA are due to publish the updated PFRAs and flood risk areas by December 2017.

The Flood Risk Management Plan (FRMP) process adopts the same catchments as used in the preparation of River Basin Management Plans, in accordance with the Water Framework Directive. The FRMP draws on previous policies and actions identified in Catchment Flood Management Plans (CFMP) and incorporates information from Local Flood Risk Management Strategies (LFRMS). Reigate and Banstead Borough and Tandridge District lie within the Thames River Basin, and Mole Valley District lies within both the Thames River Basin and the South East River Basin District. Accordingly, more detailed strategic information on proposed strategic measures and approaches can be found in the Thames River Basin District¹⁰ and South East River Basin District¹¹ Flood Risk Management Plans - Parts A, B, C and D. The FRMP summarises the flooding affecting the area and describes the measures to be taken to address the risk in accordance with the Flood Risk Regulations.

2.2.2 Flood and Water Management Act, 2010

The Flood and Water Management Act (2010)¹² (FMWA) aims to create a simpler and more effective means of managing both flood risk and coastal erosion and implements a number of Sir Michael Pitt's recommendations following his review of the 2007 floods. The FWMA received Royal Assent in April 2010.

Surrey County Council as LLFA has developed a Local Flood Risk Management Strategy under the Act, in consultation with local partners. This is discussed further in Section 2.2.4. This Strategy acts as the basis for the discharge of duty for Flood Risk Management co-ordinated by Surrey County Council. This was published in 2014, and updated in 2017.

Local authorities are responsible for flood management relating to Ordinary Watercourses (i.e. smaller ditches, brooks), with the Environment Agency responsible for Main Rivers. The Upper Medway Internal Drainage Board has responsibility for certain Ordinary Watercourses and land drainage in the eastern part of the study area. The Internal Drainage Board should be consulted on development proposals which affect land or watercourses in their jurisdiction.

The Act also introduced a requirement for local planning authorities to consult LLFAs on the management of surface water on major planning applications in order to satisfy that:

- the proposed minimum standards of operation are appropriate
- through the use of planning conditions or planning obligations, there are clear arrangements for on-going maintenance arrangements over the development's lifetime.

In addition, the FWMA also updates the Reservoirs Act 1975 by allowing for the reduction in the capacity of reservoir regulation from 25,000m³ to 10,000m³. Although this section of the legislation has not yet been commenced in England, Phase 1 of the risk regulation process was implemented in 2013 by requiring large raised reservoirs to be registered to allow the Environment Agency to categorise whether they are 'high risk' or 'not high risk'.

^{10,} Thames River Basin District Flood Risk Management Plan 2015-2021 Part C, Environment Agency (2016). Accessed online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/507148/LIT_10231_THAMES_FRMP_PART_C.pdf, on: 26/04/2017

¹¹ Thames River Basin District Flood Risk Management Plan 2015-2021 Part C, Environment Agency (2016). Accessed online at: https://www.gov.uk/government/publications/south-east-river-basin-district-flood-risk-management-plan, on: 26/04/2017

¹² Flood and Water Management Act (2010), UK Government (2010). Accessed online at:

http://www.legislation.gov.uk/ukpga/2010/29/pdfs/ukpga_20100029_en.pdf on: 26/04/2017



2.2.3 Lead Local Flood Authorities

The FWMA established lead local flood authorities (LLFAs). Surrey County Council is the LLFA for the Councils' areas. Duties for LLFAs include:

- Local Flood Risk Management Strategy (LFRMS): LLFAs must develop, maintain, apply and monitor a LFRMS to outline how they will manage flood risk, identify areas vulnerable to flooding and target resources where they are needed most
- Flood Investigations: When appropriate and necessary, LLFAs must investigate and report on flooding incidents (Section 19 investigations)
- Register of Flood Risk Features: LLFAs must establish and maintain a register of structures or features which, in their opinion, are likely to have a significant effect on flood risk in the LLFA area
- Designation of Features: LLFAs may exercise powers to designate structures and features that affect flood risk, requiring the owner to seek consent from the authority to alter, remove or replace it
- Consenting: When appropriate LLFAs will perform consenting of works on Ordinary Watercourses

On 18 December 2014, a Written Ministerial Statement laid by the Secretary of State for Communities and Local Government set out changes to the planning process that applied to major development from 6 April 2015. In considering planning applications, local planning authorities should consult the LLFA on the management of surface water, satisfy themselves that the proposed minimum standards of operation are appropriate and ensure, through use of planning conditions or obligations, that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.

In March 2015, the LLFA was made a statutory consultee which came into effect on 15 April 2015. As a result, Surrey County Council, is required to provide technical advice on surface water drainage strategies and designs put forward for new major developments.

Major developments are defined as:

- Residential development: 10 dwellings or more, or residential development with a site area of 0.5 hectares or more where the number of dwellings is not yet known; and
- Non-residential development: provision of a building or buildings where the total floor space to be created is 1,000 square metres or more or, where the floor area is not yet known, a site area of 1 hectare or more.

2.2.4 Surrey Local Flood Risk Management Strategy (2017-2032)¹³

Surrey County Council is responsible for developing, maintaining, applying and monitoring a LFRMS for Surrey, which covers the administrative areas of the three councils. The Strategy was developed by the Surrey Flood Risk Partnership Board, this partnership is made up of all the authorities responsible for managing flood risk in Surrey. The Strategy is used as a means by which the Flood Risk Partnership Board, led by Surrey County Council, co-ordinates Flood Risk Management on a long term and day to day basis. The Strategy also sets measures to manage all flood risk i.e. flood risk from surface water, groundwater, Ordinary Watercourses and Main Rivers. The Environment Agency is responsible for managing flooding from Main Rivers and reservoirs, with the LLFA responsible for managing Ordinary Watercourses. The high-level objectives proposed in the Strategy for managing flood risk are:

- 1. "Our understanding of local and strategic flood risk will be improved through clear data management and sharing between risk management authorities to ensure partnership delivery of works to high risk areas.
- 2. Risk Management Authorities will reduce flood risk by delivering an effective maintenance regime for their drainage assets and managing their estates across the County in an environmentally sustainable manner.

¹³ Local Flood Risk Management Strategy, Surrey County Council (2017). Accessed online at:

https://www.surreycc.gov.uk/__data/assets/pdf_file/0009/126378/Surrey-Local-Flood-Risk-Management-Strategy-FINAL_v2.pdf on: 03/08/2017



- 3. We will agree with partners who the Risk Management Authorities in Surrey are, jointly define their responsibilities and establish clear lines of communication with them to support the delivery of partnership-based flood alleviation projects.
- 4. Private owners will be made aware of their riparian responsibilities to maintain their drainage assets and watercourses. We will support, promote and enforce these responsibilities.
- 5. The residents and businesses of Surrey will be supported to improve community resilience. Local people will be empowered to reduce the risk of flooding on both an individual and community level.
- 6. We will reduce the risk of flooding to and from development through local planning policy and processes.
- 7. We will reduce flood risk from all sources via a programme of capital works, which will be integrated with the activities of other Risk Management Authorities.
- 8. We will investigate significant flooding incidents in order to make recommendations that help to reduce flood risk."

The LFRMS also sets out an action plan¹⁴ of how the authorities, working in the partnership intend to achieve these objectives (and their supporting sub-objectives). The action plan contains the following information:

- A description of the action
- The objective the action relates to
- The driver behind the action
- The organisation responsible for delivering the action.
- Supporting organisations
- The source of funding
- When the action was added
- Timescale for completion or current status

The Strategy is set over a 15 year period, but the objectives are considered to be enduring beyond. The action plans are intended to be updated regularly or when key triggers are activated. Examples of a key triggers would be issues such as amendments to partner responsibilities, updates to legislation, alterations in the nature or understanding of flood risk or a significant flood.

Notable actions from the LFRMS pertinent to this SFRA include:

Current Actions

- LPAs to ensure that flood risk does not increase from minor developments.
- LPAs and SCC seek to ensure that only developments that meet the requirements of the NPPF and national SuDS standards are given planning approval.
- LPAs and statutory consultees to provide pre-application advice when requested.

Short term actions

- LPAs to review how effectively flood risk and resilience is being considered on minor planning applications and implement improvement based on review outcomes.
- LPAs and statutory consultees to review existing networks and methods / processes for identifying new minor and major developments which have the potential to contribute to a reduction in flood risk and develop a mechanism to record and facilitate identifying opportunities to reduce flood risk through development.
- LPAs to review and identify local policy, guidance and evidence which can be used to mitigate impacts of development in high-risk flooding areas and utilise opportunities to reduce local flood risk through local (re) development.
- LPAs to assess CIL for opportunities to fund/support flood alleviation schemes.

¹⁴ Surrey Local Flood Risk Management Strategy - Annexe A - Objective Action Plans, Surrey County Council (2017). Accessed online at: https://www.surreycc.gov.uk/__data/assets/pdf_file/0005/120893/Annexe-A-Action-Plans.pdf on: 06/10/2017



Medium term actions

- LPAs to review, with support of SCC, developments' success in implementing sustainable drainage and flood risk mitigation measures. LPAs will develop a process to identify whether developments have successfully constructed and utilised SuDS to drive benefits and capture / share this information moving forwards.
- LPAs to proactively engage with one another and the SFRPB to understand / review their collective policy, guidance and evidence (e.g. local plans and supplementary planning documents) and ensure that development and flood risk management plans are aligned.

2.3 Localism Act

The Localism Act (2011) requires local authorities to "engage constructively, actively and on an ongoing basis in any process by means of which development plan documents are prepared so far as relating to a strategic matter"¹⁵, known as 'duty to cooperate'. It also provides rights to allow local communities to come together and shape new developments deciding where new homes and businesses should go and what they should look like through the preparation of neighbourhood development plans.

2.4 National Planning Policy Framework

The **National Planning Policy Framework** (NPPF)¹⁶ was issued on 27 March 2012 to replace previous national planning policy as part of reforms to, firstly, make the planning system less complex and more accessible, and, secondly, to protect the environment and promote sustainable growth. It replaced most of the older Planning Policy Guidance Notes (PPGs) and Planning Policy Statements (PPSs) that were referred to in previous versions of the SFRAs prepared by the Councils. The NPPF helps local planning authorities prepare Local Plans and applicants prepare planning submissions.

Paragraph 100 of the NPPF:

"Local Plans should be supported by a strategic flood risk assessment and develop policies to manage flood risk from all sources, taking account of advice from the Environment Agency and other relevant flood risk management bodies, such as lead local flood authorities and internal drainage boards. Local Plans should apply a sequential, risk-based approach to the location of development to avoid, where possible, flood risk to people and property and manage any residual risk, taking account of the impacts of climate change".

A web-based Planning Practice Guidance on Flood Risk and Coastal Change¹⁷ (henceforth referred to as 'the Planning Practice Guidance') was published in March 2014 and since been periodically updated and sets out how the policy should be implemented. It also sets out Flood Zones, the appropriate land uses for each zone, flood risk assessment requirements and the policy aims for developers and authorities regarding each Flood Zone. Further details on Flood Zones and associated policy is provided in Figure 3-2, Table 3-1 and throughout this report.

A description of how flood risk should be taken into account in the preparation of Local Plans is outlined in Diagram 1 contained within the Planning Practice Guidance and depicted in Figure 2-2.

http://www.legislation.gov.uk/ukpga/2011/20/section/110 on: 02/06/2017

¹⁵ Localism Act 2011: Section 110, UK Government (2011). Accessed online at:

¹⁶ National Planning Policy Framework (DCLG, 2012). Accessed online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf on: 02/05/2017

¹⁷ Planning Practice Guidance, (DCLG 2014). Accessed online at: https://www.gov.uk/guidance/flood-risk-and-coastal-change on: 02/05/2017



Figure 2-2: Flood risk and the preparation of Local Planst

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

2.5 Surface Water Management Plans

Surface Water Management Plans (SWMPs) outline the preferred surface water management strategy in a given location. SWMPs are prepared, when required, by LLFAs in consultation with key local partners who are responsible for surface water management and drainage in their area. They are prepared to understand the flood risks that arise from local flooding, which is defined by the Flood and Water Management Act 2010 as flooding from surface runoff, groundwater, and Ordinary Watercourses. SWMPs establish a long-term action plan to manage surface water in a particular area and are intended to influence future capital investment, drainage maintenance, public engagement and understanding, land-use planning, emergency planning and future developments. The action plan from SWMPs should be reviewed and updated as a minimum, every six years.

No formal SWMPs have been undertaken within the Councils' areas, however, a surface water management study has been undertaken for the Caterham-on-the-Hill area in the north of Tandridge. The study focuses on the area between Queen's Park and Coulsdon Common and

provides a series of recommendations for improving the understanding of flood risk and sets out a variety of conceptual options for reducing flood risk.

2.6 Catchment Flood Management Plan

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

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

The six national policies are:

- 1. No active intervention (including flood warning and maintenance). Continue to monitor and advise.
- 2. Reducing existing flood risk management actions (accepting that flood risk will increase over time).
- 3. Continue with existing or alternative actions to manage flood risk at the current level (accepting that flood risk will increase over time from this baseline).
- 4. Take further action to sustain the current level of flood risk (responding to the potential increases in risk from urban development, land use change and climate change).
- 5. Take action to reduce flood risk (now and/or in the future).
- 6. Take action with others to store water or manage runoff in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment.

The CFMP provides a starting point for measures being considered strategically to manage flood risk within its area. To that end, an important consideration of the NPPF relates to safeguarding land from development that is required for current and future flood management (paragraph 100).

The three Councils' areas are covered by three Catchment Flood Management Plans, the Thames CFMP (2009)¹⁸, the Arun and Western Streams CFMP (2009)¹⁹ and the River Medway CFMP (2009)²⁰.

2.6.1 Thames CFMP (2009)

This plan covers the whole of Reigate and Banstead Borough, the northern and western areas of Tandridge District and the majority of Mole Valley District with the exception of the south west.

The Councils' areas covered by this plan are in three sub-areas:

- Sub-area 3 Villages in open flood plain (south) Policy option 2
- Sub-area 4 Chalk and downland catchments Policy option 3
- Sub-area 5 Urbanised places with some flood defences Policy option 6

Policy option 2 is for areas of low to moderate flood risk where the Environment Agency can generally reduce existing flood management actions.

Policy option 3 is for areas of low to moderate flood risk where the Environment Agency are generally managing existing flood risk effectively.

Policy option 6 is for areas of low to moderate flood risk where the Environment Agency will take actions with others to store water or manage runoff in locations that provide overall flood risk reduction or environmental benefits.

¹⁸ Thames Catchment Flood Management Plan, Environment Agency (2009). Accessed online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/293903/Thames_Catchment_Flood_Management_Pla n.pdf on: 24/04/2017

¹⁹ Arun and Western Streams Catchment Flood Management Plan, Environment Agency (2009). Accessed online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/293864/Arun_and_Western_Streams_Catchment_Flo od_Management_Plan.pdf on 24/04/2017

²⁰ Medway Catchment Flood Management Plan, Environment Agency (2009). Accessed online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/293890/Medway_Catchment_Flood_Management_Pla n.pdf on: 24/04/2017

2.6.2 Arun and Western Streams CFMP (2009)

This plan covers the south west part of the Mole Valley District which lies in Sub-area 1 of the catchment. Policy option 6 is applied in this area.

2.6.3 River Medway CFMP (2009)

This plan covers the south east of Tandridge District which lies in sub area 1 (Upper Catchment). Policy option 3 is applied in this area.

2.6.4 Habitats Directive

The EU Habitats Directive aims to protect the wild plants, animals and habitats that make up our diverse natural environment. The directive created a network of protected areas around the European Union of national and international importance called Natura 2000 sites.

These sites include:

- Special Areas of Conservation (SACs) these support rare, endangered or vulnerable natural habitats, plants and animals (other than birds).
- Special Protection Areas (SPAs) support significant numbers of wild birds and their habitats.

Special Protection Areas and Special Areas of Conservation are established under the EC Birds Directive and Habitats Directive respectively. All in all the directive protects over 1,000 animals and plant species and over 200 so called "habitat types" (e.g. special types of forests, meadows, wetlands, etc.), which are of European importance.

This study was not intended to provide a screening of effects on environmentally protected sites, and any future development should undertake a project level Habitats Regulations Assessment (HRA). An Environmental Impact Assessment (EIA) may be required in some cases.

2.6.5 The Water Framework Directive

The Water Framework Directive (WFD) was first published in December 2000 and transposed into English and Welsh law in December 2003. It introduced a more rigorous concept of what "good status" should mean than the previous environmental quality measures. The WFD estimated that 95% of water bodies were at risk of failing to meet "good status".

River Basin Management Plans (RBMP) are required under the WFD and are strategies that should influence development plans and be influenced by them. The study area predominately falls within the Thames River Basin District (RBD)²¹ the South East River Basin District (RBD)²². Under the WFD the RBMPs, which were originally published in December 2009 were reviewed and updated in December 2015.

A primary WFD objective is to ensure 'no deterioration' in environmental status, therefore all water bodies must meet the class limits for their status class as declared in the Final Anglian/ Thames River Basin Management Plans.

Another equally important objective requires all water bodies to achieve good ecological status. Future development needs to be planned carefully so that it helps towards achieving the WFD and does not result in further pressure on the water environment and compromise WFD objectives. The WFD objectives as outlined in the updated RBMPs are summarised below:

- To prevent deterioration of the status of surface waters and groundwater
- To achieve objectives and standards for protected areas
- To aim to achieve good status for all water bodies or, for heavily modified water bodies and artificial water bodies, good ecological potential and good surface water chemical status

²¹ Thames River Basin Management Plan, Environment Agency (2016). Accessed online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/500548/Thames_RBD_Part_1_river_basin_managem ent_plan.pdf on: 26/05/2017

²² South East River Basin Management Plan, Environment Agency (2015). Accessed online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/500473/South_East_RBD_Part_1_river_basin_manag ement_plan.pdf on: 24/04/2017



- To reverse any significant and sustained upward trends in pollutant concentrations in groundwater
- The cessation of discharges, emissions and loses of priority hazardous substances into surface waters
- Progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants."

LPAs must have regard for Water Framework Directive as implemented in the Environment Agency's River Basin Management Plans (see below).

2.7 River Basin Management Plans

River Basin Management Plans (RBMPs) are prepared under the Water Framework Directive (WFD) and assess the pressure facing the water environment in River Basin Districts. The current RBMPs were reviewed and updated in 2015 and the final version of the plans were published in February 2016 and updated the plans first published in 2009 with the aim to build on the work done to protect and improve the quality of the water environment during the first WFD cycle over the next 6 years. Reigate and Banstead Borough, Tandridge District and the majority of Mole Valley District are covered by the Thames River Basin Management Plan. The south west part of Mole Valley District is covered by the South East River Basin Management Plan.

2.7.1 Thames River Basin Management Plan

The second cycle of the Thames RBMP²³ was published in February 2016, replacing the previous version published in 2009. The document provides information on the following:

- Current state of the water environment
- Pressures affecting the water environment
- Environmental objectives for protecting and improving waters
- Programme of measures and actions needed to achieve the objectives
- Progress since the 2009 plan

The Thames RBMP identified a number of significant water management issues, including:

- Physical modifications
- Pollution from waste water
- Pollution from towns, cities and transport
- Changes to the natural flow and level of water
- Negative effects of invasive non-native species
- Pollution from rural areas

The RBMP document describes how development planning needs to consider a number of issues relevant to the RBMP including housing locations, sewage treatment options, initiatives to reduce flow to sewage works, water efficiency measures and the reduction of nutrients from diffuse pollution.

The RBMP notes that 11% of water bodies in the Thames River Basin District currently have a 'good or better' overall status, which is expected to increase to 13% by 2021. However, this 'good or better' overall status is forecast to increase notably for the extended deadline of 2027 reported in the RBMP.

2.7.2 South East River Basin Management Plan

The South East RBMP²⁴ was also published in February 2016, replacing its respective 2009 version and following the same format as the Thames RBMP.

²³ Thames River Basin Management Plan, Environment Agency (2016). Accessed online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/500548/Thames_RBD_Part_1_river_basin_managem ent_plan.pdf on: 26/05/2017

²⁴ South East River Basin Management Plan, Environment Agency (2015). Accessed online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/500473/South_East_RBD_Part_1_river_basin_manag ement_plan.pdf on: 24/04/2017



The RBMP notes that 15% of water bodies in the South East RBD currently have a 'good or better' overall status, which is expected to increase to 19% by 2021, with further sizable improvements before the extended deadline of 2027.

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

The Association of British Insurers (ABI) and the National Flood Forum have published guidance for local authorities with regards to planning in flood risk areas²⁵. The guidance aims to assist local authorities in England in producing local plans and dealing with planning applications in flood risk areas. The guidance complements the National Planning Policy Framework. The key recommendations from the guidance are:

- Ensure strong relationships with technical experts on flood risk
- Consider flooding from all sources, taking account of climate change
- Take potential impacts on drainage infrastructure seriously
- Ensure that flood risk is mitigated to acceptable levels for proposed developments
- Make sure Local Plans take account of all relevant costs and are regularly reviewed

The insurance companies and the Government have been working together to develop a new flood re-insurance scheme known as FloodRe. It was launched in April 2016, and is designed to:

- Enable flood cover to be affordable for those households at highest risk of flooding;
- Increase availability and choice of insurers for customers;
- Allow time for government, local authorities, insurers and communities to become better prepared for flooding;
- Create a 'level playing field' for new entrants and existing insurers in the UK home insurance market.

FloodRe thus helps to offer affordable insurance to everyone owning or living in existing eligible properties that may be prone to flooding. Further details are available on the FloodRe website at www.floodre.co.uk.

2.9 Implications for the Authorities' Areas

The new and emerging responsibilities under the Flood and Water Management Act 2010 and the Flood Risk Regulations 2009 are summarised in Table 2-1.

Table 2-1: Roles and responsibilities in the Councils' area

Risk Management Authority (RMA)	Strategic Level	Operational Level
		Preliminary Flood Risk Assessment (per River Basin District) (the Environment Agency exercised an exception to the regulations and instead prepared Flood Hazard and Risk mapping and Flood Risk Management Plans)
	National Statutory Strategy	Managing flooding from Main Rivers and reservoirs and communication of flood risk warnings to the public, media and partner organisations.
Environment		Identifying Significant Flood Risk Area
Agency	Reporting and supervision (overview role)	Preparation of Flood Risk and Hazard Maps
		Preparation of Flood Risk Management Plan
		Enforcement authority for Reservoirs Act 1975
		Managing Regional Flood and Coastal Committees (RFCCs) and supporting funding decisions, working with LLFAs and communities.
		Emergency planning and multi-agency flood plans, developed by local resilience forums
Lead Local Flood Authority	Input to National Strategy.	Responsible for enforcing and consenting works for Ordinary Watercourses, risk assessing Ordinary Watercourses.
(Surrey County		Managing local sources of flooding from surface water

25 Guidance on Insurance and Planning in Flood Risk Areas for Local Planning Authorities in England, Association of British Insurers and National Flood Forum (2012). Accessed online at: https://www.abi.org.uk/globalassets/sitecore/files/documents/publications/public/migrated/flooding/abi-nff-guidance-oninsurance-and-planning-for-local-planning-authorities.pdf on: 02/05/2017

Risk Management Authority (RMA)	Strategic Level	Operational Level
Council)	Formulate and implement Local Flood Risk Management Strategy.	runoff and groundwater and carrying out practical works to manage flood risk from these sources where necessary. Preparing and publishing a PFRA Identifying Flood Risk Areas Preparing Flood Hazard and Flood Risk Maps Preparing Flood Risk Management Plans (where local flood risk is significant) Investigating certain incidents of flooding in Section 19 Flood Investigations Statutory roles in planning for surface water drainage. Keeping asset registers of structures and features which have a significant effect on local flood risk. The LFRMS has been signed up to by all members of the partnership board of which MVDC, RBBC and TDC are part. All authorities under the operational level are bound to act consistently with the LFRMS in realising FRM activities and have due regard in the discharge of other functions of the Strategy.
Local Planning Authority (Reigate and Banstead Borough Council, Mole Valley or Tandridge District Councils)	Input to National and local authority Plans and Strategy	Preparation of a Local Plan to guide development. The competent determining authority for planning applications and have the ultimate decision on the suitability of a site in relation to flood risk and management of surface water runoff. Responsibilities for emergency planning as a responder to a flood event. Own and manage public spaces which can potentially be used for flood risk management.

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

SFRAs contain information that should be referred to in responding to the Flood Risk Regulations and the formulation of local flood risk management strategies and plans. SFRAs are also linked to the preparation of Catchment Flood Management Plans (CFMPs), Surface Water Management Plans (SWMPs), and Water Cycle Studies (WCSs).

A water cycle study was conducted by RBBC, Crawley Borough Council, Mid Sussex District Council, and Horsham District Council in 2011 covering the Gatwick sub-region. This included small parts of all three Councils' areas. The WCS report summarises the SFRAs available for the four councils at the time and concluded that all the proposed development sites could be accommodated within Flood Zone 1 so a Level 2 SFRA was unnecessary. It also contains some recommendations for the adoption of SuDS²⁶.

²⁶ Gatwick Sub Region Outline Water Cycle Study, Entec, (2011). Accessed online at: http://www.midsussex.gov.uk/media/3478/wcs_outline_2011.pdf on: 22/06/2017



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

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3 How flood risk is assessed

3.1 Introduction

This section describes how we define and assess flood risk, and the main sources of information, data and mapping we have used to assess flood risk for the Councils in this SFRA.

Planners and developers should use the evidence and maps presented in this SFRA, along with any other available evidence, to identify any risk of flooding from all sources for a particular site.

3.2 Definitions

3.2.1 Flood

Section 1 (subsection 1) of the Flood and Water Management Act (FWMA) (2010)²⁷ defines a flood as:

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

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

- a. heavy rainfall;
- b. a river overflowing or its banks being breached;
- c. a dam overflowing or being breached;
- d. tidal waters;
- e. groundwater; or
- f. anything else (including any combination of factors).

Note: Sources of flooding under this definition do not include excess surface water from any part of a sewerage system, unless caused by an increase in the volume of rainwater entering or affecting the system, or a flood caused by a burst water main.

3.2.2 Flood Risk

Section 3 (subsection 1) of the FWMA defines the risk of a potentially harmful event (such as flooding) as:

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

Thus, it is possible to summarise flood risk as:

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

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



²⁷ Flood and Water Management Act 2010, UK Government (2010). Accessed online at: http://www.legislation.gov.uk/ukpga/2010/29/pdfs/ukpga_20100029_en.pdf on: 02/05/2017

Using this definition, it can be seen that:

Increasing the probability or chance of a flood being experienced increases the flood risk: In situations where the probability of a flood being experienced increases gradually over time, for example due to the effects of climate change, then the severity of the flood risk will increase (flooding becomes more frequent or has increased effect).

The potential scale of the consequences in a given location can increase the flood risk:

- Flood Hazard Magnitude: If the direct hazard posed by the depth of flooding, velocity of flow, the speed of onset, rate of risk in flood water or duration of inundation is increased, then the consequences of flooding, and therefore risk, is increased.
- Receptor Presence: The consequences of a flood will be increased if there are more receptors affected, for example with an increase in extent or frequency of flooding. Additionally, if there is new development that increases the probability of flooding (for example, increase in volume of runoff due to increased impermeable surfaces) or increased density of infrastructure then consequences will also be increased.
- Receptor Vulnerability: If the vulnerability of the people, property or infrastructure is increased then the consequences are increased. For example, old or young people are potentially more vulnerable to being harmed in the event of a flood.

3.3 Using SFRA risk information

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

Figure 3-1: Use of SFRA information

Assess risk	Avoid or reduce risk	Control or mitigate risk	Tactical response to flood event	Post event recovery support	
Before a flood			During a flood	After a flood	

The SFRA will complement the Surrey Local Flood Risk Management Strategy (2017)²⁸ and will assist the LLFA with the stated objectives.

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

- Flood zones
- Actual flood risk
- Residual risk

3.4 Fluvial Flood Zones

The NPPF sets out a Sequential Test to steer new development to areas with the lowest probability of flooding. This is initially based on the Flood Map for Planning (Rivers and Sea), as provided by the Environment Agency, but may be refined by the SFRA to take into account the probability of flooding, other sources of flooding and the impact of climate change.

A concept diagram showing the classification of NPPF Flood Zones graphically, is included at Figure 3-2. Table 3-1 includes a description and discussion of appropriate development. A fuller

²⁸ Surrey Local Flood Risk Management Strategy, Surrey County Council (2017). Accessed online at:

https://www.surreycc.gov.uk/__data/assets/pdf_file/0009/126378/Surrey-Local-Flood-Risk-Management-Strategy-FINAL_v2.pdf on: 24/04/2017

discussion of Flood Zones and their relation to planning policy can be found in the NPPF and the Planning Policy Guidance



Figure 3-2: Definition of Flood Zones

Table 3-1: Flood Zone Descriptions

Zone	Probability	Description	
Zone 1	Low	This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).	
		All land uses are appropriate in this zone.	
		For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water runoff, should be incorporated in a Flood Risk Assessment (FRA)	
		Developers and local authorities should seek opportunities to reduce the overall level of flood risk from all sources in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems.	
Zone 2	Medium	This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding $(0.1\% - 1\%)$ or between 1 in 200 and 1 in 1000 annual probability of sea flooding $(0.1\% - 0.5\%)$ in any year.	
		Essential infrastructure, water compatible infrastructure, less vulnerable and more vulnerable land uses (as set out by NPPF) are appropriate in this zone. Highly vulnerable land uses are allowed as long as they pass the Exception Test.	
		All developments in this zone require an FRA.	
		Developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems.	
Zone 3a	High	This zone comprises land assessed as having a greater than 1 in 100 annual probability of river flooding (>1.0%) or a greater than 1 in 200 annual probability of flooding from the sea (>0.5%) in any year.	
		Water compatible and less vulnerable land uses are permitted in this zone. Highly vulnerable land uses are not permitted. More vulnerable and essential infrastructure are only permitted if they pass the Exception Test.	
		All developments in this zone require an FRA.	
		Developers and local authorities should seek opportunities to: Reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems.	
		Relocate existing development to land in lower risk zones.	
		pathways and by identifying, allocating and safeguarding open spaces for flood	

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Zone	Probability	Description	
		storage.	
Zone 3a plus climate change	High	This zone comprises land assessed as having a greater than 1 in 100 annual probability of river flooding (>1.0%) or a greater than 1 in 200 annual probability of flooding from the sea (>0.5%) in any year, accounting for changes in river flows and sea level resulting from climate change up to 2115 in a Higher Central or Upper End scenario.	
		Water compatible and less vulnerable land uses are permitted in this zone. Highly vulnerable land uses are not permitted. More vulnerable and essential infrastructure are only permitted if they pass the Exception Test.	
		All developments in this zone require an FRA.	
		Developers and local authorities should seek opportunities to: Reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems. Relocate existing development to land in lower risk zones. Create space for flooding by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open spaces for flood storage.	
Zone 3b	Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. SFRAs should identify this Flood Zone in discussion with the LPA and the Environment Agency. The identification of functional floodplain should take account of local circumstances.	
		Only water compatible and essential infrastructure are permitted in this zone and should be designed to remain operational in times of flood, resulting in no loss of floodplain or blocking of water flow routes. Infrastructure must also not increase flood risk elsewhere.	
		All developments in this zone require an FRA.	
		Developers and local authorities should seek opportunities to: Reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems. Relocate existing development to land in lower risk zones	

3.4.1 Flood Map for Planning (Rivers and Sea) (Flood Zone 2 and 3a)

The Flood Map for Planning (Rivers and Sea) is made up of a suite of map layers, including Flood Zone 2 and 3a, Defences, Areas Benefiting from Defences, and Flood Storage Areas.

The Flood Zones (Appendix C) describe the land that would flood from rivers if there were no defences present. They are based on broad scale modelling that has been refined with detailed hydraulic models in areas of higher risk. Areas Benefiting from Defences can be identified using the accompanying layers.

Where outlines are not informed by detailed hydraulic modelling, the Flood Map for Planning is based on generalised modelling to provide an indication of flood risk. Whilst the generalised modelling is reasonably reliable on a large scale, it is not intended for specific sites or provided at locations where the catchment area of the watercourse falls below 3km^2 . For this reason, the Flood Map for Planning is not of a resolution suitable for use as planning application evidence to provide details for flooding of individual properties or sites, and for any sites with watercourses on, or adjacent to the site. Accordingly, for site specific assessments it is necessary to perform more detailed studies in circumstances where flood risk could be an issue (making reference to the RoFSW mapping as a guide) and the FRA should include site specific estimates of the Flood Map for Planning is based on generalised modelling, developers should undertake a more detailed analysis and assessment of the flood risk at the planning application stage.

The most up to date version of the Flood Map for Planning (Rivers and Sea) should always be used, and can be viewed on the Environment Agency's website²⁹.

²⁹ Flood Map for Planning (Rivers and Sea), Environment Agency (2017). Accessed online at:



For planning purposes under the NPPF, a more detailed breakdown of risk within the Flood Zones is required and the SFRA is required to define Flood Zone 3b (also known as a Functional Floodplain) and Flood Zone 3a with climate change, using more detailed data from hydraulic models where available. This information is included in the detailed mapping which accompanies this report and covers all of the potential development sites identified by the three authorities at the time of preparation of this SFRA.

3.4.2 Updating the Flood Zone Mapping

The Environment Agency's Flood Zone 3a and 2 are 'living' datasets, and are updated quarterly with any new detailed hydraulic modelling information, and planners and developers should always refer to the most up to date issue. These data sets are now freely available on the Government open data website at https://data.gov.uk/.

The Flood Zone 3b and 3a plus climate change provided by the SFRA will not be automatically updated. However, users should be aware that if Flood Zone 3a and 2 have changed, this is an indication that new modelled information is also available which could be used to refine Flood Zone 3b and 3a plus climate change.

3.4.3 Hydraulic Modelling

The detailed hydraulic models available for use in this SFRA are as follows:

Table 3-2: Models used for Flood Zone Mapping

Model and provider	Туре	Year
The Burstow Stream, Environment Agency	ESTRY- TUFLOW	2011
Lower Mole, Environment Agency	ISIS-TUFLOW	2009
Middle Mole, Environment Agency	ISIS-TUFLOW	2017
Upper Mole, Environment Agency	ISIS-TUFLOW	2004
Redhill Brook and Salfords Stream, Environment Agency	ESTRY- TUFLOW	2014
Medway, Environment Agency	ISIS-TUFLOW	2017

The Upper Mole model is currently in the process of being updated.

3.4.4 Functional Floodplain (Flood Zone 3b)

The 'functional floodplain' is defined as an area of land where water has to flow or be stored in times of flood. This forms Flood Zone 3b in terms of the NPPF. Following discussion between the Councils and Environment Agency, the following definition of the functional floodplain was agreed:

- Use the 1 in 20-year modelled flood extent wherever suitable hydraulic models are available.
- Elsewhere, take a precautionary approach and assume that Flood Zone 3a (1 in 100-year flood extent) represents the functional floodplain

The combined extents were produced for Flood Zone 3b and is displayed in Appendix C. It has also been delivered alongside this report in GIS format.

3.4.5 Climate Change (Flood Zone 3a plus climate change)

The Flood Map supplied by the Environment Agency does not provide any allowance or indication of the impact of climate change on the Flood Zones.

https://flood-map-for-planning.service.gov.uk/ on: 02/06/2017
Updated government guidance on assessing the impact of climate change on flooding in line with the UKCP09 Climate Change Projections was released in February 2016 and updated in 2017³⁰. The guidance provides a range of climate change allowances which are dependent on location (by river basin) and timescale of development (epoch). It also provides several bands (termed 'Central', 'Higher Central' and 'Upper End' that reflect the relative confidence in the magnitude of the predicted effect, as derived from UKCP09 - the confidence in the lower magnitude predictions being higher and the higher magnitude predictions being lower) to test depending on the vulnerability of the development and the Flood Zone within which it is located. A risk based approach has been adopted to the selection of the allowances, for example, for 'more vulnerable' development in Flood Zone 3a, FRAs should use the Higher Central and Upper End estimates to assess a range of allowances. In Flood Zone 1 the central allowance for essential infrastructure, highly vulnerable, more vulnerable and less vulnerable developments should be used.

For the purposes of strategic planning, the key epoch considered is 2070-2115 as this reflects the lifetime of development; and the key vulnerability is 'more vulnerable' as this represents a conservative classification incorporating all vulnerabilities. The key allowances to consider for Flood Zone 3a are therefore the higher central and upper end (35%, 70% in Thames River Basin) as shown in Table 3-3:

River basin borough	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)
South East	Upper end	25%	50%	105%
	Higher central	15%	30%	45%
	Central	10%	20%	35%
Thames	Upper end	25%	35%	70%
	Higher central	15%	25%	35%
	Central	10%	15%	25%

Table 3-3: Climate change allowances

Flood Zone 3a plus climate change flood extents have been produced using the following methodology:

- Produce new 1 in 100-year plus 35% (Higher Central) and plus 70% (Upper End) climate change modelled flood extents wherever suitable hydraulic models are available
- Elsewhere, use Flood Zone 2 (1 in 1000-year flood extent) as a proxy. A reality check was carried out against the EA's Risk of Flooding from Surface Water (RoFSW) 1 in 1000-year extent along watercourses and no areas were found to be significantly greater in extent so no further amendments were made.

Combined extents were produced for the +35% (Higher central) and +70% (Upper End) scenarios. They are very similar in extent and so only the maximum Flood Zone 3a plus climate change has been displayed in Appendix D, but both layers have been delivered alongside this report in GIS format.

3.4.6 Actual Flood Risk

In terms of evidence to support plan-making, if it has not been possible for all future development to be situated in Zone 1 then a more detailed assessment is needed to understand the implications of locating proposed development in Zones 2 or 3. This is accomplished by considering information on the "actual risk" of flooding. The assessment of actual risk takes account of the presence of flood risk management measures (such as defences) and provides a picture of the safety of existing and proposed development. At locations where there are no flood risk management measures (such as defences) then the flood extents described by the Flood Zones are the actual risk. It should be understood that the standard of protection afforded by flood risk management measures (such as defences) is not constant and it is presumed that the required minimum standards for new development are:

³⁰ Flood risk assessments: climate change allowances, Environment Agency (2017). Accessed online at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances accessed on: 13/03/2017.



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

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

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

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

3.4.7 Residual Risk

The residual risk refers to the risks that remain in circumstances after measures have been taken to alleviate flooding (such as flood defences). It is important that these risks are quantified to confirm that the consequences can be safely managed. The residual risk can be:

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

The assessment of residual risk demands that attention be given to the vulnerability of the receptors and the response to managing the resultant flood emergency. In this instance, attention should be paid to the characteristics of flood emergencies and the roles and responsibilities during such events. Additionally, in the cases of breach or overtopping events, consideration should be given to the structural safety of the dwellings or structures that could be adversely affected by significant high flows or flood depths.

3.5 Risk of Flooding from Surface Water

Mapping of surface water flood risk and risk from small Ordinary Watercourses and drains that are not included within the Flood Zones has been taken from the Risk of Flooding from Surface Water (RoFSW) published online (Appendix E). Surface water flood risk is subdivided into the following four categories:

- High: An area has a chance of flooding greater than the 1 in 30 (3.3%) each year;
- Medium: An area has a chance of flooding between 1 in 100 (1%) and 1 in 30 (3.3%) each year;

- Low: An area has a chance of flooding between 1 in 1000 (0.1%) and 1 in 100 (1%) each year;
- Very Low: An area has a chance of flooding of less than 1 in 1000 (0.1%) each year.

This information is based on a national scale map identifying those areas where surface water flooding poses a risk. It shows predictions of flooded areas but should not be used to determine whether individual properties will be affected by surface water flooding or have been affected in the past. However, it can be used to identify development sites where surface water risk may be a constraint to development, and where further detailed modelling may be required as part of a Flood Risk Assessment.

3.6 Groundwater flooding

Compared with other sources of flooding, current understanding of the risks posed by groundwater flooding is limited and mapping of flood risk from groundwater sources is in its infancy. Under the Flood and Water Management Act (2010), LLFAs have powers to undertake risk management functions in relation to groundwater flood risk. Groundwater level monitoring records are available for areas on Major Aquifers. However, for low lying valley areas, which can be susceptible to groundwater flooding caused by a high water-table in mudstones, clays and superficial alluvial deposits, very few records are available. Additionally, there is increased of groundwater flooding where long reaches of watercourses are culverted as a result of elevated groundwater levels not being able to naturally pass into watercourses and be conveyed to less susceptible areas.

JBA's Groundwater Flood Map (Appendix F) has a resolution of 5m and provides a detailed assessment of groundwater flood hazard. The risk of groundwater flooding is scaled between 0 and 4, 0 exposing no risk and 4, groundwater levels are either at or very near (within 0.025 m of) the ground surface. The groundwater levels are compared to ground surface levels to determine the head difference in m; with 0 suggesting artesian discharge of groundwater at the ground surface. Appendix J provides more details of the categories that are applied to the Groundwater Flood Map. The data allows for the LLFAs to determine whether there may be risk of flooding from groundwater.

The JBA Groundwater Flood Map should be used in combination with other information, for example local data or historic data. It should not be used as sole evidence for any specific flood risk management, land use planning or other decisions at any scale. The data can however help to identify areas for assessment at a local scale where finer resolution datasets exist.

3.7 Reservoir Inundation

Reservoirs are artificial bodies of water, where water is collected and stored behind a man-made structure and released under control either to reduce the flow magnitudes in downstream channels or to meet a requirement when needed for purposes such as irrigation, municipal needs or hydroelectric power³¹.

Flooding from reservoirs may occur following partial or complete failure of the control structure designed to retain water in the artificial storage area. It is estimated that the risk of such failure is low and the occurrence of complete reservoir failure is exceptionally rare since the introduction of safety legislation in 1930. The Environment Agency is responsible for inspection of all large reservoirs in England under the Reservoirs Act 1975 (now replaced by the Flood and Water Management Act 2010). However, 1.1 million properties in England are in areas considered to be at risk of flooding from reservoir failure.

Reservoir flooding is very different from other forms of flooding. It may happen with little or no warning and evacuation will need to happen immediately. The likelihood of such flooding is very difficult to estimate, but it is much less likely than flooding from rivers or surface water. It may not be possible to seek refuge from floodwaters upstairs as buildings could be unsafe or unstable due to the force of water from the reservoir breach or failure. The Environment Agency maps (available online at the Government's Flood Warning Information Service website³²) represent a

³¹ National flood and coastal erosion risk management strategy for England, DEFRA (2011). Accessed online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/228898/9780108510366.pdf on: 04/08/17

³² Flood Warning Information service website, Environment Agency (2017). Accessed online at:

https://flood-warning-information.service.gov.uk/long-term-flood-risk/ on: 26/05/2017

credible worst-case scenario. In these circumstances, it is the time to inundation, the depth of inundation and the velocity of flood flows that will be most influential.

The risk to development from reservoirs is residual but developers should consider reservoir flooding during the planning stage. Developers should seek to contact the reservoir owner to obtain information which may include:

- Reservoir characteristics: type, dam height at outlet, area / volume, outflow location
- Operation: discharge rates / maximum discharge
- Discharge during emergency drawdown
- Inspection / maintenance regime

Developers should apply the sequential approach to locating development within the site. The following questions should be considered:

- Can risk be avoided through substituting less vulnerable uses or by amending the site layout?
- Can it be demonstrated that less vulnerable uses for the site have been considered and reasonably discounted?
- Can layout be varied to reduce the number of people or flood risk vulnerability or building units located in higher risk parts of the site?

Developers should consult with relevant authorities regarding emergency plans in case of reservoir breach.

The Environment Agency's Risk of Flooding from Reservoirs map is used to identify areas that may be at risk from failure or overtopping of reservoirs. The data was published following the Environment Agency's National Reservoir Inundation Mapping project in 2009. Layers showing depth, extent and speed of flooding are available, but no information is given on the likelihood of reservoir failure.

3.8 Sewer Flooding

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

Since 1980, the Sewers for Adoption³³ guidelines have meant that most new surface water sewers have been designed to have capacity for a rainfall event with a 1 in 30-chance of occurring in any given year, although until recently this did not apply to smaller private systems. This means that even where sewers are built to current specification, they are likely to be overwhelmed by larger events of the magnitude often considered when looking at river or surface water flooding (e.g. a 1 in 100-chance of occurring in any given year). Existing sewers can also become overloaded as new development adds to their catchment, or due to incremental increases in roofed and paved surfaces at the individual property scale (urban creep). Sewer flooding is therefore a problem that could occur in many locations across the study area.

The assessment in the SFRA is based on record of sewer flooding incidents as recorded in Thames Water and Southern Water's sewer flooding register (Appendix I). This is a register of flooding from the 'public' sewer system ('public' in this context meaning assets under the control of Water & Sewerage Companies (WaSC) in England & Wales). Properties at risk of flooding are recorded in a register which is made available to OFWAT. The WaSC and OFWAT consider the register to be confidential and do not release the data in more detail than 'number of properties per 4 or 5 digit postcode.

³³ Sewers for Adoption 7th Edition - A Design & Construction Guide for Developer. WRc plc. 2012.



3.9 Possible responses to flooding

3.9.1 Assess

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

3.9.2 Avoid

The sequential approach necessitates that the first requirement is to avoid the hazard. If it is possible to place all new development in areas at a low probability of flooding, then the flood risk management considerations will include provisions so that proposed development does not increase the probability of flooding to others. This can be achieved by implementing Sustainable Drainage Systems (SuDS) and other measures to control and manage runoff.

In some circumstances, it might be possible to include measures within proposed development areas that reduce the probability of flooding to others and assist existing communities to adapt to the effects of climate change. In such circumstances, the development proposals should include features that can deliver the necessary levels of mitigation so that the standards of protection and probability of flooding are not reduced by the effects of climate change. Consideration should be given not only to the peak flows generated by new development but also to the volumes generated during longer duration storm events.

3.9.3 Substitute, Control and Mitigate

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

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

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

- Strategic measures to maintain or improve the standard of flood protection so that the development can be implemented safely for its lifetime (this must include firm commitments to invest in infrastructure that can adapt to the increased chance and severity of flooding presented by climate change).
- Design and implement measures such that the proposed development includes features that enable the infrastructure to adapt to the increased probability and severity of flooding so that new communities are safe and the risk to others is not increased (preferably reduced).
- Flood resilient measures that reduce the consequences of flooding to infrastructure so that the magnitude of the consequences is reduced. Such measures would need to be considered alongside improved flood warning, evacuation and welfare procedures so that occupants affected by flooding could be safe for the duration of a flood event and rapidly return to properties after an event had been experienced.

It is essential that appropriate funding arrangements are established for new development proposed in locations where a long-term investment commitment is required to sustain Flood Risk Management (FRM) measures. The strategic investment commitment is required so that in future the FRM measures can be maintained and afforded for the lifetime of the development.

Grant in aid funding (GIA) is available to fund flood and coastal erosion risk management (FCERM) projects. Under this system, central government contributions will cover the full cost of a scheme if it has high benefits – such as if a high number of houses are protected. However, where the benefits are not high enough for central government contributions to cover the costs, local contributions may be available to top up the funding.

The National Flood and Coastal Erosion Management Strategy³⁴ summarises the new system:

"In essence, instead of meeting the full cost of a limited number of schemes, a new partnership approach to funding could make government money available to pay a share of any worthwhile scheme. The amount in each case will depend on the level of benefits the scheme provides. For example, the number of households protected, or the amount of damage that can be prevented. The level of government funding potentially available towards each scheme can be easily calculated. Local authorities and communities can then decide on priorities and what to do if full funding isn't available. Projects can still go ahead if costs can be reduced or other funding can be found locally."

The Government stated that this scheme will help to:

- Encourage total investment in Flood and Coastal Erosion Risk Management by operating authorities to increase beyond what is affordable to national budgets alone;
- Enable more local choice within the system and encourage innovative, cost-effective options to come forward in which civil society may play a greater role.
- Maintain widespread uptake of flood insurance.

³⁴ The national flood and coastal erosion risk management strategy for England, Defra (2011). Accessed online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/228898/9780108510366.pdf on: 02/05/2017



4 Understanding flood risk across the Councils' areas

4.1 Topography, geology, soils and hydrology

4.1.1 Study area

The study area is approximately 636km², and has a population of 307,800 distributed between the three local authority areas. The 2011 census showed 85,000 in the 22 wards of Mole Valley District Council, 137,800 in 19 wards in Reigate and Banstead Borough Council and 85,000 in 20 wards in Tandridge District Council.

4.1.2 Topography

The topography that characterises the study area is displayed in Figure 4-1 below, and is dominated by the North Downs escarpment in the north. The highest elevations are approximately 210 m Above Ordnance Datum (AOD), falling away rapidly on the scarp slope to a height of approximately 130-140 m across most of the southern part of the study area. A significant other high point, Leith Hill is found in the Mole Valley District at ~210 m.

There are three significant watercourses within the study area, the most prominent of which is the River Mole, which originates south of the area, has tributaries in all three authorities' areas and flows to the north of the study area to meet the Thames. The North River, a tributary to the River Arun, originates by Leith Hill, and the River Eden rises in the south east of Tandridge District.

Figure 4-1: Topography of the study area



4.1.3 Geology and soils

The geology of the catchment can be an important influencing factor in the way that water runs off the ground surface. This is primarily due to variations in the permeability of the surface material and bedrock stratigraphy. The study area can be split into three distinct areas, the area north of the North Downs escarpment, the escarpment itself, and the area south of the escarpment.

Figure 4-2 shows that the bedrock north of the escarpment is predominantly Thames group (Clay, silt, sand and gravel), with isolated pockets of Thanet Sand and Lambeth group. The escarpment itself consists of bands north to south of Grey Chalk subgroup, Gault Formation and Upper Greensand Formation, and Lower Greensand Group. South of the escarpment is predominantly Wealden Group (mudstone, siltstone, and sandstone) and Wealden Group interbedded (sandstone and siltstone).

Figure 4-3 shows superficial (at the surface) deposits of clay with flints across the North Downs, with small deposits of Crag Group (sand and gravel). The flood plain of the River Mole contains deposits of Alluvium along the course of the lower Mole, and sand and gravel by the middle and upper Mole, as well as localised deposits in the east of Redhill. The floodplain of the River Eden in the south east of the study area also contains Alluvium, sand and gravel.







Figure 4-3: Superficial geology



4.2 Historical flooding

4.2.1 Summary of Historic Flooding

The study area has a long history of flood events, with multiple sources of flooding. The most significant events were in 1968 (considered to be the worst in living memory), and in 2000.

Details of the significant flood events noted to have affected the study are summarised as follows:

- March 1947 Redhill area
- September 1958 Oxted and Limpsfield, Edenbridge
- June 1960 Horley
- November 1960 Edenbridge, Lingfield,
- September 1968 Widespread throughout whole region
- November 1974 Horley
- February 1990 Widespread along River Mole
- October 1993 Salfords

- JBA consulting
- December 2000 Widespread along River Mole, including river flooding exacerbated by blocked culverts, surface water flooding and sewer flooding.
- December 2013 Leatherhead and various points along Mole, Lingfield and around Horley

The maximum extent of flooding indicated by the historical flood records (all extents from these records combined) are shown in Appendix H.

4.2.2 Flooding within the last 5 years

In the winter of 2013/2014 a succession of storms hit the UK bringing significant disruption to infrastructure and property damage from both wind and flood. The individual storms themselves were not remarkable, but their combined affect; including the wettest January on record for parts of the UK; led to widespread flooding³⁵. Total economic damages for England and Wales due to flooding were estimated to be between £1,000 million and £1,500 million³⁶.

In December 2013 Leatherhead, Horley, various points along the Mole, and Lingfield were all affected. The cause was predominantly a mixture of fluvial and surface water flooding following a period of unprecedented rainfall (275% above an average winter). A feature of this particular flood was the speed in which the River Mole rose (one foot per hour), and then returned to its previous level after 10 hours. During this flood, there were 270 incidents of internal property flooding, with rest centres having to be set up in Dorking and Leatherhead on Christmas Eve. Outside of the floodplain of the Mole, the main source of flooding was surface water flowing off the hills into villages.

Flooding was experienced in Caterham, Whyteleafe and Woldingham in February and March 2014. The flooding also affected areas of the London Borough of Croydon to the north of Tandridge and the flood investigation carried out on behalf of Croydon Council³⁷ identified high groundwater as the dominant source of flooding in this event. The high groundwater levels caused by the record rainfalls in December 2013 and January 2014 led to the Caterham Bourne rising, the emergence of springs causing flooding in gardens and basements, and ingress of groundwater to the sewer network. This was exacerbated by surface water runoff which could not infiltrate and blockages to drainage infrastructure.

SCC and TDC aided by the Army constructed a series of emergency storage areas in the fields adjacent to Woldingham Road in January and February. These were subsequently formalised into major attenuation features aimed at reducing flow downstream.

In June 2016, surface water flooding was experienced in the north of Tandridge district, particularly in Caterham and Chaldon, where one and a half times the mean June rainfall fell in a 2-hour period. 86 internal property floods and 63 external property floods were reported, with many of the internal floods involving sewage. Seven road closures had to be carried out by the police and one by Surrey CC Highways. Groundwater levels were above normal in June, but it is not known if this was a contributing factor.

4.3 Fluvial flood risk

4.3.1 Watercourses

The Main River watercourses in the study area are listed below and shown in Figure 4-4.

- River Mole
- North River (Tributary to River Arun)
- Tillingboune (Tributary to River Wey)
- Pipp Brook (Tributary to River Mole)
- Tanners Brook (Tributary to River Mole)

³⁵ Winter storms, December 2013 to January 2014, Met Office (2014). Accessed online at:

http://www.metoffice.gov.uk/climate/uk/interesting/2013-decwind on: 22/06/17

³⁶ The costs and impacts of the winter 2013 to 2014 floods, Environment Agency, (2016). Accessed online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/501783/The_costs_and_impacts_of_the_winter_2013 _to_2014_floods_-_summary.pdf on: 22/06/17

³⁷ Caterham Bourne Flood Investigation, URS (2014). Accessed online at:

https://www.croydon.gov.uk/sites/default/files/articles/downloads/Caterham%20Bourne%20S19%20Flood%20Investigation%20Report%20%E2%80%93%20October%202014%202.pdf on: 03/08/17

- Leigh Brook (Tributary to River Mole)
- Salfords Stream (Tributary to River Mole)
- Redhill Brook (Tributary to Salfords Stream)
- Burstow Stream (Tributary to River Mole)
- River Eden
- Gibbs Brook (Tributary to River Eden)
- Ray Brook (Tributary of River Eden)
- Eden Brook (Tributary of River Eden)
- Caterham Bourne (Ephemeral stream)

Figure 4-4: Watercourses within the study area



4.3.2 Flood risk

4.3.2.1 River Mole and tributaries

The River Mole is the most significant water body within the study area and one that has a long history of flooding. The Mole catchment is predominantly rural with the exception of the three



large urban areas of Horley, Dorking and Leatherhead. The river and its tributaries has seen isolated flooding events in Redhill in 1947, Horley in 1960 and 1974, Salfords in 1993, and widespread flooding in 1968, 1990, 2000 and 2013.

The Mole enters the study area just north of Gatwick Airport with houses in the south of Horley lying in Flood Zone 3, and the villages of Charlwood, Povey Cross and Hookwood at risk from tributaries. North of Horley the Mole is joined by the Burstow Stream which flows round the eastern and northern edges of Horley. The land here is generally flat resulting in a wide flood plain.

Downstream, the Mole flows through predominantly rural areas with few houses at risk until it reaches Brockham to the east of Dorking. On its way, it is joined by several tributaries that pose more of a flood risk, the first of these being Salfords Stream which flooded in 1968 and 1990. This is in turn joined by Redhill Brook that has Redhill Aerodrome, Ridge Green, and parts of Redhill itself within its Flood Zone 3.

Two other tributaries joining from the west are Deanoak Brook and Leigh Brook, which pass through the settlements of Cudworth, Leigh, and Holmwood Corner, and pose a risk of fluvial flooding to several farms.

Other small tributaries contribute to flood risk in the west of Reigate, with a limited area flooded in 1947 and 1968.

Once the Mole reaches Brockham, several houses can be found in Flood Zone 3, and flooding was recorded in 1968 and 2000.

The Pipp Brook flows through Westcott and the northern area of Dorking, with a narrow band of properties at risk, until it reaches the Mole at Pixham. After this the river cuts through the North Downs at Westhumble before reaching Leatherhead. As it passes through there are many properties lying within Flood Zone 3, and recorded flood outlines in Fetcham as well as the west of Leatherhead. Just before it leaves the study area by the M25, it is joined by the Rye. This flows through Ashstead Common where several properties lie on the edge of Flood Zone 3.

4.3.2.2 River Eden and tributaries

The River Eden lies in the eastern part of Tandridge and has a relatively wide flood plain due to the low lying and flat topography of that area. The main areas of flood risk are on the Upper Eden where it passes through Limpsfield and Oxted, Gibbs Brook through Godstone, Ray Brook through Blindley Heath, and Eden Brook, in Lingfield.

4.3.2.3 Caterham Bourne

The Caterham Bourne is an ephemeral chalk stream recorded as flowing about 1 year in 7, but has been the source of significant flood events. The watercourse originates to the north of the M25 and flows north from Caterham before passing into Purley and Croydon in the London Borough of Croydon. The river is heavily culverted with only an estimated 20% of its length remaining as open channel³⁸. Significant flooding has been recorded along the length of the Bourne which is a complex mix of fluvial flooding exacerbated by culverts, surface water and groundwater.

4.3.2.4 Tilingbourne and North River

These two watercourses run north to south in the south west part of the Mole Valley District Council area. Several small settlements and farms are in Flood Zone 3, but there are relatively few recorded flood events on these watercourses in comparison to the Mole and the River Eden.

4.3.2.5 Ordinary Watercourses

Numerous smaller watercourses exist within the study area, and may pose a flood risk to a small number of properties. Where these impact upon specific sites, they will be discussed in more detail in the relevant Level 2 SFRA.

4.4 Flood defences

A high-level review of formal flood defences was carried out for this SFRA interrogating existing information that gives their condition and standard of protection. Details of the flood defence

³⁸ Caterham Bourne Study Volume One, Arup Water (2002)



locations and condition were provided by the Environment Agency for the purpose of preparing this assessment, in addition to some further explanation of the details of some of these defences. Defences considered are categorised as either raised flood defences (e.g. walls/embankments) or flood storage areas (FSAs). The assessment has considered man-made defences and not natural defences which may arise for instance due to the presence of naturally high ground adjacent to a settlement.

These types of defences and their locations are summarised in the following sections.

4.4.1 Defence standard of protection and residual risk

One of the principal aims of the SFRA is to outline the present risk of flooding across the study area including consideration of the effect of flood risk management measures (including flood banks and defences). The modelling that informs understanding of flood risk within the study area is typically of a catchment-wide nature, suitable for preparing evidence on possible site options for inclusion in development plans. In cases where a specific site risk assessment is required, more detailed studies should be performed to seek to refine the current understanding of flood risk from all sources.

Consideration of the residual risk behind flood defences has been undertaken as part of this study. The residual risk of flooding in a flood event or from failure of defences should also be carefully considered. Developers should also consider the standard of protection provided by defences and residual risk as part of a detailed Flood Risk Assessment (FRA).

4.4.2 Defence condition

Formal structural defences are given a rating based on a grading system for their condition³⁹. A summary of the grading system used by the Environment Agency for condition is provided in Table 4-1. This detail, in addition to descriptions and standard of protection for each, were provided by the Environment Agency for the purpose of preparing this SFRA which reports on the standard of protection using this information.

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

Table 4-1: Defence asset condition rating

Source: Condition Assessment Manual – Environment Agency 2006

The condition of existing flood defences and whether they will continue to be maintained and/or improved in the future requires consideration as part of the risk based sequential approach and this should inform conclusions as to whether possible site options for development are appropriate and sustainable. In addition, detailed FRAs will need to thoroughly explore the condition of defences, especially where these defences are informal and demonstrate a wide variation of condition grades. It is important that all of these assets are maintained to a good condition and their function remains unimpaired.

A review of key defences across the study area, their condition and standard of protection is included in the following sections.

4.4.3 Defences affecting the Councils' areas

The Environment Agency's national Spatial Flood Defences layer identifies flood defences in the authorities' areas. They are located along the River Mole, Eden and North River and their tributaries, and are recorded as either "high ground" or "embankment". Further examination of the description of these assets shows that many are actually the natural bank of the river. Also

³⁹ Condition Assessment Manual, Environment Agency (2006)

present are engineered channels, bank protection, maintained channels, and an example of channel realignment (river restoration to restore meanders on Ashtead Common⁴⁰).

The design Standard of Protection (SoP) for the majority of the assets is 1 in 5 years, with a few cases of a higher SoP of 100 or 200 years; mostly constructed in the last 20 years.

Two areas are designated as benefiting from Capital Defence schemes, one to the south west of Horley, and the other benefiting a large area from Gatwick Airport to the confluence with Salfords Streams. Both of the schemes linked to these areas are actually located outside of the study area. The River Mole models are currently being updated to include a representation of the schemes in the upper catchment, however due to the age of the existing models of the River Mole that have been used to develop the current Flood Zone mapping it is assumed that the present Flood Zones take no account of the flood storage areas.

Following the flooding in Woldingham and Whyteleafe in 2014, Surrey Highways have completed various permanent flood relief solutions⁴¹. These include two flood storage areas (approximately 15,000-20,000m³ capacity) to control the amount and rate of water entering the drainage system when the Caterham Bourne levels are high. A third storage area is currently in the planning stage. This scheme provides a cross-boundary benefit to both the Tandridge Council area and the London Borough of Croydon.

4.4.4 Potential flood management schemes

A number of flood alleviation schemes are currently at the appraisal or initial assessment stage and are shown in Table 4-2 below.

⁴⁰ Restoration of the Rye Brook, The River Restoration Centre, 2015). Accessed online at:

http://www.therrc.co.uk/sites/default/files/projects/p70.pdf on: 06/06/2017

⁴¹ Update 3: Woldingham & Whyteleafe Flood Relief Work, Surrey County Council (2014). Accessed online at:

http://www.caterhamvalleypc.org.uk/wp-content/uploads/2014/09/ARTWORK-140496-Flooding-Update-Newsletter_surrey.pdf on: 03/08/17

Name	Details of scheme	Lead	Timeline
Leatherhead and Fetcham	Scheme to protect residential Fetcham and Leatherhead. Currently at appraisal stage.	Environment Agency	Construction by 2020/21 (if shown to be economically and technically feasible)
Redhill FAS	Scheme to protect commercial town centre and residential community of Redhill. Currently at appraisal stage.	Environment Agency	Construction by 2020/21 (if shown to be economically and technically feasible)
Caterham Bourne FAS	To protect Caterham from groundwater and fluvial flooding from the Bourne. Groundwater model being developed to assist in appraisal.	London Borough of Croydon	
Caterham Hill FAS	Surface water scheme to protect communities around Caterham Hill. Currently at appraisal stage.	Surrey County Council	
Brockham and Strood Green FAS	Scheme to manage surface water flooding. At initial assessment stage.	Surrey County Council	
Dorking FAS	To protect Dorking from Pipp Brook fluvial flooding. At appraisal stage. Defra funding obtained to explore Natural Flood Management techniques in collaboration with Forestry Commission.	Environment Agency	Construction in 2019 (if shown to be economically and technically feasible)
Burstow Stream FAS	Scheme to protect residential areas around Horley. At appraisal stage. (Links closely with Smallfield FAS)	Environment Agency	Construction by 2020/21 (if shown to be economically and technically feasible)
Smallfield FAS	Surface water project focused on a tributary of Burstow Stream. At appraisal stage. TDC have contributed CIL funds.	Surrey County Council	

Table 4-2: Potential Flood Alleviation Schemes (FAS) in the study area

4.5 Tidal flood risk

Tidal flood risk can be assessed using Extreme Still Water Sea Levels (ESWSL). An ESWSL is the level the sea is expected to reach during a storm event for a particular magnitude tidal flood event as a result of the combination of tides and surges. As these levels are based on 'still' water, the effect of short-term fluctuations in sea level associated with wind and swell waves are not included in these predictions, but should be considered at locations where wind and wave effects are influential.

Given that the reach of the rivers within the study area are of fluvial influence only, the tidal flood risk to the area has not been assessed as part of this SFRA.

4.6 Surface water flooding

4.6.1 General

Flooding from surface water runoff (or 'pluvial' flooding) is usually caused by intense rainfall that may only last a few hours. Flooding usually occurs when rainfall fails to infiltrate to the ground or enter the drainage system. Ponding generally occurs at low points in the topography. The likelihood of flooding is dependent on not only the rate of runoff but also saturation of the receiving soils, the groundwater levels and the condition of the surface water drainage system (i.e. surface water sewers, highway authority drains and gullies, open channels, Ordinary Watercourses and



SuDS). Surface water flooding problems are inextricably linked to issues of poor drainage, or drainage blockage by debris, and sewer flooding.

The Risk of Flooding from Surface Water (RoFSW) predominantly follows topographical flow paths of existing watercourses or dry valleys and therefore may cross local authority boundaries in places with some isolated ponding located in low lying areas. Mapping of the RoFSW throughout the study area is provided in Appendix E.

4.6.2 Caterham

In February 2014, a major incident was declared due to severe surface water flooding in the Caterham Bourne catchment. The flooding caused major property damage with 100 properties and 13 businesses affected in Tandridge, and significant disruption to infrastructure including the closure of the A22 for four weeks. The flooding also affected areas of Kenley and Purley in the London Borough of Croydon to the north.

A surface water management study was commissioned by Surrey County Council for Caterham on the Hill⁴² and identified a number of properties that were affected by the surface water flooding in the winter of 2013/14. The study aimed to assess options for addressing flooding from surface water. The report recommended measures including kerb raising in flood risk areas to increase the volume of water stored on the road, the creation of a flood storage area in Queen's Park, replacement of an underground asset with an above-ground detention basin, improved use of green infrastructure, and maintenance of existing assets (including litter management).

Surface water flooding occurred again in June 2016 following heavy thunderstorm where 40mm of rain fell in less than two hours and caused damage to properties and the closure of 4 local primary schools⁴³.

Flood risk associated with the Caterham Bourne catchment crosses into the London Borough of Croydon and highlights the importance of a cross-boundary approach to managing flood risk.

4.7 Groundwater flooding

As part of the SFRA deliverables, mapping of the whole study area has been provided showing both the Areas Susceptible to Groundwater Flooding (AStGWF) from the Environment Agency and the JBA Consulting Groundwater Flood Map. This information is provided in Appendix F. The AStGWF is a strategic-scale map showing groundwater flood areas on a 1 km square grid. The data was produced to annotate indicative Flood Risk Areas for PFRA studies and allow the LLFAs to determine whether they may be at risk of flooding from groundwater. This data shows the proportion of each 1km grid square, where geological and hydrogeological conditions indicate that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring, nor does it take account of the chance of flooding from groundwater rebound. This dataset covers a large area of land and only isolated locations within the overall susceptible area are actually likely to suffer the consequences of groundwater flooding.

The JBA Consulting Groundwater Flood Map is a higher resolution dataset using 1:50,000 geological data and a 5m digital terrain model to provide a 5m resolution groundwater hazard map. It shows the hazard due to rising groundwater levels following periods of prolonged heavy rainfall, as well as where river levels may lead to groundwater flooding. It is an indication of areas where a property or site-specific assessment of groundwater hazard is recommended.

The information indicates that susceptibility to groundwater flooding is greatest in the area of Horley with an extensive area showing as high risk. Other areas with increased risk include Caterham, Whyteleafe and Woldingham, South Merstham and the northern part of Redhill, the west of Reigate, east of Lingfield, Oxted, and Westcott. This strongly links to the geology in these areas, with the alluvial deposits (clay, silt, sand and gravel) being a contributing factor. Rising river levels may also contribute to groundwater flooding along the length of the Mole from Dorking to Leatherhead, and along the Tillingborne in the west of the Mole Valley district.

⁴² Caterham on the Hill Surface Water Management Study (Atkins, 2016). Accessed online at:

https://www.surreycc.gov.uk/__data/assets/pdf_file/0004/106069/Caterham-on-the-Hill-Surface-Water-Management-Study-v2-November-2016.pdf, on: 25/05/2017

⁴³ Caterham floods chaos causes thousands of pounds of damage, getSurrey (2016). Accessed online at:

http://www.getsurrey.co.uk/news/surrey-news/caterham-floods-chaos-causes-thousands-11446257 on: 23/06/17



The AStGWF data should be used only in combination with other information, for example local or historical data. It should not be used as sole evidence for any specific flood risk management, land use planning or other decisions at any scale. However, the data can help to identify areas for assessment at a local scale where finer resolution datasets exist. It should be noted that although an area may be designated as susceptible to groundwater flooding, this does not mean that groundwater flooding will definitely be a problem within these areas, rather it provides an indication of the risk.

It is often difficult to ascertain if the source of a flood event is from groundwater. This is because it may be a result of a combination of sources, or a culverted watercourse being mistaken for a spring or underground stream.

As a result, developers planning to build within any groundwater emergence zones should investigate whether groundwater flooding is likely to be a problem locally.

4.8 Flooding from artificial sources

4.8.1 Flooding from sewers

Historical incidents of flooding are detailed by Southern Water and Thames Water in their DG5 registers. Both Thames Water and Southern Water have provided extracts from their Sewer Flooding Register for the purposes of the SFRA. These are water-company held registers 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.

The SIRF hydraulic overload information is summarised in Table 4-3 below and indicates a total of 579 recorded flood incidents in the three Councils' areas. This information is also included as a map of recorded sewer flood incidents in Appendix I. The more frequently flooded postcodes are RH6, RH7, KT22 and CR3. It is important to recognise that the information does not identify whether flooding incidences were caused by general exceedance of the design sewer system, or by operational issues such as blockages. The information also represents a snap shot in time and may become outdated following future rainfall events. Also, risk in some areas may reduce in some locations as a result of capital investment to increase of the capacity of the network. As such, the sewer flooding flood risk is not a comprehensive 'at risk register' and updated information should be sought to enhance understanding of flood risk from sewers at a given location.

Where a postcode area does not have any recorded incidents of sewer flooding, it does not mean that sewer flood has not occurred in the past or will not occur in the future, merely that an incident has not been recorded.



Table 4-3: Sewer flooding by postcode

4

0

0

3

1

5

20

4

33

4

20

17

3

1

5

10

6

3

3

10

6

1

159

RH2 9

RH6 7

RH6 8

RH6 9

SM7 1

SM7 2

UB8 3

Grand Total

Post code

area

KT2 5 KT2 7

KT205

KT206

KT207

KT211

KT212

KT220

KT227

KT228

KT229

KT233

KT234

KT246

RH2 8

RH3 7

RH4 1

RH4 3

RH5 4

RH5 5

RH6 0

RH6 7

4.8.2 Flooding from reservoirs

Grand Total

The RBBC area contains three reservoirs where there is a residual risk of flooding from reservoir failure, although the likelihood of occurrence is extremely low.

3

7

24

34

6

14

1

222

Grand Total

78

No other bodies of water defined as reservoirs under the Reservoirs Act are contained within the study area.



4.9 The impact of climate change

Flood Risk Assessments (FRAs) are required to demonstrate that future implications of climate change have been considered, and risks managed where possible, for the lifetime of the proposed development. This may include for instance:

- Consideration of the vulnerability of the proposed development types or land use allocations to flooding and directing the more vulnerable away from areas at higher risk due to climate change.
- Use of 'built in' resilience measures, for example, raised floor levels.
- Capacity or space in the development to include additional resilience measures in the future, using a 'managed adaptive' approach.

The last consideration acknowledges that there may be instances where some flood risk management measures are not necessarily needed now but may be in the future. This 'managed adaptive' approach may include for example setting a development away from a river so it is easier to improve flood defences in the future.

As discussed in Section 3.4.5, the latest guidance on climate change allowances for flood risk assessment released by the Environment Agency⁴⁴ provides predictions of anticipated change to:

- peak river flow;
- peak rainfall intensity;
- sea level rise; and
- offshore wind speed and extreme wave height.

4.9.1 Fluvial flooding

Climate change mapping for the study area has been provided in Appendix D. This presents Flood Zone 3a climate change mapping for the +35% and +70% scenarios following the latest guidance and was made available by the Environment Agency to inform the SFRA. Where detailed models are not available the mapping presented displays the Flood Zone 2 information, which it is expected provides a conservative (larger) estimate of climate change flood risk and so can be used to assess potential sensitivity of areas to climate change.

It is important to note that climate change does not just affect the extent of flooding. Even where flood extents do not significantly change - flooding is likely to become more frequent under a climate change scenario. The impact of an event with a given probability is also likely to become more severe. For example, as water depths, velocities and flood hazard increase, so will the risk to people and property. Although qualitative statements can be made as to whether extreme events are likely to increase or decrease over the UK in the future, there is still considerable uncertainty regarding the magnitude of localised impact of these changes. Further details regarding the uncertainties in predicting the impacts of climate change can be found in: Environment Agency (2016) Flood Risk Assessments: Climate Change Allowances.

4.9.2 Surface water flooding

Climate change is predicted to increase rainfall intensity in the future by up to 40% (for the Upper End estimate to the 2080s epoch (2070 to 2115)) under the new range of allowances published by the Environment Agency. This will increase the likelihood and frequency of surface water flooding, particularly in impermeable urban areas, and areas that are already susceptible. Changes to predicted rainfall should be incorporated into flood risk assessments and drainage and surface water attenuation schemes associated with developments.

4.9.3 Groundwater flooding

The effect of climate change on groundwater flooding problems, and those watercourses where groundwater has a large influence on winter flood flows, is more uncertain. The updated climate change guidance released in February 2016 does not provide information on expected changes to groundwater flooding under future climate change. However, milder wetter winters may increase the frequency of groundwater flooding incidents in areas that are already susceptible, but warmer drier summers could counteract this effect by drawing down groundwater levels to a greater extent

⁴⁴ Flood Risk Assessments: Climate Change Allowances, Environment Agency (2017). Accessed online at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances on: 26/05/2017



during the summer months. Where groundwater flooding is expected to influence a development site, it will be expected that consideration of groundwater flooding under a changing climate is assessed and measures taken to mitigate any change in risk.

4.9.4 Climate change assessment of flood risk at sites

To inform the SFRA, outputs made use of the hydraulic modelling and mapping of fluvial flood risk from the River Mole and River Eden (part of the River Medway model). This information was prepared by the Environment Agency and permitted for use in the SFRA. The modelling and mapping focused on predicted flood risk at the 2080s epoch (2070-2115) under increased flow rates of +35% and +70% for the undefended case 1 in 100-year event (Flood Zone 3a). The fluvial flow allowances represent the Higher Central and Upper End allowances under the latest guidance.

With respect to the vulnerability classification of development and its intended lifetime, the Environment Agency consider that within Flood Zone 3a More Vulnerable development types should consider the Higher Central (+35% flows) estimate as the design flood, whilst Essential Infrastructure should consider the Upper End (+70% flows) estimate. Less Vulnerable and Water Compatible development should consider the Central (+25% flows) estimate as the design flood, which is not available from the current flood risk information.



5 The sequential, risk-based approach to development

5.1 The sequential, risk-based approach

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

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

Development should reflect the application of the Sequential Test using the Environment Agency's Flood Zones and the additional detail on Flood Zone 3b, 3a plus climate change and other sources of flooding contained within the maps produced for this SFRA. The information in this SFRA should be used as evidence and, where necessary, reference should also be made to relevant evidence in other documents referenced in this report. The Flood Zone maps and flood risk information on other sources of flooding contained in this SFRA should be used where appropriate to apply the Sequential Test and taking account of the content of 3.4.1.

Where other sustainability criteria outweigh flood risk issues, the decision-making process should be transparent and justification will be required to support decisions to allocate land in areas at high risk of flooding.

The flood risk management hierarchy is summarised in 5.1.

Figure 5-1: Flood Risk Management Hierarchy



The sequential, risk-based approach outlined in the NPPF and the Planning Practice Guidance is designed to ensure areas with little or no risk of flooding (from any source) are developed in preference to areas at higher risk, with the aim of keeping development outside of medium and high flood risk areas (Flood Zones 2 and 3), and that within Flood Zone 1, development is situated away from areas at risk from other sources of flooding, including Ordinary Watercourses, surface water, groundwater and sewer flooding.

5.2 Appropriate development in the Flood Zones

5.2.1 Vulnerability of development

Under the NPPF, development is classed as 'Essential Infrastructure', 'Less Vulnerable', 'More Vulnerable', 'Highly Vulnerable' or 'Water Compatible'. Table 2 and Table 3 of the Planning Practice Guidance provide further detail of the type of development considered appropriate for each Flood Zone, where development is not permitted, and where development is allowed only when the Exception Test is passed.

5.2.2 Appropriate development in the Flood Zones

Section 3.4 contains a detailed description of the Flood Zones defined in the NPPF.

The preference when allocating land is, whenever possible, to place all new development on land in Flood Zone 1 and away from other sources of flooding, taking into account the impacts of climate change. Section 5.1 of this report contains information on the sequential risk based approach. Since the Flood Zones identify locations that are not reliant on flood defences, placing development within Flood Zone 1 means there is no future commitment to spending money on



flood banks or flood alleviation measures avoiding costly long-term expenditure that would become increasingly unsustainable as the effects of climate change increase.

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

When preparing a Local Plan, the LPA should demonstrate it has considered a range of possible site options for development, using SFRAs to apply the Sequential Test, and the Exception Test where required.

5.3.1 Sequential Test

The Sequential Test should be applied to the whole of each LPA area to increase the opportunities to allocate development in areas not at risk of flooding. The Sequential Test can be undertaken as part of a Local Plan Sustainability Appraisal. Alternatively, it can be demonstrated through a free-standing document, or as part of strategic housing land or employment land availability assessments. The Planning Practice Guidance 'Applying the Sequential Test in the preparation of a Local Plan⁴⁵ describes the process.

Each Council will carry out the Sequential Test (and, if necessary, the Exception Test) as part of the Sustainability Appraisal (SA) process, and partners will be consulted on this under the Localism Act's 'duty to cooperate' process.

The Councils will apply the Sequential Test, taking into account **all sources of flooding, and allowing for climate change**.

The first stage of the Sequential Test will identify all potential sites located within Flood Zone 1, and at low risk of flooding from other sources, in order that they can be taken forward for inclusion in the Draft Site Allocations. Across the three Councils' areas, the working definition of low risk of flooding from other sources is considered to be:

- Sites in Flood Zone 1 and not identified as being at risk from fluvial flooding with climate change, Ordinary Watercourses, reservoirs, sewer flooding or critical drainage issues.
- Sites with less than 10% of their area within the RoFSW 1 in 1000-year extent.
- Sites where 1 in 100-year groundwater levels are estimated to reach the ground surface.

The Councils accept that low levels of surface water and groundwater risk can be dealt with through drainage design as part of the planning process and therefore the above criteria (such as up to 10% of the site at risk in the 1 in 1000-year event) have been chosen to identify those where other sources of flooding are not likely to represent a constraint to development.

If all the necessary development cannot be accommodated by the sites identified above, and additional sites are required to enable delivery of the development need set out in the Local Plan, the next stage will be to prepare a Level 2 SFRA to provide further detail on the flood risk (including flood hazards and depths, actual flood risk and residual flood risk to sites), the potential for using sequential design of the site to move development away from flood risk (see section 6.4.1) and support the application of the Exception Test if required.

5.3.2 Exception Test

If, following an application of the Sequential Test, it is not possible for the development to be located in areas with a lower probability of flooding, the Exception Test must then be performed.

The guidance also explains how the Exception Test should be applied in the preparation of a Local Plan (Figure 5-2) as shown in Diagram 3 of the Planning Practice Guidance (Figure 5-2).

45 Applying the Sequential Test in the Preparation of a Local Plan, DCLG (2014). Accessed online at:

https://www.gov.uk/guidance/flood-risk-and-coastal-change#Sequential-Test-to-Local-Plan on: 02/06/2017



Figure 5-2: Applying the Exception Test in the preparation of a Local Plan

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

The requirements for the Exception Test depend on the proposed type/vulnerability of the development and the Flood Zone, as set out in Table 3 of the Planning Practice Guidance (shown below):

Table 5-1 Flood zone vulnerability classification

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	1	1	1	1	1
Zone 2	1	Exception Test required	1	1	1
Zone 3a †	Exception Test required †	x	Exception Test required	~	1
Zone 3b *	Exception Test required *	×	×	×	1.

Key:

- ✓ Development is appropriate
- X Development should not be permitted.

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

" * " In Flood Zone 3b (functional floodplain) essential infrastructure that has 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.



Vulnerability classifications for different type of development are given in Table 2 of the Planning Practice Guidance. The majority of the allocations to be made in the Councils' areas are housing (More Vulnerable, but Highly Vulnerable for basement dwellings) with some employment (Less Vulnerable). Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.

At present, Table 3 of the Planning Practice Guidance does not reflect the need to avoid flood risk from other sources. If a Level 2 SFRA finds that flood risk from other sources is found to pose a significant risk to proposed development, the Councils may identify that the Exception Test should be required.

The Exception Test should only be applied following the application of the Sequential Test. For the Exception Test to be passed:

- it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk (informed by the evidence in the SFRA)
- 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

5.4 Applying the Sequential Test and the Exception Test to individual planning applications

In addition to those sites which are allocated in the Councils' Local Plans, other sites may become available over time. The Local Plan will need to be flexible enough to ensure that where sites can contribute to the sustainable development of the individual authority's area they can be developed.

In these circumstances, the Local Plan includes policies and practice which set out how sites not identified in the Local Plan will require the Sequential Test to be applied on an individual site basis.

For sites that are not allocated in a Local Plan, developers should use evidence provided in this SFRA to apply the Sequential Test as well as provide evidence to show that they have adequately considered other reasonably available sites, including other sites allocated as suitable for residential development.

When assessing sites not identified in the Local Plan, the following procedure should be followed:

- Identify whether the Sequential Test is required (e.g. it is not needed for minor development or change of use (except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site) or for sites in Flood Zone 1, which are at low risk from flooding from other sources as shown by the maps in this SFRA.
- If the Sequential Test is required, the LPA should agree the area of search with the applicant. This should be guided by the requirement for the proposed development in a particular area.
- Determine whether there are any other 'reasonably available' sites within Flood Zone 1 and away from other sources of flood risk, or the sequential approach can be used to move all of the development to Flood Zone 1 and away from other sources of flood risk.
- If there are found to be other reasonably available sites at a lower risk of flooding, then the development has failed the Sequential Test and planning permission should be refused. If there are no other reasonably available sites, then the development can be deemed as passing the Sequential Test and the Exception Test will be required.

When assessing flood risk at sites not allocated in the Local Plan consideration must be given to the Local Plan policies and it must be demonstrated that the proposals are compliant with these policies. This assessment should be included in the site-specific FRA.



6 Guidance for planners and developers: Flood risk

6.1 When is an FRA required?

The requirement for an FRA is set out in Paragraph 103 of the NPPF (footnote 20). The Flood risk assessment: local planning authorities guidance⁴⁶, Flood Risk Assessment for Planning Applications guidance⁴⁷ describe when a FRA is needed as part of a planning application, how to do one and how it is processed. For the Councils, an FRA is required in the following circumstances:

- All developments greater than 1ha located in Flood Zone 1.
- All developments located within Flood Zone 2 or 3 or 3a plus climate change. This includes standing advice for minor developments such as non-residential extensions, alterations which do not increase the size of the building or householder developments. It also includes changes of use of an existing development.
- All developments less than 1ha in Flood Zone 1 where a change of use in development type (e.g. conversion of commercial to residential) leads to a more vulnerable classification or where development could be affected by sources of flooding other than rivers and the sea. This includes surface water, drains and reservoirs.
- All developments located in an area which has been highlighted as having critical drainage problems by the Environment Agency.

Advice should be sought from the relevant LPA (Mole Valley, Reigate and Banstead or Tandridge), the LLFA (Surrey County Council) and/or the Environment Agency, as appropriate, at the pre-planning application stage to determine the need for a site-specific FRA. The Environment Agency charge a fee for this advice.

6.2 Requirements for flood risk assessments

The aim of a FRA is to demonstrate that the development is protected to the 1 in 100-year (1% AEP) event and is safe during the design flood event, including an allowance for climate change. This includes an assessment of mitigation measures required to safely manage flood risk.

FRAs should follow government guidance on development and flood risk, complying with the approach recommended by the NPPF (and its associated guidance) and guidance provided by the Environment Agency. The NPPF advocates a risk-based approach to flood risk management in terms of appraising, managing and reducing the consequences of flooding both to and from a development site.

An FRA should first assess in detail the level of flood risk to the site, including:

- The area liable to flooding from all sources of flood risk, including fluvial, surface water and drainage;
- The probability of flooding occurring now and over time;
- The extent and standard of existing flood defences and their effectiveness over time;
- The likely depth of flooding;
- The rates of flow likely to be involved;
- The likelihood of impacts to other areas, properties, habitats and protected species;
- The effects of climate change;
- The nature and currently expected lifetime of the development proposed.

Proposals for the design of the site should:

- Be in accordance with the requirements of the Sequential and, when necessary, the Exception Tests;
- Not increase flood risk, either upstream or downstream, of the site, taking into account the impacts of climate change;
- Seek to not increase surface water volumes or peak flow rates that would result in increased flood risk to the receiving catchments;

⁴⁶ https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities 47 https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications



- Use opportunities provided by new development to, where practicable, reduce flood risk within the site and elsewhere;
- Ensure that where development is necessary in areas of flood risk (after application of the Sequential and Exception Tests), it is made safe from flooding for the lifetime of the development, taking into account the impact of climate change as stated in Paragraph 102 of the NPPF;
- Seek to use natural flood management such as increasing floodplain connectivity and enhancing natural flood storage to provide connectivity for the movement of flood water, habitats and protected species.

FRAs should include evidence that demonstrates that the proposals are in accordance with the policies described in the Local Plan.

6.3 Assessing the impact of climate change

At all stages of the development process it is important to understand not only the current flood risk to a site but also the flood risk for the lifetime of the development, taking into account the future impact of predicted climate change.

Many areas currently situated within Flood Zone 2 may become part of Flood Zone 3a in the future, due to the effects of climate change, therefore it is essential that the potential risk of flooding in the future is considered when planning development.

In accordance with the Flood Risk Assessments: Climate change allowances guidance⁴⁸, FRAs are required to demonstrate that future implications of climate change have been considered, and that risks are managed where possible, for the lifetime of the proposed development. This may include for instance:

- Consideration of the vulnerability of the proposed development types or land use allocations to flooding and directing the 'more vulnerable' land uses away from areas at higher risk due to climate change.
- Use of 'built in' resilience measures (e.g. raised floor levels).

The guidance provides a range of climate change allowances for river flows and rainfall intensities which are dependent on location (by river basin) and timescale of development (termed 'epoch'). Different allowances are given for different epochs but it is envisaged that the '2070-2115' epoch will be appropriate for most developments (Table 6-1: and Table 6-3:).

The guidance also gives several categories (termed 'central', 'higher central' and 'upper end') to test depending on the vulnerability of the development and the Flood Zone within which it is located (summarised in Table 6-2:). For example, for 'more vulnerable' development in Flood Zone 3a, FRAs should use the higher central and upper end estimates to assess a range of allowances.

When carrying out an FRA, it may be necessary to carry out new or additional modelling to properly test these climate change allowances. It is advisable to contact the Environment Agency to establish what is expected for any particular site, and whether any new modelling is available.

River basin borough	Allowance category	Total potential change anticipated for the '2080s' (2070 to 2115)
South East	Upper end	105%
	Higher central	45%
	Central	35%
Thames	Upper end	70%
	Higher central	35%
	Central	25%

Table 6-1: Climate change allowances (% increase in river flow)

⁴⁸ https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances



Table 6-2:	Using peak	river flow	allowances i	n FRAs

	Allowance category	Total potential change anticipated for the '2080s' (2070 to 2115)
England	Upper end	40%
	Central	20%

6.4 Reducing flood risk through site layout and design

6.4.1 Sequential approach to site design

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

The NPPF states that a sequential, risk-based approach should be applied to try to locate more vulnerable land use away from all sources of flood risk.

In terms of fluvial risk, all built development should be sited with preference to Flood Zone 1, leaving higher risk Flood Zones as open space, preserving flow routes and flood storage.

Areas at risk from surface water or locations at risk of groundwater emergence should also be protected from development to ensure flow routes are not blocked, preventing water from building up to potentially dangerous depths (see also Section 7). The RoFSW maps and any detailed surface water modelling should be used to inform the site design at master planning stage.

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

More flood-compatible development (e.g. vehicular parking, recreational space) may be located in higher risk areas. In assessing the acceptability of vehicular parking in floodplains account should be taken of the nature of parking, flood depths and hazard, including evacuation procedures and flood warning.

There is also a requirement to have a buffer of at least 10 m between the top of the bank of any Main River, and the built environment. The built environment includes formal landscaping, sport fields, footpaths, lighting and fencing, and the buffer should be managed for native biodiversity. If this buffer is not provided, the development is likely to be subject to an objection by the Environment Agency. The Councils will also seek to retain a buffer along Ordinary Watercourses.



6.4.2 Access and egress

Safe access and egress must be provided during the 100-year plus climate change event, from any source of flooding.

6.5 Mitigation measures

In accordance with the Flood Risk Management Hierarchy Figure 5-1, mitigation measures should be considered as a last resort to address flood risk issues, where the Sequential and Exception Tests have demonstrated that development is necessary for wider sustainability benefits.

Consideration should first be given to minimising risk by planning sequentially across a site (section 6.4.1). Once risk has been minimised as far as possible, only then should mitigation measures be considered.

The minimum acceptable standard of protection against flooding for new residential property within flood risk areas is 1 in 100-year (1%) plus climate change annual probability for fluvial flooding. An allowance for climate change over the lifetime of the development must be made when assessing each of these scenarios. The measures chosen will depend on the nature of the flood risk.

6.5.1 Building design and raised floor levels

The raising of floor levels within a development avoids damage occurring to the interior, furnishings and electrics in times of a flood. Finished Floor Levels (FFL) are usually recommended in line with the Environment Agency's Guidance on Flood Risk, which requires a minimum FFL of 300mm above the modelled 1 in 100-year (1%) AEP fluvial water level with allowance for climate change. This additional height that the floor level is raised above the maximum water level is referred to as the "freeboard". Additional freeboard may be required because of risks relating to blockages to the channel, culvert or bridge and should be considered as part of an FRA.

If residual surface water flood risk remains following the site drainage design (see also Section 7), the likely flow routes and depths across the site should be modelled. The site should be designed so that these flow routes are preserved and building design should provide resilience against this residual risk. FFLs should also be 300mm above the modelled 1 in 100-year (1%) AEP surface water level with allowance for climate change where available. If no surface water model is available, they should be 300mm above ground level.

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

Similarly, the use of basements should be avoided. Habitable use of basements within Flood Zone 3 should not be permitted, whilst basement dwellings in Flood Zone 2 will be required to pass the Exception Test.

6.5.2 Development and raised defences

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

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

6.5.3 Modification of ground levels

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



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

Compensatory flood storage should normally be provided, and would normally be on a level for level, volume for volume basis on land that does not currently flood but is adjacent to the floodplain (in order for it to fill and drain). It should be in the vicinity of the site and within the red line of the planning application boundary.

Any proposal for modification of ground levels will need to be assessed as part of a detailed flood risk assessment.

6.5.4 Developer contributions

In some cases, and following the application of the Sequential Test, it could potentially be necessary for the developer to make a contribution to the improvement of flood management provision that would benefit both proposed new development and the existing local community. Developer contributions can also be made to maintenance and provision of flood risk management assets and the reduction of surface water flooding (i.e. SuDS), provided that they reduce the flood risk impact of the development.

The appropriate route for the consideration of strategic measures to address flood risk issues and whether developers can contribute to these wider measures is the Local Flood Risk Management Strategy (LFRMS) prepared by the LLFA.

6.6 Making space for water

The NPPF sets out a clear policy aim in Flood Zone 3 to create space for flooding by restoring functional floodplain.

All new development close to rivers should consider the opportunity presented to improve and enhance the river environment. For instance, as a minimum, developers should aim to set back development 10m from the river, providing a buffer strip to 'make space for water' and allow additional capacity to accommodate climate change. The 10m buffer should not contain any built environment including roads, lighting and fencing.

Developments should, where possible, encompass opportunities for river restoration and enhancement as part of the development. Options include backwater creation, de-silting, inchannel habitat enhancement and removal of structures. When designed properly, such measures can have benefits such as reducing the costs of maintaining hard engineering structures, reducing flood risk, improving water quality and increasing biodiversity. Social benefits are also gained by increasing green space and access to the river.

Consideration of making space for water should also be applied to surface water generated by impermeable surfaces. All new developments should aim to incorporate SuDS to minimise the amount of surface water that is generated. Through a sequential design, known areas of flood risk from surface water can be set aside as open space to ensure flow routes are not blocked, preventing water from building up to potentially dangerous depths. The provision of SuDS also allows water related features to become part of the landscape, offering improved aesthetics to a development and removing the need for underground storage or culverting.

When designedproperly, such measures can have benefits such as reducing the costs of maintaining hard engineering structures, reducing flood risk, improving water quality and increasing biodiversity. Social benefits are also gained by increasing green space and access to the river. Advice on river restoration, de-culverting and providing other environmental enhancements on development sites is available from the Environment Agency. Early consultation is recommended.

Any modifications made as part of the proposed opening up, and / or restoration of river channels and corridors should be designed by suitable professionals and a full flood risk assessment of the impact of modification will be required to be carried out.

The River Restoration Centre is the national advice centre for best practice river restoration, habitat enhancement and catchment management, with an advisory board consisting of members from the Environment Agency and Natural England, (and regional equivalents from Scotland,



Wales and Northern Ireland). The Manual of River Restoration Techniques⁴⁹ contains examples of best practice and case studies as well as links to further information.

Natural Flood Management (NFM) is being increasingly recognised as a method of managing flood risk by protecting, restoring and emulating the natural regulating function of catchments and rivers, and has the potential to provide environmentally sensitive approaches to minimising flood risk, and to reduce flood risk in areas where "hard" flood defences are not feasible⁵⁰. Several studies are underway assessing the impact of NFM measures at a catchment scale, but evidence from other studies in the UK has suggested that techniques such as woodland planting, runoff attenuation features and buffer strips offer a reduction in flood peak for certain flood events.

The Dorking FAS identified in Table 4-2 is an example of an NFM scheme within the study area that has recently gained funding.

There is significant overlap between NFM measures and the Catchment Based Approach (CaBA) which seeks to use catchment management to improve water quality. Within the study area, there are ongoing catchment partnerships for the River Mole⁵¹ and River Wey⁵², which are seeking to address high levels of ammonia and phosphates, as well as river morphology and barriers to fish passage.

6.7 Reducing flood risk from other sources

6.7.1 Groundwater

Groundwater flooding has a very different flood mechanism to flooding from other sources and for this reason many conventional flood defence and mitigation methods are not suitable. The only way practicable to fully reduce flood risk is through building design (development form), so that floor levels are raised above flood water levels e.g. the water levels caused by a 1 in 100 annual probability plus climate change event. Site design also needs to preserve any flow routes followed by the groundwater overland so flood risk is not increased downstream or on adjacent land.

Infiltration SuDS can cause increased groundwater levels and subsequently may increase flood risk on or off the site. Developers should provide evidence that this has been considered within the design and that this will not be a significant risk.

When redeveloping existing buildings, it may be acceptable to install pumps in basements as a resilience measure. However, for new development this is not generally considered an appropriate solution.

6.7.2 Surface water and sewer flooding

Developers should discuss public sewerage capacity with the water utility company at the earliest possible stage, and determine whether there is a requirement to improve the drainage infrastructure to reduce flood risk on site and locally. It is important that a drainage impact assessment shows that this will not increase flood risk elsewhere, and that the drainage requirements regarding runoff rates and SuDS for new development are met.

If residual surface water flood risk remains, the likely flow routes and depths across the site should be modelled. Since most drainage collection and conveyance systems are designed to meet specified thresholds it is important to evaluate how systems will perform when these criteria are exceeded and confirm that new development is safe and flood risk is not exacerbated downstream or on adjacent land. Wherever appropriate the site should be designed so that these exceedance flow routes are preserved and building design should provide resilience against this residual risk.

http://www.therrc.co.uk/manual-river-restoration-techniques on: 02/06/2017

⁴⁹ The Manual of River Restoration Techniques, River Restoration Centre (2013). Accessed online at:

⁵⁰ Understanding the Effectiveness of Natural Flood Management, National Environmental Research Council, (2017). Accessed online at: http://www.nerc.ac.uk/research/funded/programmes/nfm/#xcollapse5 on: 20/09/2017

⁵¹ River Mole Catchment Partnership, CaBA (2017). Accessed online at:

https://www.catchmentbasedapproach.org/index.php?option=com_k2&view=item&layout=item&id=73&Itemid=285 on: 06/10/2017 52 River Way Catchment Partnership, CaBA (2017). Accessed online at:

https://www.catchmentbasedapproach.org/index.php?option=com_k2&view=item&layout=item&id=70&Itemid=336 on: 06/10/2017



When redeveloping existing buildings, the installation of some permanent or temporary floodproofing and resilience measures could protect against both surface water and sewer flooding. Non-return valves prevent water entering the property from drains and sewers. Non-return valves can be installed within gravity sewers or drains within a property's private sewer upstream of the public sewerage system. These need to be carefully installed and be regularly maintained. Consideration must also be given to attenuation and flow ensuring that flows during the 1 in 100 annual probability plus climate change storm event are retained within the site if any flap valves shut. This must be demonstrated with suitable modelling techniques.

6.7.3 Sustainable Drainage Systems

Sustainable Drainage Systems (SuDS) aim to mimic the natural processes of greenfield surface water drainage by encouraging water to flow along natural flow routes and thereby reduce runoff rates and volumes during storm events while providing some water treatment benefits. SuDS also have the advantage of providing effective blue and green infrastructure and ecological and public amenity benefits when designed and maintained properly.

The inclusion of SuDS within developments should be seen as an opportunity to enhance ecological and amenity value, and promote Green Infrastructure, incorporating above ground facilities into the development landscape strategy. SuDS must be considered at the outset, during preparation of the initial site conceptual layout to ensure that enough land is given to design spaces that will be an asset to the development rather than an after-thought. Advice on best practice is available from the Environment Agency and the Construction Industry Research and Information Association (CIRIA). More detailed guidance on the use of SuDS is provided in section 7.5.



7 Guidance for planners and developers: Surface water runoff and drainage

7.1 What is meant by Surface Water Flooding?

For the purposes of this SFRA, the definition of surface water flooding is that set out in the Defra SWMP guidance⁵³. Surface water flooding describes flooding from sewers, drains, and ditches that occurs during heavy rainfall in urban areas.

Surface water flooding includes

- pluvial flooding: flooding as a result of high intensity rainfall when water is ponding or flowing over the ground surface (overland surface runoff) before it either enters the underground drainage network or watercourse or cannot enter it because the network is full to capacity;
- sewer flooding: flooding that occurs when the capacity of underground water conveyance systems is exceeded, resulting in flooding inside and outside of buildings. Normal discharge of sewers and drains through outfalls may be impeded by high water levels in receiving waters which may cause water to back up and flood on the urban surface. Sewer flooding can also arise from operational issues such as blockages or collapses of parts of the sewer network; and
- overland flows entering the built-up area from the rural/urban fringe: includes overland flows originating from groundwater springs.

7.2 Role of the LLFA and LPA in surface water management

Objective 6 of the LFRMS aims to reduce flood risk to and from development through local planning policy and processes. This is planned to be achieved by SCC:

- taking a robust statutory consultee role on surface water drainage;
- Influencing policy and advising local planning authorities on managing flood risk;
- taking viable opportunities to utilise existing and new development to reduce flood risk;
- and educating planning officers, members and developers on flood risk and drainage, particularly SuDS and environmentally beneficial measures.

From April 2015, local planning policies and decisions on planning applications relating to major developments or major commercial developments should make provision for sustainable drainage systems to manage runoff, where major development is defined as:

- residential development: 10 dwellings or more, or residential development with a site area of 0.5 hectares or more where the number of dwellings is not yet known; and
- non-residential development: provision of a building or buildings where the total floor space to be created is 1,000 square metres or more or, where the floor area is not yet known, a site area of one hectare or more.

(The LLFA will also provide advice on minor development on a non-statutory basis).

The local planning authorities must satisfy themselves that clear arrangements are in place for future maintenance of the management arrangements and the LLFA (Surrey County Council), as statutory consultee is required to review the drainage and Sustainable Urban Drainage (SuDS) proposals to confirm they are appropriate.

When considering planning applications, local planning authorities should seek advice from the relevant flood risk management bodies, principally the LLFA on the management of surface water (including what sort of SuDS they would consider to be reasonably practicable), satisfy themselves that the proposed minimum standards of operation are appropriate and ensure, through the use of planning conditions or planning obligations, that there are clear arrangements for on-going maintenance over the development's lifetime. Judgement on what SuDS system

⁵³ Surface Water Management Plan Technical Guidance, DEFRA (2010). Accessed online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69342/pb13546-swmp-guidance-100319.pdf on: 26/05/2017



would be reasonably practicable should be through reference to Defra's technical standards and should take into account design and construction costs.

It is essential that the consideration of sustainable drainage takes place at an early stage of the development process – ideally at the master planning stage. This will assist with the delivery of well designed, appropriate and effective SuDS. Proposals should also comply with the key SuDS principles regarding solutions that deliver multiple long-term benefits. These principles are:

- Quantity: should be able to cope with the quantity of water generated by the development at the agreed rate with due consideration for climate change via a micro-catchment based approach
- **Quality:** should utilise SuDS features in a "treatment train" that will have the effect of treating the water before infiltration or passing it on to a subsequent water body
- Amenity/Biodiversity: should be incorporated within "open space" or "green corridors" within the site and designed with a view to performing a multifunctional purpose

7.3 Role of the developer in surface water management

It is the responsibility of a developer to make proper provision for surface water drainage to ground, water courses or surface water sewers (following the hierarchy defined in section 7.5). It must not be allowed to drain to the foul sewer, as this is a major contributor to sewer flooding.

7.4 Level 1 Assessment of surface water flood risk

In assessing the surface water flood risk across the study area, the Environment Agency's Risk of Flooding from Surface Water (RoFSW) map has been used (Appendix E). These maps are intended to provide a consistent standard of assessment for surface water flood risk across England and Wales in order to help LLFAs, the Environment Agency and any potential developers to focus their management of surface water flood risk.

The RoFSW map is derived primarily from identifying topographical flow paths of existing watercourses or dry valleys that contain some isolated ponding locations in low lying areas. The map displays different levels of surface water flood risk depending on the annual probability of the land in question being inundated by surface water. The levels of flood risk are outlined in Table 7-1 below.

Category	Definition
High	Flooding occurring as a result of rainfall with a greater than 1 in 30 chance in any given year (annual probability of flooding 3.3%)
Medium	Flooding occurring as a result of rainfall of between 1 in 100 (1%) and 1 in 30 (3.3%) chance in any given year.
Low	Flooding occurring as a result of rainfall of between 1 in 1,000 (0.1%) and 1 in 100 (1%) chance in any given year.
Very Low	Flooding occurring as a result of rainfall with less than 1 in 1,000 (0.1%) chance in any given year.

Table 7-1: RoFSW risk categories

Although the RoFSW map offers improvement on previously available datasets, the results should not be used to understand flood risk for individual properties. The results should be used for high level assessments such as SFRAs for local authorities. If a particular site is indicated in the Environment Agency mapping to be at risk from surface water flooding, a more detailed assessment should be prepared to more accurately illustrate the flood risk at a site-specific scale. Such an assessment will use the RoFSW in partnership with other sources of local flooding information to confirm the presence of a surface water risk at that particular location. This may include information within other strategy documents, such as the Surrey Local Flood Risk Management Strategy (see section 2.2.4) and a Surface Water Management Plan should one exist (see section 2.5). It will be important for this to consider the potential impacts of climate change. Guidance relating to climate change allowances is made in section 6.3.



7.5 Sustainable Drainage Systems (SuDS)

Sustainable Drainage Systems (SuDS) are water management practices which aim to enable surface water to be drained in a way that mimics (as closely as possible) the runoff and drainage prior to site development. The primary benefits of SuDS can be categorised under four distinct themes. These are highlighted in Figure 7-1 and are referred to as the four pillars of SuDS design.





Source: The SuDS Manual C753 (2015)

There are a number of ways in which SuDS can be designed to meet surface water quantity, water quality, biodiversity and amenity goals. Given this flexibility, SuDS are generally capable of overcoming or working alongside various constraints affecting a site, such as restrictions on infiltration, without detriment to achieving these goals.

The inclusion of SuDS within developments should also be seen as an opportunity to enhance ecological and amenity value as well as promote Green Infrastructure by incorporating above ground facilities into the landscape development strategy. Appropriately located SuDS measures also offer an opportunity to contribute to the priority habitat restoration and creation targets for the county outlined in The Surrey Nature Partnership's "Biodiversity Opportunity Areas" document⁵⁴.

SuDS must be considered at the outset and during preparation of the initial conceptual site layout to ensure that enough land is given to design spaces that will be an asset to the development as

⁵⁴ Biodiversity Opportunity Areas: the basis for realising Surrey's ecological network, Surrey Nature Partnership (2015). Accessed online at:

https://surreynaturepartnership.files.wordpress.com/2014/11/biodiversity-opportunity-areas_surrey-nature-partnership_20151.pdf on: 15/09/2017



opposed to an ineffective afterthought. For SuDS trains to work effectively the appropriate techniques should be selected based on the objectives for drainage and the site-specific constraints. It is recommended that on all developments source control is implemented as the first stage of a management train allowing for improvements in water quality and reducing or eliminating runoff from smaller, more frequent, rainfall events.

Where practicable, all new major development proposals should ensure that sustainable drainage systems for management of runoff are put in place. The developer is responsible for ensuring the design, construction and future/ongoing maintenance of such a scheme is carefully and clearly defined, and a clear and comprehensive understanding of the existing catchment hydrological processes and existing drainage arrangements is essential.

Discharge of runoff should be in accordance with the hierarchy defined in Part H of the Building Regulations (2010)⁵⁵, with surface water drainage discharging to a soakaway or infiltration system being the preferred option, followed by discharge to a water body (with appropriate consents), and finally discharge into the sewer system (with discharge to a combined sewer system a last resort).

SuDS systems should be carefully designed to suit the proposed development and site characteristics. For instance, areas of high groundwater or impermeable clay soil may limit the opportunities for infiltration schemes, but a combination of source control and above and below-ground storage may be employed on such sites. Regular maintenance is required to ensure long term effectiveness of measures.

7.6 Types of SuDS

There are many different SuDS techniques that can be implemented in attempts to mimic predevelopment drainage (see Table 7-2 below). The suitability of the techniques will be dictated in part by the development proposal and site conditions. Advice on best practice is available from the Environment Agency and the Construction Industry Research and Information Association (CIRIA) e.g. the CIRIA SuDS Manual C753 (2015).

SuDS Technique	Flood Reduction	Water Quality Treatment & Enhancement	Landscape and Wildlife Benefit
Living roofs	✓	✓	✓
Basins and ponds	✓	✓	✓
Constructed wetlands	√	✓	✓
Balancing ponds	✓	✓	✓
Detention basins	✓	✓	✓
Retention ponds	1	1	✓
Filter strips and swales	✓	✓	✓
Infiltration devices	✓	✓	✓
Soakaways	√	✓	✓
Infiltration trenches and basins	✓	✓	✓
Permeable surfaces and filter drains	✓	✓	
Gravelled areas	√	✓	
Solid paving blocks	✓	✓	
Porous pavements	1	1	
Tanked systems	1		
Over-sized pipes/tanks	✓		
Storm cells	✓		

Table 7-2: Examples of SuDS techniques and potential benefits

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/442889/BR_PDF_AD_H_2015.pdf on: 15/09/2017

⁵⁵ The Building Regulations 2010, Part H, HM Government (2010). Accessed online at:


7.6.1 SuDS Management Train

SuDS should not be used individually but as an interconnected system, designed to capture water at the source and convey it to a discharge location. This system is described as a SuDS Management Train (Figure 7-2). By using a number of SuDS features in series it is possible to reduce the flow and volume of runoff as it passes through the system, minimise the pollutants which may be generated by a development, and tailor surface water management to the local context.

Figure 7-2: SuDS Management Train



Source: Water. People. Places: A guide for master planning sustainable drainage into developments (2013)



7.6.2 Treatment

A key part of the four pillars of SuDS is to provide the maximum improvement to water quality through the use of the SuDS Treatment Train. To maximise the treatment within SuDS, CIRIA recommends the following good practice guide is implemented in the treatment process:

- 1. **Manage surface water runoff close to source:** This makes treatment easier due to the slower velocities and also helps isolate incidents rather than transport pollutants over a large area.
- 2. **Treat surface water runoff on the surface:** This allows treatment to be delivered by vegetation and the sources of pollution to be more easily identified. It also helps with future maintenance work and identifying damaged or failed components of the treatment train.
- 3. **Treat a range of contaminants:** SuDS should be chosen and designed to deal with the likely contaminants that may pose a risk to the receiving environment and be able to reduce them to acceptably low levels.
- 4. **Minimise the risk of sediment remobilisation:** SuDS should be designed to prevent sediments being washed into receiving water bodies or systems during events greater than those for which the component may have been specifically designed.
- 5. **Minimise the impact of a spill:** Designing SuDS to be able to trap spills close to the course, facilitate contamination management and removal. The selected SuDS should also provide robust treatment along several components in series.

The number of treatment stages required depends primarily on the source of the runoff. The C753 SuDS Manual advises a simple index approach to determining the number of treatment stages. This involves determining a pollutant hazard score for each pollutant type. An index is then used to determine the treatment potential of different SuDS features for different pollutant types. This is known as the mitigation index. The total SuDS mitigation index should be equal or greater than the pollution hazard score to deliver adequate treatment.

7.7 SuDS Guidance

Information and guidance regarding SuDS design and implementation is available from a number of sources.

7.7.1 Water. People. Places: A guide for master planning sustainable drainage into development⁵⁶

The guide for master planning sustainable drainage into developments was published in 2013 by the LLFAs of the South East of England, of which Surrey County Council is a part, to outline the process for integrating SuDS into the master planning of large and small developments. The South East LLFAs expect this guidance to be used as part of the initial planning and design plans for all types of residential, commercial and industrial development. The guidance complements existing guidance on SuDS design, maintenance and operation which should also be used to inform detailed design and delivery of SuDS.

Although SuDS can be applied to any site, there are a variety of conditions and constraints that could restrict the suitability of different types of SuDS or trigger the need for bespoke design. Therefore, consideration of the movement of water and its interaction with site-specific conditions (e.g. soil types) at the earliest stage of design is crucial to the success of a SuDS scheme.

Section 4 of the 'Water. People. Places' document provides detailed SuDS design guidance for a range of commonly encountered site conditions. A summary of this guidance is provided in the SuDS Selection Matrix (Figure 7-3), whereby the suitability of each type of SuDS is presented for each common site condition.

It is noted in the guidance document that SuDS design should be fully integrated into a master plan as an essential part of land use and development planning, and considered in conjunction with other aspects of the design. Although there is no formal process for master planning, a typical design process for SuDS is outlined in Sections 5 and 6 of the guidance document. The process is designed to allow planners and designers to scope and embed opportunities for SuDS as land use and design ideas evolve.

⁵⁶ A guide for master planning sustainable drainage into development, Susdrain (2015). Accessed online at: http://www.susdrain.org/files/resources/other-

guidance/water_people_places_guidance_for_master_planning_sustainable_drainage_into_developments.pdf on: 27/04/2017



Figure 7-3: SuDS selection matrix for site conditions



Extract from the SuDS guidance document prepared by the Lead Local Flood Authorities of the South East of England: Water. People. Places: A guide for master planning sustainable drainage into developments.



7.7.2 Further information and guidance

Developers should also have regard to the documents developed to provide further information and guidance about SuDS and their implementation in new developments across the study area. Such documents include:

DEFRA Sustainable Drainage Systems - Non-statutory technical standards for sustainable drainage systems.⁵⁷ Sets out non-statutory technical standards for SuDS to be used in conjunction with NPPF guidance.

Natural England advise the use of the **"Local Action Toolkit"**⁵⁸ to aid LPAs in identifying how SuDS and Green Infrastructure can be most effectively applied in an urban setting.

Surrey County Council SUDS Advice Note⁵⁹ (February 2017) - designed to set out the information required to form part of a surface water drainage strategy document to support a major planning application.

RBBC Adopted Core Strategy

CS10: Sustainable Development⁶⁰

"Be located to minimise flood risk, through the application of the Sequential Test and where necessary the Exception Test, taking account of all sources of flooding including fluvial, surface water, sewer and pluvial flooding, and reservoir failure, and manage flood risk through the use of SuDS and flood resistant/resilient design features, and where necessary provide floodplain compensation."

TDC - Core Strategy (2008)

Core Strategy Policy 15⁶¹ - Environmental Quality requires new development to provide Sustainable Drainage Systems (SUDS) to mitigate against flood risk. This will be superseded by future iterations of the Local Plan.

MVDC Adopted Core Strategy and Approaches

Policy CS20 of the Core Strategy seeks to direct development away from Flood Zones 3a and 3b, and requires new development to provide SUDs to mitigate flood risk. Advice on new development at risk from flooding will also be taken into account from detailed FRAs and the Environment Agency.

⁵⁷ DEFRA Sustainable Drainage Systems - Non-statutory technical standards for sustainable drainage systems, DEFRA (2015). Accessed online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf on: 15/09/2017

⁵⁸ Local Action Toolkit, West Country Rivers Trust (2016). Accessed online at: http://urbanwater-eco.services/ on: 18/09/2017 59 Surrey County Council SUDS Advice Note, Surrey County Council (2017). Accessed online at:

https://www.surreycc.gov.uk/__data/assets/pdf_file/0006/116169/SuDS-Advice-Note-2017.pdf on: 02/05/2017

⁶⁰ Adopted Core Strategy (Reigate & Banstead Borough Council, 2014). Accessed online at:

http://www.reigate-banstead.gov.uk/download/downloads/id/3073/adopted_core_strategy_july_2014.pdf on: 26/05/2017 61 Core Strategy, Tandridge District Council (2008). Accessed online at:

https://www.tandridge.gov.uk/Planning-and-building/Planning-strategies-and-policies/Current-and-adopted-planning-policies/Corestrategy on: 05/10/2017



7.8 Groundwater Vulnerability Zones

The Environment Agency published new groundwater vulnerability maps in 2015. These maps provide a separate assessment of the vulnerability of groundwater in overlying superficial rocks and those that comprise the underlying bedrock. The maps show the vulnerability of groundwater at a location based on the hydrological, hydrogeological and soil properties within a one-kilometre grid square.

Two maps are available:

Basic groundwater vulnerability map: this shows the likelihood of a pollutant discharged at ground level (above the soil zone) reaching groundwater for superficial and bedrock aquifers and is expressed as high, medium and low vulnerability

Combined groundwater vulnerability map: this map displays both the vulnerability and aquifer designation status (principal or secondary). The aquifer designation status is an indication of the importance of the aquifer for drinking water supply.

The groundwater vulnerability maps should be considered when designing SuDS.

7.9 Groundwater Source Protection Zones (GSPZ)

In addition to the Areas Susceptible to Ground Water Flooding (AStGWF) data, the Environment Agency also defines Groundwater Source Protection Zones in the vicinity of groundwater abstraction points. These areas are defined to protect areas of groundwater that are used for potable supply, including public/private potable supply, (including mineral and bottled water) or for use in the production of commercial food and drinks. The definition of each zone is noted below:

- Zone 1 (Inner Protection Zone) Most sensitive zone: defined as the 50-day travel time from any point below the water table to the source. This zone has a minimum radius of 50 metres
- Zone 2 (Outer Protection Zone) Also sensitive to contamination: defined by a 400-day travel time from a point below the water table. This zone has a minimum radius around the source, depending on the size of the abstraction
- Zone 3 (Total Catchment) Defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source. In confined aquifers, the source catchment may be displaced some distance from the source. For heavily exploited aquifers, the final Source Catchment Protection Zone can be defined as the whole aquifer recharge area where the ratio of groundwater abstraction to aquifer recharge (average recharge multiplied by outcrop area) is >0.75. Individual source protection areas will still be assigned to assist operators in catchment management
- Zone 4 (Zone of Special Interest) A fourth zone SPZ4 or 'Zone of Special Interest' usually represents a surface water catchment which drains into the aquifer feeding the groundwater supply (i.e. catchment draining to a disappearing stream). In the future, this zone will be incorporated into one of the other zones, SPZ 1, 2 or 3, whichever is appropriate in the particular case, or become a safeguard zone.

The EA's approach to groundwater protection was updated in March 2017⁶² and is summarised below:

- Development must be appropriate to the sensitivity of the site. Where potential consequences of a development or activity are serious or irreversible the EA will adopt the precautionary principle to manage and protect groundwater. The EA will also apply this principle in the absence of adequate information with which to conduct an assessment.
- The Environment Agency expects developers and operators to assess the area of influence of their activities and to take account of all current and future groundwater uses and dependent ecosystems. Developers and operators are expected to assess and mitigate the potential impact on groundwater throughout planning, construction, operation, and decommissioning phases of the development or operation.

With regards to infiltration SuDS in source protection zones, position statement G13 contains relevant advice.

⁶² The Environment Agency's approach to groundwater protection, Environment Agency (2017). Accessed online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/598778/LIT_7660.pdf on: 02/05/2017



The scheme and its treatment stages must be appropriate to the sensitivity of the location and subject to a relevant risk assessment, considering the types of pollutants likely to be discharged, design volumes and the dilution and attenuation properties of the aquifer. Unless the supporting risk assessments show that SuDS schemes in SPZ1 will not pose an unacceptable risk to drinking water abstraction, the EA will object to the use of infiltration SuDS under position statement G10 (developments posing an unacceptable risk of pollution).

Where infiltration SuDS are to be used for surface runoff from roads, car parking and public amenity areas, they should:

- be suitably designed
- meet Governments non-statutory technical standards for sustainable drainage systems these standards should be used in conjunction with the NPPF and PPG
- use a SuDS management treatment train that is, use drainage components in series to achieve a robust surface water management system that does not pose an unacceptable risk of pollution to groundwater.

Where infiltration SuDs are proposed for anything other than clean roof drainage in a SPZ1, a hydrogeological risk assessment should be undertaken, to ensure that the system does not pose an unacceptable risk to the source of supply.

7.9.1 GSPZ in study area

Several GSPZs of varying sizes have been identified in the northern part of the study area. These are shown in Figure 7-4 below. The identified zones are centred around the following areas:

- Leatherhead
- Tadworth
- Dorking
- Buckland
- Area north of Reigate
- Woodmanstone
- Godstone
- M25 J7
- M25 J6
- M25 North of Limpsfield
- M25 close to Clacket Lane services





7.10 Nitrate Vulnerable Zones

Nitrate Vulnerable Zones (NVZs) are areas designated as being at risk from agricultural nitrate pollution. Nitrate levels in waterbodies are affected by surface water runoff from surrounding agricultural land entering receiving waterbodies. The level of nitrate contamination will potentially influence the choice of SuDS and should be assessed as part of the design process. The definition of each NVZ is as follows:

 Groundwater NVZ – an area of land where groundwater supplies are at risk from containing nitrate concentrations exceeding the 50 mg/l level dictated by the EU Council's Surface Water Abstraction Directive (1975)⁶³ and Nitrates Directive (1991)⁶⁴.

64 The EU Council's Nitrates Directive (Annex I), EU (1991). Accessed online at:

JBA

⁶³ The EU Council's Surface Water Abstraction Directive (Annex II, parameter 7*), EU (1975). Accessed online at:

http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31975L0440&from=en on: 26/05/2017

http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31991L0676&from=EN on: 26/05/2017



- Surface Water NVZ an area of land where surface waters (in particular those used or intended for the abstraction of drinking water) are at risk from containing nitrate concentrations exceeding the 50 mg/l level dictated by the EU Council's Surface Water Abstraction Directive (1975) and Nitrates Directive (1991).
- Eutrophic NVZ- an area of land where nitrate concentrations are such that they could/will trigger the eutrophication of freshwater bodies, estuaries, coastal waters and marine waters.

The entire study area lies within a surface water NVZ. Within this there are three smaller regions classified as groundwater NVZs, these are located in and to the south of Leatherhead, Dorking to Coldharbour, south of the M25 from Godstone to Limpsfield. No eutrophic NVZs have been identified in the study area.

8 Flood warning and emergency planning

8.1 Flood emergencies

The evidence used to prepare this SFRA report demonstrates that the Authorities' areas are affected by flood risk hazards and that particular communities are potentially vulnerable to flooding during events that exceed the design capacity of the defences, or from failure of those defences (residual risk)

Emergency planning aids the management of flood related incidents and is relevant in circumstances where there is a residual risk of flooding. Emergency planning is a core component of civil protection and public safety practices and seeks primarily to prevent, or secondly mitigate the risk to life, property, businesses, infrastructure and the environment. In the UK, emergency planning is performed under the direction of the 2004 Civil Contingencies Act (CCA).

From a flood risk perspective, emergency planning can be broadly split into three phases: before, during and after a flood. The measures involve developing and maintaining arrangements to reduce, control or mitigate the impact and consequences of flooding and to improve the ability of people and property to absorb, respond to and recover from flooding. In development planning, a number of these activities are already **integrated** in national building control and planning policies e.g. the NPPF.

Safety is a key consideration for any new development and includes the likely impacts of climate change and, where there is a residual risk of flooding, the availability of adequate flood warning systems for the development, safe access and egress routes and evacuation procedures. It is a requirement under the NPPF that a flood warning and evacuation plan is prepared for sites at risk of flooding used for holiday or short-let caravans and camping and are important at any site that has

Emergency planning and flood risk management links

- 2004 Civil Contingencies Act: http://www.legislation.gov.uk/ukpga/ 2004/36/contents
- DEFRA (2014) National Flood Emergency Framework for England: https://www.gov.uk/government/publ ications/the-national-floodemergency-framework-for-england
- Government guidance for public safety and emergencies is available at: https://www.gov.uk/topic/publicsafety-emergencies/emergenciespreparation-response-recovery

transient occupants (e.g. hostels and hotels)⁶⁵ and for essential ancillary sleeping or residential accommodation for staff required by uses in this category [water-compatible development]. Flood warning and evacuation plans may also be referred to as an emergency flood plan or flood response plan.

8.2 Existing Flood Warning Systems

The Environment Agency is the lead organisation for providing warnings of fluvial flooding (for watercourses classed as Main Rivers) and coastal flooding in England. The Environment Agency supplies Flood Warnings via the Floodline Flood Warning System (FWS) service, to homes and business within Flood Zones 2 and 3, and this covers fluvial, tidal and coastal flooding. Using the latest available technology, Environment Agency staff monitor rainfall, river levels and sea conditions 24 hours a day and use this information to forecast the possibility of flooding. If flooding is forecast, warnings are issued using a set of four easily recognisable codes, shown below in Table 8-1 Generic advice and examples on actions to be taken on receipt of the warning are shown in the column called "What to do".

Flood warnings are disseminated to people registered to receive flood warnings via the FWS service by phone, text and / or email. Warnings may also be reported in news and weather bulletins. The Environment Agency have a Floodline number (0345 988 1188) and a quick-dial number specific to the Flood Warning Area, which the public can call to receive more detailed information regarding the flood warning.

⁶⁵ NPPF Planning Practice Guidance: Flood Risk and Coastal Change (paragraph 056, Reference ID: 7-056-20140306), DCLG (2014)

It is the responsibility of individuals to sign-up this service, to receive the flood warnings via FWS. Registration and the service are free and publicly available. It is recommended that any household considered at risk of flooding signs-up. Developers should also encourage those owning or occupying developments, where flood warnings can be provided, to sign up to receive them. This applies even if the development is defended to a high standard.

The Councils fall within the Kent, South London and East Sussex Environment Agency Area⁶⁶.

Table 8-1: Environment Agency Flood Warnings Explained

Flood Warning Symbol	What it means	What to do
	Flood Alerts are used to warn people of the possibility of flooding and encourage them to be alert, stay vigilant and make early preparations. It is issued earlier than a flood warning, to give customers advice notice of the possibility of flooding, but before we are fully confident that flooding in Flood Warning Areas is expected.	 Be prepared to act on your flood plan Prepare a flood kit of essential items Monitor local water levels and the flood forecast on the Environment Agency website Stay tuned to local radio or TV Alert your neighbours Check pets and livestock Reconsider travel plans
	Flood Warnings warn people of expected flooding and encourage them to take action to protect themselves and their property.	 Move family, pets and valuables to a safe place Turn off gas, electricity and water supplies if safe to do so Seal up ventilation system if safe to do so Put flood protection equipment in place Be ready should you need to evacuate from your home 'Go In, Stay In, Tune In'
	Severe Flood Warnings warn people of expected severe flooding where there is a significant threat to life.	 ✓ Stay in a safe place with a means of escape ✓ Co-operate with the emergency services and local authorities ✓ Call 999 if you are in immediate danger
Warnings no longer in force	Informs people that river or sea conditions begin to return to normal and no further flooding is expected in the area. People should remain careful as flood water may still be around for several days.	 Be careful. Flood water may still be around for several days If you've been flooded, ring your insurance company as soon as possible

8.2.1 Flood Alert and Warning Areas in study area

There are currently 10 Flood Alert Areas and 11 Flood Warning Areas covering the study area. The coverage of these areas can generally be split into 3 areas: those covering the fluvial corridors of the River Mole through the central and north west of the study area, the tributaries of the River Eden to the East, and the area at risk of groundwater flooding to the north east (covering Caterham and Warlingham).

⁶⁶ Environment Agency area structure map, Environment agency (2014). Accessed online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/549638/Environment_Agency_areas_map.pdf on: 28/04/2017

Figure 8-1 shows the warning and alert coverage for the study area. If a home or business falls within this coverage, this means that the Environment Agency can provide flood alerts or warnings.



Figure 8-1: Environment Agency Flood Alert and Warning Areas

8.2.2 Groundwater alerts

In selected areas, the Environment Agency can provide a groundwater alert / warning. These tend to be for communities located on chalk bedrock or known to have a history of groundwater flooding⁶⁷. If a groundwater alert is issued, this does not necessarily mean that properties within its coverage are definitely at risk. The Environment Agency notes that the alerts cover large areas that could be affected if groundwater levels are high and that groundwater is difficult to predict as the location of the flooding is normally related to the local geology. The Environment Agency only provides a limited groundwater alert service.

There are currently no national systems offering flood warnings for flooding from Ordinary Watercourses, surface water, sewer, road and drainage sources or reservoir / flood management infrastructure failure.

⁶⁷ Flood Warning Data Integrity Guide, Environment Agency (2014). Accessed online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/297923/Flood_Warning_-_Data_Integrity_Guide_v2_0.pdf on: 26/05/2017



8.3 Lead times and onset of flooding

Flood alerts and warnings provide advanced notification that flooding is possible or expected. The time from when the alert or warning is issued to the onset of property flooding (termed the lead time) can provide time for people to prepare for flooding (see the "What to do" column in Table 8-1). The Environment Agency endeavours to give a two-hour lead time for issuing Flood Warnings; however, for fast responding catchments and areas at risk of flash flooding, this may not be possible.

A failure or breach of flood defences can cause immediate and rapid inundation to areas located near the vicinity of the breach or failure. Such incidents can pose a significant risk to life given the near lack of warning and lead time to prepare or respond.

For developers, it is therefore important to consider how to manage the consequences of events that are un-foreseen or for which no warnings can be provided. A typical example would be managing the residual risk of a flood defence breach or failure (see section 3.4.7 for further information on residual risk).

8.4 Managing flood emergencies

8.4.1 Local Resilience Forum

Surrey County Council's Local Resilience Forum (LRF) is one of a number of Local Resilience Forums that have been set up across England. The overall aim of an LRF is to ensure that the various agencies and organisations plan and subsequently work together so that responses to emergencies are coordinated appropriately. The Surrey LRF is made up of a number of different agencies and organisations that work together across a range of areas including planning for emergencies.

In response to the Civil Contingencies Act 2004⁶⁸, the LRF publish a Surrey Community Risk Register⁶⁹. This contains known hazards, such as flooding, and the proposed mitigations and response plans.

8.4.2 Surrey Council Major Incident Protocol⁷⁰

Surrey Council's Major Incident Protocol is designed to outline the arrangements for the response to a Major Incident in Surrey, and identifies which agency leads the response and the recovery for the risks identified in the Surrey Community Risk Register. The document refers to specific plans for certain risks, such as the Multi-Agency Flood Plan.

8.4.3 Surrey MAFP

Surrey Council produces a Multi-Agency Flood Plan (MAFP) that sets out the principles that govern the Council's response to a significant flooding event within their administrative area. The plan was produced to meet the requirements of the Civil Contingencies Act 2004, and builds upon the existence and maintenance by Category 1 and 2 Responders of their own plans for response to flooding.

8.4.4 Councils' MAFPs

Each of the District and Borough Councils that make up the study area have their own MAFP. The MAFPs should be reviewed and updated regularly, for example the Reigate & Banstead BC Multi Agency Flood Plan was updated in September 2016 and is reviewed every two years.

The MAFPs contain flow charts for activation of the respective plans, key contacts, and immediate actions upon activation and will be put on standby following receipt of a EA Flood Alert / Warning for any of the flood alert areas within the Borough or District or a National Severe Weather warning for rain is issued. Full activation of the plan should occur when a local response is required or the Police are establishing a tactical meeting.

⁶⁸ Civil Contingencies Act 2004, UK Government (2004). Accessed online at:

http://www.legislation.gov.uk/ukpga/2004/36/pdfs/ukpga_20040036_en.pdf on: 28/04/2017

⁶⁹ Surrey Community Risk Register, Surrey County Council (2016). Accessed online at:

https://www.surreycc.gov.uk/__data/assets/pdf_file/0009/91917/SLRF-Strategic-Climate-Change-Guidance-V1.2.pdf on: 28/04/2017 70 Surrey Major Incident Protocol, Surrey County Council (2015). Accessed online at:

https://www.surreycc.gov.uk/__data/assets/pdf_file/0007/87253/Surrey-Major-Incident-Protocol-V12.4-Public-Facing.pdf, on: 28/04/2017



Advice on flooding and further details of the individual Council flood plans are available via their respective web sites.

8.4.5 Community Flood Plans

Flood action groups are community-led groups working on ways to reduce flood risk in their local area. They work with risk management authorities to resolve issues and provide a direct link between communities and organisations responsible for flood management.

Flood Action Groups in Surrey active in the three authorities' areas are:

- Bookham⁷¹
- Brockham and Strood Green. In addition to the flood forum, there is also the Brockham and Strood Green Emergency Response Team (BERT), a community resilience group that helps during times of flooding⁷².
- Burstow
- Caterham on the Hill and Old Coulsdon⁷³
- Charlwood
- Horley
- Leatherhead and Fetcham⁷⁴
- Leigh
- Ockley
- Whyteleafe

8.5 Emergency planning and development

8.5.1 NPPF

The NPPF Flood Risk Vulnerability and Flood Zone 'Compatibility' table seeks to avoid inappropriate development in areas at risk from all sources of flooding. It is normally essential that any development which will be required to remain operational during a flood event is located in the lowest flood risk zones to ensure that, in an emergency, operations are not impacted by flood water or that such infrastructure is resistant to the effects of flooding such that it remains serviceable/operational during 'upper end' events, as defined in the Environment Agency's climate change guidance. For example, the NPPF classifies police, ambulance and fire stations and command centres that are required to be operational during flooding as Highly Vulnerable development, which is not permitted in Flood Zones 3a and 3b and only permitted in Flood Zone 2 providing the Exception Test is passed. Essential infrastructure located in Flood Zone 3a or 3b must be operational during a flood event to assist in the emergency evacuation process. All flood sources such as fluvial, surface, groundwater, sewers and artificial sources (such as canals and reservoirs) should be considered. In particular, sites for proposed development should be considered in relation to the areas of drainage critical problems.

The outputs of this SFRA should be compared and reviewed against any emergency plans and continuity arrangements within the Authorities. This includes the nominated rest and reception centres (and prospective ones), so that evacuees are outside of the high-risk flood zones and will be safe during a flood event.

8.5.2 Safe access and egress

The NPPF Planning Practice Guidance outlines how developers can secure safe access and egress to and from development to demonstrate that development satisfies the second part of the Exception Test⁷⁵. Access considerations should include the voluntary and free movement of

74 Leatherhead and Fetcham Flood Action Group (2017). Accessed online at:

⁷¹ Bookham Flood Forum (2017). Accessed online at: http://www.bookhamfloodforum.uk/ on: 04/08/2017

⁷² Brockham and Strood Green Emergency Response Team. Accessed online at:

http://www.brockham.org/community/charities-and-support-groups/bert-brockham-emergency-response-team/ on: 04/08/2017 73 Caterham Flood Action Group (2017). Accessed online at: http://caterhamfloodactiongroup.myfreesites.net/ on: 04/08/2017

https://leatherheadandfetchamfloodgroup.wordpress.com/ on: 04/10/2017

⁷⁵ NPPF Planning Practice Guidance: Flood Risk and Coastal Change (paragraph 039, Reference ID: 7-056-20140306), DCLG (2014)



people during a 'design flood' as well as for the potential of evacuation before a more extreme flood. The access and egress must be functional for changing circumstances over the lifetime of the development. The NPPF Planning Practice Guidance sets out that:

- access routes should allow occupants to safely access and exit their dwellings in design flood conditions. In addition, vehicular access for emergency services to safely reach development in design flood conditions is normally required; and
- where possible, safe access routes should be located above design flood levels and avoid flow paths including those caused by exceedance and blockage. Where this is unavoidable, limited depths of flooding may be acceptable providing the proposed access is designed with appropriate signage etc. to make it safe. The acceptable flood depth for safe access will vary as this will be dependent on flood velocities and risk of debris in the flood water. Even low levels of flooding can pose a risk to people in situ (because of, for example, the presence of unseen hazards and contaminants in floodwater, or the risk that people remaining may require medical attention).

The depth, velocity and hazard mapping from hydraulic modelling should help inform the provision of safe access and egress routes.

As part of an FRA, the developer should review the acceptability of the proposed access in consultation with the local authority and the Environment Agency. Site and plot specific velocity and depth of flows should be assessed against standard hazard criteria to ensure safe access and egress can be achieved.

8.5.3 Potential evacuations

During flood incidents, evacuation may be considered necessary. The NPPF Planning Guidance states practicality of safe evacuation from an area will depend on ⁷⁶

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

The vulnerability of the occupants is also a key consideration. The NPPF and application of the Sequential Test aims to avoid inappropriate development in flood risk areas. However, developments may contain proposals for mixed use on the same site. In this instance, the NPPF Planning Practice Guidance states that layouts should be designed so that the most vulnerable uses are restricted to higher ground at lower risk of flooding, with development which has a lower vulnerability (parking, open space, etc.) in the highest risk areas, unless there are overriding reasons to prefer a different location⁷⁷. Where the overriding reasons cannot be avoided, safe and practical evacuation routes must be identified.

The Environment Agency and DEFRA provide standing advice for undertaking FRAs for planning applications. Please refer to the government website for the criteria on when to follow the standing advice. Under these criteria, developers will need to provide details of emergency escape plans for any parts of the building that are below the estimated flood level. The plans should show:

- single storey buildings or ground floors that do not have access to higher floors can access a space above the estimated flood level, e.g. higher ground nearby;
- basement rooms have clear internal access to an upper level, e.g. a staircase; and

⁷⁶ NPPF Planning Practice Guidance: Flood Risk and Coastal Change (paragraph 057, Reference ID: 7-057-20140306), DCLG (2014)

⁷⁷ NPPF Planning Practice Guidance, Reducing the causes and impacts of flooding (paragraph: 053 Reference ID: 7-053-20140306), DCLG (2014)



occupants can leave the building if there is a flood and there is enough time for them to leave after flood warnings⁷⁸.

Situations may arise where occupants cannot be evacuated (e.g. prisons) or where it is safer to remain "in-situ" and / or move to a higher floor or safe refuge area (e.g. developments located immediately behind a defence and at risk of a breach). These allocations should be assessed against the outputs of the SFRA and where applicable, a site-specific FRA to help develop appropriate emergency plans.

8.5.4 Flood warning and evacuation plans

Flood warning and evacuation plans are potential mitigation measures to manage the residual risk, as stated in the NPPF Planning Practice Guidance. It is a requirement under the NPPF that a flood warning and evacuation plan is prepared for sites at risk of flooding used for holiday or short-let caravans and camping and are important at any site that has transient occupants (e.g. hostels and hotels).

A flood warning and evacuation plan should detail arrangements for site occupants on what to do before, during and after a flood as this will help to lessen its impact, improve flood response and speed up the recovery process. The Environment Agency provides practical advice and templates on how to prepare a flood plan for individuals,

Guidance documents for preparation of flood response plans

- **Environment Agency (2012)** Flooding – minimising the risk, flood plan guidance for communities and groups
- Environment Agency (2014) **Community Flood Plan template**
- **Environment Agency Personal** flood plans
- Flood Plan UK 'Dry Run' A **Community Flood Planning Guide**

communities and businesses (see text box for useful links).

It is recommended that emergency planners at the Authorities are consulted prior to the production of any emergency flood plan. The relevant Council will provide guidance to help local communities to protect their home and valuables and understand what to do before, during and after a flood, as shown under Objective 5 of the Surrey LFRMS. Once the emergency flood plan is prepared, it is recommended that it is distributed to emergency planners at the Authorities and the emergency services. When developing a flood warning and evacuation plan, it is recommended that it links in with any existing parish / community level plan.

8.5.5 Other sources of information



As well as being a statutory consultee for new development at risk of flooding, the Environment Agency can offer independent technical advice. The Environment Agency website contains a breadth of information on flood risk and there are numerous publications and guidance available. For example, the "flooding from groundwater" guide has been produced by the Environment Agency and Local Government Association to offer practical advice to reduce the impact of flooding from groundwater.

⁷⁸ Flood Risk Assessment: Standing Advice, Environment Agency (2012). Accessed online at: https://www.gov.uk/flood-risk-assessment-standing-advice on: 26/05/2017







The Met Office provides a **National Severe Weather Warning Service** about rain, snow, wind, fog and ice. The severity of warning is dependent upon the combination of the **likelihood** of the event happening and the **impact** the conditions may have. In simplistic terms, the warnings mean: Yellow: Be Aware, Amber: Be Prepared, Red: Take Action. This service does not provide flood warnings. The Met Office provides many other services and products. For further information, please visit their website.

The National Flood Forum (NFF) is a **national charity**, set up in 2002 to support those at risk and affected by flooding. The NFF helps people to prepare and recover from flooding as well as campaigning on behalf of flood risk communities, including providing advice on matters such as insurance.



Individual property-level protection (PLP) measures are design to help protect homes and businesses from flooding. These include a combination of **flood resistance measures** - trying to prevent water ingress – and **flood resilience measures** - trying to limit the damage and reduce the impact of flooding, should water enter the building. It is important that any measures have the **BSI Kitemark**. This shows that the measure has been tested and ensures that it meets industry standards. Please visit the Government website: "improve your property's flood protection" for more information.

9 Strategic flood risk solutions

9.1 Introduction

Strategic flood risk solutions may offer potential opportunity to reduce flood risk in the Councils' areas by encouraging cooperation between difference RMAs and communities. As described in section 2.6, the Councils' areas are covered by three catchment flood management plans.

9.1.1 Thames CFMP

The Thames CFMP covers the whole of the Reigate and Banstead borough, the northern and western areas of Tandridge district and the majority of the Mole Valley district.

Sub-area 3 (Towns and villages in open flood plain)

Policy option 2 is applied - reducing existing flood management actions. Preferred actions identified are to:

- Maintain the capacity of watercourses in the towns and villages through the ongoing maintenance programme, with maintenance reduced elsewhere.
- Safeguard the natural flood plain from inappropriate development by working with local authority partners. This will provide local social and economic benefits (by reducing flood risk) and environmental benefits (by allowing flooding).
- Work closely with local authority partners to ensure that plans are prepared to respond to flooding. This will help communities to work with local organisations to produce community flood plans.

Sub-area 4 (Chalk and downland catchments)

Policy option 3 is applied - continue with existing or alternative actions to manage flood risk at the current level. Preferred actions identified are to:

- Maintain the existing capacity of the river systems in developed areas to reduce the risk of flooding from more frequent events. Work with partners to identify opportunities to make existing systems more efficient (for example, where there are significant restrictions to flow from undersized culverts or bridges).
- Work with local planning authorities to retain the remaining flood plain for uses that are compatible with flood risk management and put in place policies that lead to long-term adaptation of urban environments in flood risk areas.
- Continue to increase public awareness, including encouraging people to sign up for the free Floodline Warnings Direct service.

Sub-area 5 (Urbanised places with some flood defences)

Policy Option 6 is applied - take action with others to store water or manage runoff in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment. Preferred actions identified are to:

- Maintain the existing flow of rivers in urban areas that reduce the risk of flooding from the smaller, more frequent floods.
- Continue to make sure the recommendations in SFRAs and Local Development Framework policies create the potential to reduce flood risk through adaptation of places at risk, managing runoff and retaining open spaces in the flood plain.
- Identify locations where the attenuation of water could have social and economic benefits (by reducing flood risk) and environmental benefits (by increasing the frequency of flooding) and encourage compatible land uses.
- Develop emergency response planning to deal with extreme events, including raising public awareness and working with key partners to identify critical infrastructure at risk.

9.1.2 Arun and Western Streams CFMP

This plan covers the south west corner of the MVDC area, taking in North River.

Sub-area 1 (Rother Valley / Middle Arun / The Weald)

Policy option 6 is applied. Preferred actions identified are to:

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- Develop a System Asset Management Plan to review maintenance regimes.
- Investigate opportunities to work with landowners to create wetland habitat throughout the sub area.
- Work with the National Farmers Union and Natural England to develop a Land Management Plan exploring the potential for changes in land use and land management practices throughout the sub-area. This would aim to reduce the runoff from surrounding countryside, to reduce soil erosion and to achieve local flood risk benefits.

9.1.3 River Medway CFMP

This plan covers the eastern area of the Tandridge District Council area, taking in the Eden and its tributaries.

Sub-area 1 (Upper catchment)

Policy option 3 is applied. Preferred actions identified are to:

- Undertake System Action Management Plans (SAMPs) to review maintenance regimes and to maintain current level of investment.
- With reference to the planned development at East Grinstead, PPS25 [since been superseded by the NPPF] and the Strategic Flood Risk Assessment should be followed to manage development that might influence the speed of runoff and flood risk.
- Work towards improving the flood warning service, Floodline Warnings Direct. Improve the accuracy of real-time flood warnings by assisting the development of our National Flood Forecasting System.
- Investigate opportunities to work with landowners to create wetland habitat (link to Regional Habitat Creation Programme).
- Implement outcomes of the Middle Medway strategy
- Influence the development of emergency response plans.

9.2 Flood storage schemes

Flood storage schemes aim to reduce the flows passed downriver to mitigate downstream flooding. Development increases the impermeable area within a catchment, creating additional and faster runoff into watercourses. Some flood storage schemes aim to detain this additional runoff brought about by development, releasing it downstream at a slower rate, to avoid any increase in flood depths and/or frequency downstream. Methods to provide these schemes include⁷⁹:

- Enlarging the river channel
- Raising the riverbanks
- Constructing flood banks set back from the river
- Implementation of SuDS storage schemes

Flood storage schemes have the advantage that they generally benefit areas downstream, not just the local area. Benefits of a flood storage area may therefore cross local authority borders to those for instance further downstream along the River Mole, and conversely the Councils may benefit from schemes outside their area, for instance flood attenuation schemes on the Upper Mole.

Opportunities to work with natural processes to reduce flood and erosion risk, benefit the natural environment, and reduce cost of schemes should be sought. This requires integrated catchment management and involving those who use and shape the land. It also requires partnership working with neighbouring authorities, organisations and water management bodies.

Conventional flood prevention schemes listed above will likely still be preferred, but consideration of 're-wilding' rivers upstream could provide cost efficiencies as well as considering multiple sources of flood risk; for example, through wider land management practices (e.g. woodland management, creation of upland wetlands and managed farming practices) or building earth banks to capture runoff, could be cheaper and smaller-scale measures than implementing flood

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⁷⁹ Fluvial Design Guide - Chapter 10, Environment Agency (2010). Accessed online at:

http://evidence.environment-agency.gov.uk/FCERM/en/FluvialDesignGuide/Chapter10.aspx?pagenum=2 on: 26/05/2017

walls for example. Again, this may require partnership working with neighbouring authorities and landowners. With flood prevention schemes, consideration needs to be given to the impact that flood prevention has on the WFD status of watercourses. It is important that any potential schemes do not have a negative impact on the ecological and chemical status of waterbodies.

9.3 Flood plain restoration

Compared to flood defences and flood storage, floodplain restoration represents the most sustainable form of strategic flood risk solution, by allowing watercourses to return to a more naturalised state, and by creating space for naturally functioning floodplains working with natural processes.

Although the restoration of floodplain is difficult in previously developed areas where development cannot be rolled back, the following measures could be considered:

- Promoting existing and future brownfield sites that are adjacent to watercourses to naturalise banks as much as possible. Buffer areas around watercourses provide an opportunity to restore parts of the floodplain
- Removal of redundant structures to reconnect the river and the floodplain. There are a number of culverted sections of watercourse located throughout the study area which if returned to a more natural state would potentially reduce flood risk to the local area
- Apply the Sequential Approach to avoid new development within currently undefended floodplain.

9.4 Engaging with key stakeholders

Flood risk to an area or development can often be attributed to a number of sources such as fluvial, surface water and/or groundwater. In rural areas, the definition between each type of flood risk is easier to distinguish. However, within urban areas flooding from multiple sources can become intertwined. Where complex flood risk issues are highlighted it is important that all stakeholders are actively encouraged to work together to identify issues and provide appropriate solutions.

Engagement with riparian owners is also important to ensure they understand their rights and responsibilities including:

- maintaining river bed and banks;
- allowing the flow of water to pass without obstruction; and
- controlling invasive alien species e.g. Japanese knotweed.

More information about riparian owner responsibilities can be found in the Environment Agency's publication 'Living on the Edge' (2012).

10 Development management recommendations

10.1 Overview

There are a number of policy considerations relating to flood risk management in the Councils' areas, which are described in sections 2 and 8. This chapter sets out recommendations for considering and assessing flood risk in the study area.

10.2 Development management policy

The following recommendations have been identified for flood risk policy for new development. The first recommendations are relevant to all development regardless of the Flood Zone they are in. The remaining recommendations are relevant to specific Flood Zones (note some policies are relevant to more than one flood zone and hence will have been repeated).

Recommendations relevant for development in all Flood Zones (1, 2, 3a, 3b)

- Where Flood Zones do not currently exist for smaller watercourses and drains (those with a catchment area less than 3km²), the RoFSW map can give a broad indication of the potential flow path and flood extent from these watercourses. At the planning application stage, developers should be expected to undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood extents, inform development zoning within the site and prove, if required, whether the Sequential and Exception Tests can be satisfied. These assessments should also identify the existing risk of flooding to adjacent land and properties to establish whether there is a requirement to secure land to implement strategic flood risk management measures to alleviate existing and future flood risk
- An FRA is required for all developments over 1 ha and should be proportionate to the degree of flood risk, as well as the scale, nature and location of the development. The LPA and Environment Agency should be consulted to confirm the level of assessment required and to provide any information on any known local issues.
- The LPA should consult the Environment Agency's 'Flood Risk Standing Advice (FRSA) for local planning authorities', when reviewing planning applications for proposed developments at risk of flooding
- Developers should demonstrate through a Surface Water Drainage Strategy, that the proposed drainage scheme, and site layout and design, will prevent properties from flooding from surface water, allowing for climate change effects. They should also show that flood risk elsewhere will not be exacerbated by increased levels of surface runoff. Consideration must also be given to residual risk and maintenance of sustainable drainage and surface water systems
- Surface water runoff management should be undertaken, through the utilisation of appropriate SuDS techniques, prioritising the use of surface SuDS features which provide additional benefits (e.g. biodiversity, amenity space)
- Normally no buildings should be constructed within 10 metres of the banks of watercourses. This is to allow access for maintenance, as well as providing an ecological corridor
- Consideration should be given to flood risk that crosses LPA boundaries and a crossboundary approach taken where appropriate. For example, fluvial flood risk from the River Mole which crosses LPA boundaries or surface water and groundwater flood risk in Caterham.

Recommendations for Flood Zone 1

Fluvial flood risk is not a significant constraint to development within Flood Zone 1. However, there are a number of locations in Zone 1 where flooding from other sources including Ordinary Watercourses or drains that are not shown on Environment Agency flood maps, surface water as defined by the RoFSW mapping or groundwater may be an issue. This should be reviewed and assessed during the preparation of planning applications as appropriate. There is also residual risk, in some locations, from reservoirs within the Councils' areas.

- Detailed FRA is required for all developments over 1 ha.
- Reference should be made to the Local Flood Risk Management Strategy and consideration given to requirements for the management of local flood risk.

Recommendations for Flood Zone 2

Most development can be acceptable in Flood Zone 2 with the exception of Highly Vulnerable development. Highly Vulnerable development is only permitted if it has passed the Exception Test.

- An FRA is required for all developments within this zone.
- Development design should incorporate mitigation measures to manage any flood risk to the development, including residual risk. Finished Floor Levels should be above the 1 in 100-year (1% AEP) flood level, plus an allowance for climate change (agreed with the Environment Agency and the LPA).
- The layout of buildings and access routes should adopt a sequential approach, steering buildings towards areas of lowest risk within the site.

Recommendations for Flood Zone 3a

Development in Flood Zone 3a is significantly constrained by flood risk. Highly Vulnerable development is not permitted within this zone and More Vulnerable development and Essential Infrastructure are only permitted if the Exception Test can be passed.

- An FRA is required for all developments within this zone.
 - It should be demonstrated that flood defences provide an acceptable standard of protection, including an allowance for climate change for the lifetime of the development.
 - Residual risks should be assessed, and the Environment Agency consulted regarding whether there is a need for a breach analysis to map a rapid inundation zone.
- The layout of buildings and access routes should adopt a sequential approach, steering buildings towards areas of lowest risk within the site. Where rapid inundation zones have been identified, development should be avoided in these areas.
- Development should not impede flow routes, reduce floodplain storage or consume flood storage in a 'flood cell' within a defended area. If the development does result in a loss of storage, compensatory floodplain storage should be provided on a 'level for level' and 'volume for volume' basis.
- If existing defences are to be upgraded as part of the development, an assessment should be undertaken to ensure it does not result in an increase in flood risk elsewhere.
- Development design should incorporate mitigation measures, to manage any flood risk to the development, including residual risk for the lifetime of the development. FFLs should be above the 1 in 100-year (1% AEP) flood level, plus an allowance for climate change.
- It is recommended that all types of new development behind flood defences is avoided, where possible, due to the residual risks of breach and overtopping
- Consideration should be given to the type of building that will be permitted, for example single-storey buildings and basements should be avoided.

Recommendations for Flood Zone 3b (Function Floodplain)

Development is highly constrained within Flood Zone 3b. Only Essential Infrastructure and Water Compatible uses are permitted in this zone, and only if the Exception Test has been passed (subsequent to application of the Sequential Test).

Functional floodplain is vital for the conveyance and storage of floodwater. Development within this zone will potentially impede the flow of floodwater as well as result in a loss of flood storage,

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increasing flood risk both within the area and further downstream. Consideration should be given to 'rolling back' development in this zone, withdrawing development from the floodplain and allowing it to return back to a natural floodplain. This has an additional benefit of reducing flood risk to communities further downstream.

For the purpose of the SFRA, the defended case 1 in 20-year return period (5% Annual Exceedance Probability) event informs the Functional Floodplain within the Councils' areas. However, where flood outlines of Flood Zone 3b are not available, Flood Zone 3a should be considered as Flood Zone 3b unless, following further work as part of a site-specific FRA, and in consultation with the Environment Agency, it can be proven as Flood Zone 3a.

- Essential infrastructure should only be allocated in this zone if no reasonable alternative sites are available in areas of lower flood risk.
- An FRA is required for Essential Infrastructure within this zone and should include evidence to demonstrate the Exception Test has been passed. Should the site pass the Exception Test, it should be designed and constructed to:
 - o remain operational and safe for users in times of flood
 - result in no net loss of floodplain storage
 - o not impede water flows and not increase flood risk elsewhere
- Development should not impede flow routes or reduce floodplain storage. If the development does result in a loss of storage, compensatory floodplain storage should be provided on a 'level for level' and 'volume for volume' basis.
- Development design should incorporate mitigation measures, to manage any flood risk to the development, including residual risk. Floor levels should be above the 1 in 100-year (1% AEP) flood level, plus an allowance for climate change.

11 Summary

11.1 Level 1 SFRA Assessment

The 2017 Joint Mole Valley, Reigate and Banstead and Tandridge SFRA has been produced to reflect recent changes in policy and legislation, to bring the planning context and flood risk information up to date and to aid the development of the new Local Plan.

The SFRA provides general advice for planners and developers on:

- Sources of flood risk mapping and other evidence to inform the Sequential Test
- Flood risk from potential sources of flooding including Main River, Ordinary Watercourse, surface water, groundwater and sewer flooding sources within the Councils' areas
- What is required from a Flood Risk Assessment
- Other issues that need to be considered when carrying out development close to watercourses.

11.2 Use of SFRA data and future updates

It is important to remember that information on flood risk is being updated continuously. This is particularly true now that the LLFA have taken responsibility for carrying out and recording flood investigations under the FWMA. The Environment Agency has a rolling programme of flood modelling and mapping studies, and updates to the Flood Map are made quarterly. Where new mapping studies are carried out this will also affect the definition of the functional floodplain (Flood Zone 3b) and Flood Zone 3a + climate change. It is important that the Environment Agency is consulted to determine whether updated information is available prior to commencing a detailed Flood Risk Assessment.

The SFRA should be periodically updated when new information on flood risk, flood warning or new planning guidance or legislation becomes available. New information on flood risk may be provided by Surrey County Council, the Highways Authority, Thames Water, Southern Water and the Environment Agency. It is recommended that the SFRA is reviewed internally on an annual basis, allowing a cycle of review, by checking with the above bodies for any new information to allow a periodic update.

11.3 Recommendations

As the Councils move forward with their Local Plans, they must use the most up to date information in applying the Sequential Test, and developers should be aware of the latest information for use in FRAs. Both should be aware of any future changes to advice in the consideration of climate change for planning FRAs.

The Flood and Water Management Act (2010), the Localism Act (2011) and the NPPF all offer opportunities for a more integrated approach to flood risk management and development. As the three authorities are in the relatively early stages of developing their Local Plans, they have a real chance to approach planning for flood risk, sustainable drainage, green infrastructure, water quality, amenity, bio-diversity and habitat, and Water Framework Directive considerations in an integrated way. The Councils' planning policies should focus on ensuring, with support from the LLFA, that all developments, even minor ones, build SuDS into their design. New settlements on greenfield sites (and other major developments) offer excellent opportunities to ensure that master planning integrates SuDS and making space for water in the site design right from the concept stage.

The SFRA has been developed using the best available information at the time of preparation. This relates both to the current risk of flooding from rivers, and the potential impacts of future climate change.



Appendices

- A Index grid squares for Appendix mapping
- B Watercourses in the Authorities' Area
- C Flood Zone mapping
- D Climate change mapping
- E Surface water mapping
- F Groundwater mapping
- G Flood warning coverage
- H Historic flood records
- I Recorded sewer flooding incidents
- J JBA's Groundwater Map product information

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