Waverley Borough Council

Level 1 Strategic Flood Risk Assessment

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Final

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Quality information

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Abbreviations

ACRONYM	DEFINITION
AOD	Above Ordnance Datum
AIMS	Asset Information Management System
BC	Borough Council
BGS	British Geological Survey
CFMP	Catchment Flood Management Plan
FRA	Flood Risk Assessment
FWMA	Flood and Water Management Act 2010
GIS	Geographical Information System
LFRMS	Local Flood Risk Management Strategy
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
LRF	Local Resilience Forum
MAFP	Multi Agency Flood Plan
PPG	Planning Practice Guidance
NFCDD	National Flood and Coastal Defence Database
NPPF	National Planning Policy Framework
ROFfSW	Risk of Flooding from Surface Water
SCC	Surrey County Council
SFRA	Strategic Flood Risk Assessment
SPZ	Source Protection Zone
SuDS	Sustainable Drainage Systems
SWSL	Southern Water Services Ltd
TWUL	Thames Water Utilities Ltd

Glossary of Terms

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

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

Executive Summary

The lower lying areas and river valleys in the Borough of Waverley are at risk of flooding from rivers, surface water, groundwater and artificial sources. The River Wey and its tributaries (the North Wey, South Wey and Cranleigh Waters) are dominant features in the Borough and flooding from these watercourses has occurred a number of times in the last 100 years, most recently in the winter of 2013 – 2014, during which many homes and business were affected.

As the Local Planning Authority (LPA) Waverley Borough Council (BC) has the responsibility, in accordance with the National Planning Policy Framework (NPPF)[1] and Planning Practice Guidance for Flood Risk and Coastal Change[2], to ensure that flood risk is understood and managed effectively through all stages of the planning process. As such, Waverley BC is required to undertake a Strategic Flood Risk Assessment (SFRA) to form part of the evidence base for the preparation of their Local Plan and AECOM has been commissioned to review and update the Level 1 SFRA which was originally prepared in 2015[3], followed by the completion of a Level 2 SFRA in 2016[4].

This aim of this revised Level 1 SFRA is to identify the spatial variation in flood risk across the Borough of Waverley from all sources, facilitating a borough-wide comparison of future development sites with respect to flood risk considerations.

The Environment Agency identifies the fluvial floodplains associated with main rivers across the Borough, presented in the maps included in Appendix B. These should be used for planning purposes when determining the suitability of development.

It is noted that the modelling for the Middle and Upper Wey presented within this SFRA is currently draft and subject to change. The modelling outputs are undergoing internal review by the Environment Agency and will be finalised in 2019. The final model outlines will then be used to update the Flood Map for Planning.

Potential risk of flooding from other sources exists throughout the Borough, including ordinary watercourses, surface water, sewer and groundwater emergence. As the Lead Local Flood Authority (LLFA), Surrey County Council (SCC) takes the lead in flood incident reporting from these sources and has prepared a Flood Investigation Report for the 2013-2014 flood events in the Borough. SCC is also responsible for consulting on any major planning applications, watercourse consenting and public engagement in the Borough.

This revised Level 1 SFRA provides an overview of the risk of flooding from all sources across Waverley Borough, including flooding from rivers, surface water, groundwater, sewers and other artificial sources, as well as guidance for the application of the Sequential Test, requirements for site specific Flood Risk Assessments (FRAs) and recommendations for flood risk mitigation and management measures. The Level 1 SFRA should be used to inform policy formulation and strategic planning; the application of the Sequential Test by Waverley BC; and development control and emergency planning.

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

[1] Ministry of Housing, Communities and Local Government (2018) National Planning Policy Framework. Available from: https://www.gov.uk/government/collections/revised-national-planning-policy-framework
[2] Ministry of Housing, Communities and Local Government (2014) Planning Practice Guidance: Flood Risk and Coastal Change. Available from: https://www.gov.uk/guidance/flood-risk-and-coastal-change
[3] Waverley Borough Council Strategic Flood Risk Assessment, July 2015, Capita
[4] Waverley Borough Council Level 2 Strategic Flood Risk Assessment, August 2016, Capita.

1. Introduction

1.1 Background

1.1.1 In its role as the Local Planning Authority (LPA), Waverley Borough Council (BC) is currently preparing documents that will form part of the Local Plan Part 2 which, together with the Local Plan Part 1, set out a vision and framework for development in the Borough.

1.1.2 The National Planning Policy Framework[6] (NPPF) and accompanying Planning Practice Guidance (PPG)[7] emphasise the responsibilities for LPAs to ensure that flood risk is understood and managed effectively using a risk-based approach through all stages of the planning process. As such, LPAs are required to undertake a Strategic Flood Risk Assessment (SFRA) to support the preparation of their Local Plan.

1.1.3 AECOM has been commissioned by the Waverley BC to review and revise their existing Level 1 SFRA which was originally prepared in 2015. It will refine and collate the most up to date flood risk information for use by the Council as an evidence base to inform the updated Local Plan Part 2 and subsequent planning documents. The SFRA has been completed in collaboration with Waverley BC, Surrey County Council (SCC), the Environment Agency, Thames Water and Southern Water.

1.2 Approach to Flood Risk Management

1.2.1 The NPPF and associated PPG for Flood Risk and Coastal Change emphasise the active role LPAs should take to ensure that flood risk is assessed, avoided, and managed effectively and sustainably throughout all stages of the planning process. The overall approach for the consideration of flood risk set out in Section 1 of the PPG can be summarised as follows:

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

Assess flood risk

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

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

Avoid flood risk

1.2.5 Waverley BC should apply the sequential approach to site selection so that development is, as far as reasonably possible, located where the risk of flooding from all sources is lowest, taking account of climate change and the vulnerability of future users to flood risk.

[6] Ministry of Housing, Communities and Local Government (2018) National Planning Policy Framework. Available from: https://www.gov.uk/government/collections/revised-national-planning-policy-framework
[7] Ministry of Housing, Communities and Local Government (2014) Planning Practice Guidance: Flood Risk and Coastal Change. Available from: https://www.gov.uk/guidance/flood-risk-and-coastal-change

1.2.6 This involves applying the Sequential Test, and where necessary the Exception Test, to sites identified in Local Plans, as described in Figure 1-1.

1.2.7 The Sequential Test and, if necessary, the Exception Test also need to be applied to specific development proposals.

Manage and mitigate flood risk

1.2.8 Where alternative sites in areas at lower risk of flooding are not available, it may be necessary to locate development in areas at risk of flooding. In these cases, Waverley BC and developers must ensure that development is appropriately flood resilient and resistant, safe for its users for the lifetime of the development, and will not increase flood risk overall. Waverley BC and developers should seek flood risk management opportunities (e.g. safeguarding land), and to reduce the causes and impacts of flooding (e.g. through the use of sustainable drainage systems).

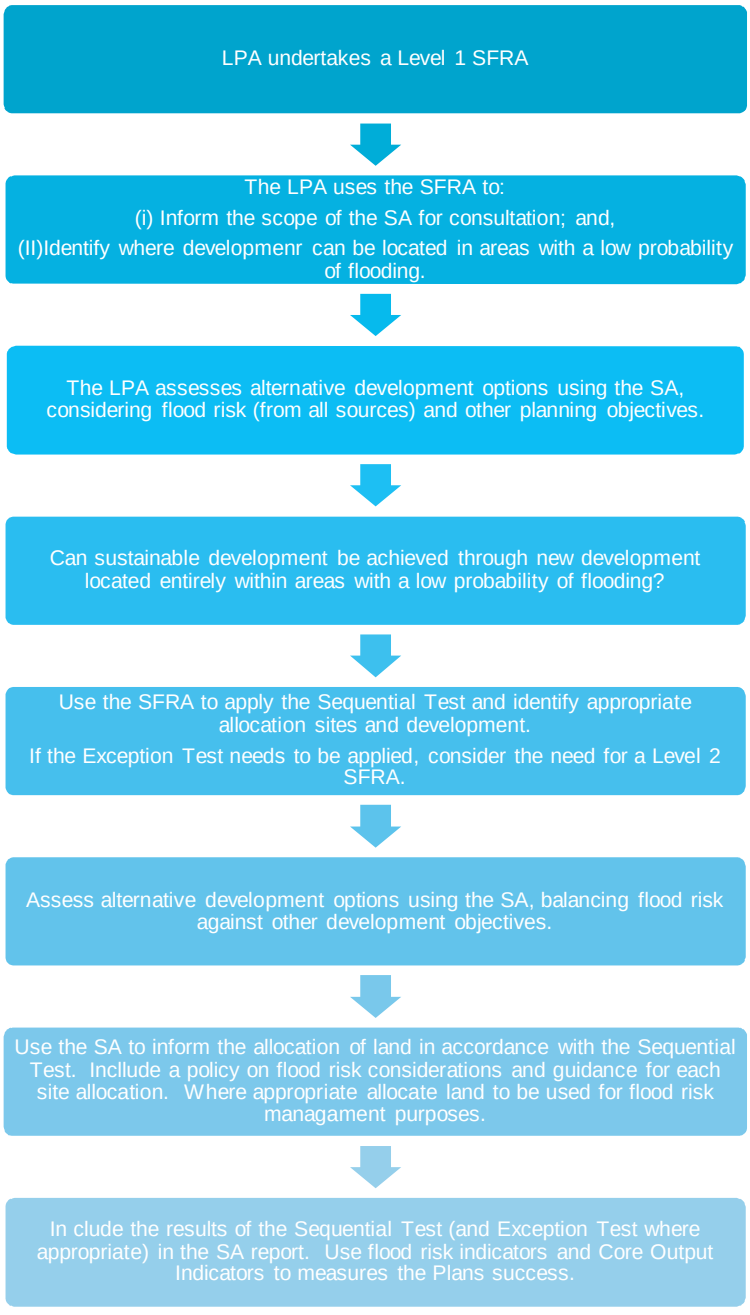

Figure 1-1 Taking flood risk into account in the preparation of a Local Plan (Planning Practice Guidance for Flood Risk and Coastal Change)

1.3 Purpose of the SFRA

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

1.3.2 In order to achieve this, the SFRA will:

- Refine information on the areas that may flood taking into account all sources of flooding and the impacts of climate change;
- Inform the Sustainability Appraisal process, so that flood risk is fully taken into account;
- Inform the application of the Sequential and, if necessary, Exception Tests in the allocation of future development sites, as required by the NPPF, and planning application process;
- Identify the requirements for site-specific Flood Risk Assessments;
- Inform the preparation of flood risk policy and guidance;
- Determine the acceptability of flood risk in relation to emergency planning capability;
- Consider opportunities to reduce flood risk to existing communities and developments through better management of surface water, provision for conveyance and storage for flood water; and,
- Identify any land safeguarded from development that is required for current and future flood management.

1.4 Flood Risk Policy and Guidance

1.4.1 There is an established body of policy and guidance documents which are of particular importance when considering development and flood risk. These are identified in Table 1-1 along with links for where these documents can be found for further detail.

Table 1-1 Flood Risk Policy and Guidance Documents

National Legislative and Policy Documents		
Flood and Water Management Act (2010)	Provides for a more comprehensive management of flood risk, designating roles and responsibilities for different Risk Management Authorities. Designates SCC Council as the LLFA, with duties and responsibilities for managing local flood risk (defined as flooding from surface water, groundwater and ordinary watercourses).	https://www.legislation.gov.uk/ukpga/2010/29/contents
Flood Risk Regulations (2009)	The Flood Risk Regulations transpose the EU Floods Directive into law in England. It aims to provide a consistent approach to flood risk across Europe.	http://www.legislation.gov.uk/uksi/2009/3042/contents/made
Revised National Planning Policy Framework	The NPPF[2] was published by the UK's DCLG in March 2012, and updated in July 2018, consolidating over two dozen previously issued documents called Planning Policy Statements (PPS) and Planning Policy Guidance Notes (PPG) for use in England.	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/728643/Revised_NPPF_2018.pdf
National Flood and Coastal Erosion Risk Management Strategy for England (2011)	The National FCERM Strategy sets out the long-term objectives for managing flood and coastal erosion risks and the measures proposed to achieve them. It provides a framework for the work of all flood and coastal erosion risk management authorities.	https://www.gov.uk/government/publications/national-flood-and-coastal-erosion-risk-management-strategy-for-england
Regional Flood Risk Policy		
Thames Catchment Flood Management Plan (River Wey catchment) Arun and Western Streams Catchment Flood Management Plan (River Lox catchment)	The role of the CFMP is to establish flood risk management policies which will deliver sustainable flood risk management for the long term (an Environment Agency Document).	https://www.gov.uk/government/collections/catchment-flood-management-plans

Guidance Documents

Planning Policy Guidance – Flood Risk and Coastal Change	Describes the planning approach to development within areas at risk of flooding from all sources	http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/
Environment Agency Standing Advice	Guidance on information to be included within robust site specific FRAs	https://www.gov.uk/guidance/flood-risk-assessment-standing-advice
Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities	A supporting note for the National FCERM Strategy. It provides the UK Climate Projections (UKCP09) climate change factors for river flood flows, extreme rainfall, storm surge and wave climate for each river basin district, and provides advice on applying climate change projections in the FCERM.	https://www.gov.uk/government/publications/adapting-to-climate-change-for-risk-management-authorities

Local Documents and Strategies

Waverley BC Adopted Local Plan Part 1(Adopted February 2018)	The Local Plan sets out the Boroughs plans for development within the Borough up to 2032, including policy guidance on flood risk.	http://www.waverley.gov.uk/info/200357/new_local_plan/247/the_new_local_plan_documents
SCC Preliminary Flood Risk Assessment (PFRA)	In accordance with the Flood Risk Regulations 2009, SCC provided a PFRA to provide a high level overview of flood risk from local sources for provision to the Environment Agency, ultimately reporting to Europe. An addendum to this PFRA was published by SCC in 2017, and should be read in conjunction with the PFRA.	https://www.surreycc.gov.uk/people-and-community/emergency-planning-and-community-safety/flooding-advice/more-about-flooding/the-preliminary-flood-risk-assessment https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/698714/PFRA_Surrey_County_Council_2017.pdf
SCC Local Flood Risk Management Strategy (LFRMS)	As LLFA, SCC has created the LFRMS to understand and manage flood risk within the Borough	https://www.surreycc.gov.uk/people-and-community/emergency-planning-and-community-safety/flooding-advice/more-about-flooding/surrey-local-flood-risk-management-strategy

1.5 Report Structure

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

- Section 2 Methodology
- Section 3 Strategic Assessment of Flood Risk
- Section 4 Avoiding Flood Risk – Guidance on Applying the Sequential Test
- Section 5 Measures for Managing and Mitigating Flood Risk
- Section 6 Guidance on the preparation of site specific FRAs
- Section 7 Recommendations for Policy and Practice
- Appendix A Data Register
- Appendix B Mapping

1.6 Living Document

1.6.1 This SFRA has been developed building heavily upon existing knowledge with respect to flood risk within the Borough. The Environment Agency review and update the Flood Map for Planning (Rivers and Sea)[8] on a quarterly basis as new modelling studies are completed.

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

AECOM Position Statement November 2018

The modelling for the Middleand Upper Wey and associated tributaries that is presented in this SFRA is draft and subject to change. The modelling outputs are undergoing internal review by the Environment Agency and will be finalised in 2019 and used to update the Flood Map for Planning. The revised datasets will be used to update this SFRA as appropriate.

[8] Environment Agency (2018) Flood Map for Planning https://flood-map-for-planning.service.gov.uk/

2. Methodology

2.1 Consultation

2.1.1 As part of the SFRA, a number of organisations were consulted A summary of the roles of each organisation, and their involvement through the SFRA project, is provided in Table 2-1.

Table 2-1 SFRA Stakeholder Organisations and Roles

Stakeholder	Role with respect to Waverley BC SFRA
Waverley BC	As a LPA Waverley BC has a responsibility to consider flood risk in their strategic land use planning and the development of their Local Plan. The NPPF requires LPAs to undertake a SFRA and to use their findings, and those of other studies, to inform strategic land use planning including the application of the Sequential Test which seeks to steer development towards areas of lowest flood risk prior to consideration of areas of greater risk. Waverley BC is also required to consider flood risk and, when necessary, apply the Sequential and Exception Tests when assessing applications for development. During the preparation of the SFRA, Waverley BC has provided access to available datasets held by the Council regarding flood risk across the Borough. The SFRA will be used by the Waverley BC's Emergency Planning team to ensure that the findings are incorporated into their understanding of flood risk and the preparation of their Multi-Agency Flood Plan (MAFP).
Environment Agency	The Environment Agency is responsible for managing the risk of flooding from Main Rivers and the sea and has a responsibility to provide a strategic overview for all flooding sources and coastal erosion. The Environment Agency has a role to provide technical advice to LPAs and developers on how best to avoid, manage and reduce the adverse impacts of flooding. Part of this role involves advising on the preparation of spatial plans, sustainability appraisals and evidence base documents, including SFRAs as well as providing advice on higher risk planning applications. The Environment Agency undertakes systematic modelling and mapping of fluvial flood risk associated with all Main Rivers in the study area, as well as supporting LLFAswith the management of surface water flooding by mapping surface water flood risk across England. The Environment Agency has supplied available datasets for use within the SFRA. The Environment Agency will be involved in reviewing the draft SFRA project deliverables.
SCC	As the LLFA, under the Flood and Water Management Act (FWMA) SCC has a duty to take the lead in the coordination of local flood risk management, specifically defined as flooding from surface water, groundwater and ordinary watercourses and to this end has prepared the Local Flood Risk Management Strategy (LFRMS) for Surrey . SCC is responsible for regulation and enforcement on ordinary watercourses and is a statutory consultee in relation to surface water for major developments (10 or more dwellings and 1000m^2 floor space) in the county, following changes to the Town and Country Planning (Development Management Procedures) (England) Order 2015. SCC is the Highways Authority and therefore has responsibilities for the effectual drainage of surface water from adopted roads insofar as ensuring that drains, including kerbs, road gullies and ditches and the pipe network which connect to the sewers, are maintained. As such, SCC is a key stakeholder in the preparation of the SFRA. SCC has provided current datasets in relation to the assessment of local sources of flooding (surface water, groundwater and ordinary watercourses), has been consulted on the draft project deliverables and will be involved in the implementation of any policy outcomes with respect to sustainable drainage or ordinary watercourse management.
Thames Water Utilities Ltd	Thames Water Utilities Ltd (TWUL) is responsible for surface water drainage from development across the majority of the Borough via adopted sewers and for maintaining public sewers into which much of the highway drainage connects. In relation to the SFRA, the main role that TWUL will play is providing data regarding past sewer flooding.
Southern Water Services Ltd	Southern Water Services Ltd (SWSL) is responsible for surface water drainage from development in the south east of the Borough via adopted sewers and for maintaining public sewers into which much of the highway drainage connects. In relation to the SFRA, the main role that SWSL will play is providing data regarding past sewer flooding.
British Geological Survey	BGS hold a number of datasets that have informed the SFRA, including superficial and bedrock geology and suitability of infiltration SuDS.
Wey and Arun Canal Trust	The Wey and Arun Canal Trust were approached to provide any relevant information or datasets regarding past flood incidents or proposals that would affect flood risk management in the study area.

2.2 Data Collection and Mapping

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

3. Strategic Assessment of Flood Risk

3.1 Overview

3.1.1 In accordance with paragraph 156 of the Revised NPFF, the risk of flooding from all sources must be considered as part of a SFRA, including flooding from the sea, rivers, land, groundwater, sewers and artificial sources. The study area is not located within an area at risk of tidal flooding, and thus flood risk from this source will not be considered further as part of this SFRA. This Section provides a strategic assessment of the flood risk across the Borough from each source. Reference should be made to the supporting mapping in **Appendix B**.

Local Area

3.1.2 The Borough of Waverley is located in south Surrey and occupies an area of 345km^2. It is bordered by the borough of Guildford to the north, Mole Valley to the East, Horsham and Chichester to the south and East Hampshire, Hart and Rushmoor boroughs to the west. The majority of the Borough lies within the catchment of the River Wey and includes its larger tributary of Cranleigh Waters. Areas in the south of the Borough lie within the catchment of the river Lox and a small area of north Farnham, in the north of Waverley, lies within the Blackwater catchment.

3.1.3 The area is generally rural in character, with larger settlements in Cranleigh, Farnham, Haslemere and Godalming. The Borough also contains extensive areas of Green Belt which cover over 60% of the Borough and which will limit the location of new development. Over 50% of the area within Waverley lie within the Surrey Hills Area of Outstanding Natural Beauty (AONB).

Topography

3.1.4 Light Detection and Ranging (LiDAR) topographic survey data[9], presented in **Appendix B Figure 1**, shows the topography of the Borough of Waverley to vary significantly across the catchment. The topography generally consists of higher areas of hills, up to 280mAOD, divided by river valleys at much lower elevations.

3.1.5 The river valleys in the Borough drain to two main basins – the River Wey in the north and east, and the River Lox to the south. The lower lying areas of the Borough, in the north and south, lie at around 30mAOD.

Geology

3.1.6 Datasets have been reviewed from the British Geological Survey (BGS) website[10] to provide a high level identification of the superficial deposits and bedrock geology across the Borough. Bedrock is the consolidated rock underlying the ground surface while superficial deposits refer to the more geologically recent deposits (typically of Quaternary age) that may be present above the bedrock such as floodplain deposits, beach sands and glacial drift. Underlying geology can influence the presence and nature of groundwater in an area, and therefore potential groundwater flood risk. The geology can also impact on the potential for infiltration based drainage systems.

3.1.7 The principle geological formations in the Borough consist of sandstone, mudstone and siltstone layers which make up the Cretaceous-age Wealden Group, Gault formation and Upper Greensand bedrock types. There is a narrow chalk band in the Farnham area which is also Cretaceous in age.

3.1.8 The BGS maps show few significant superficial deposits in the Borough. There are some River Terrace deposits in the higher river valleys, sand and gravel around Farnham and alluvium in lower river valley areas around Godalming.

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

[10] http://mapapps.bgs.ac.uk/geologyofbritain/home.html

Hydrogeology

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

3.1.10 The Environment Agency classifies areas of the Wealden Group, Upper Gault and Upper Greensand in the north and west of the Borough as a Principal Aquifer[11]. Principle Aquifers are layers of rock or drift deposits that have a high intergranular and / or fracture permeability, meaning they usually provide a high level of water storage. They may support water supply and / or river base flow on a strategic scale.

3.1.11 Some other sections of these formations have lower permeability and are classified as Secondary A aquifers, as are some of the superficial deposits along the river valleys. Secondary A aquifers are permeable strata capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of base flow to rivers.

3.1.12 The BGS datasets show Groundwater Source Protection Zones (SPZ) in the western half of the Borough, covering areas of mainly rural land west of Milford and Cramhurst as well as the settlements of Beacon Hill, Hindhead, Green Cross, Rushmoor, Tilford and Farnham.

3.1.13 The BGS considers most of the aquifers to be at low susceptibility to groundwater contamination, although there are areas of moderate and high susceptibility in the SPZ. There are areas in Farnham where very significant constraints on the infiltration of surface water are indicated due to the need to protect groundwater sources. See Section 5.8 for more information.

Main Rivers

3.1.14 The majority of the Borough of Waverley lies within the River Wey catchment. The River Wey is defined below the confluence of the North and South arms of the River Wey, at Tilford.

3.1.15 The North Wey rises to the west of Alton before flowing through Farnham to Tilford. The main tributaries within Waverley are Farnham Bourne, Farnham Park Tributary and Frensham Vale Stream.

3.1.16 The South Wey rises to the north of Haslemere, within Waverley Borough, but then flows south outside the Borough before turning northeast to re-enter Waverley and meet the North Wey at Tilford. Jumps Stream is the principle tributary within the study area.

3.1.17 The River Wey flows east from Tilford to Godalming, where it turns south towards the River Thames. The main tributaries are Truxford Brook, Royal Brook, the Ock and Cranleigh Waters.

3.1.18 Of these, Cranleigh Waters is the largest watercourse and has a number of main river tributaries including Holdhurst Brook, Littlemead Brook, Nuthurst Stream, Aldrebrook Stream and Hascombe Stream. Much of the eastern part of Waverley lies within the catchment of Cranleigh Waters.

3.1.19 Some areas of Waverley do lie outside the wider River Wey catchment. The central southern area of the Borough, to the east of Hambledon, drains south to the River Lox or its main river tributary of Hambledon Brook.

3.1.20 A small area of north Farnham, in the northwest of Waverley, drains north to the River Blackwater. The source of the Blackwater is at Heath End, on the north-western boundary of Waverley Borough.

3.1.21 The Environment Agency dataset ‘Statutory Main River Map’ has been used to identify the main rivers in the study area. These have been mapped in **Appendix B Figure 1** and **Figure 2A-2D**.

[11] http://magic.defra.gov.uk/MagicMap.aspx Accessed July 2018,

Ordinary Watercourses

3.1.22 In addition to main rivers there are a large number of smaller "ordinary watercourses[12]" in the Borough. These include smaller streams, ditches and drainage channels. Ordinary watercourses in the study area include many tributaries of the River Lox and Cranleigh Waters and the drainage density (number of ditches and small watercourses) is considerably higher in the east of the study area compared with the western region. The Environment Agency dataset 'Detailed River Network' (DRN) has been used to identify other watercourses in the study area. Many ordinary watercourses may be unmapped as the DRN was last updated in 2013.

3.2 Flooding from Rivers

Flood Map for Planning

3.2.1 The risk of flooding is the product of the probability that a flood will occur and the consequence to the community or receptor. The NPPF seeks to assess the probability of flooding from rivers by categorising areas within the fluvial floodplain into zones of low, medium and high probability, as defined in Table 3-1 and presented on the Flood Map for Planning (Rivers and Sea) available on the Environment Agency website. GIS layers of these Flood Zones have been provided by the Environment Agency via their online Partner Catalogue and are provided in **Appendix B Figure 2A-2D**.

Table 3-1 Fluvial Flood Zones (extracted from the PPG, 2014)

Flood Zone	Flood Zone Definition for River Flooding	Probability of Flooding
Flood Zone 1	Land having a less than 1 in 1,000 chance of river flooding each year (0.1% AEP). Shown as clear on the Flood Map – all land outside Flood Zones 2 and 3.	Low
Flood Zone 2	Land having between a 1 in 100 and 1 in 1,000 chance of river flooding each year (between 1% and 0.1% AEP).	Medium
Flood Zone 3a	Land having a 1 in 100 or greater chance of river flooding each year (greater than 1% AEP).	High
Flood Zone 3b	Land where water has to flow or be stored in times of flood, or land purposely designed to be flooded in an extreme flood event (flood storage area). Flood Zone 3b is defined by the LPA, in this instance the 1 in 20 annual probability (5% AEP) has been used to define Flood Zone 3b. Not separately distinguished from Flood Zone 3a on the Flood Map for Planning (Rivers and Sea).	Functional Floodplain

3.2.2 The majority of the Borough is located within Flood Zone 1, with areas of Flood Zones 2, 3a and 3b occupying the lower lying valley areas along the principle watercourses. Settlements with areas in Flood Zones 2 and 3 include north Farnham (Blackwater), central and southeast Farnham (North Wey and Farnham Bourne), west Elstead (River Wey), south and central Godalming (the Ock, River Wey), Cranleigh (Cranleigh Waters, Nuthurst Stream, Littlemead Brook), Chiddingfold (River Lox) and Bramley/Wonersh (Cranleigh Waters and Hascombe Stream).

3.2.3 The Upper Blackwater catchment is very steep which may result in flash flooding in the northern Weybourne area of Farnham[13].

Hydraulic Modelling

3.2.4 As part of the Environment Agency's national programme of coastal and fluvial modelling studies, hydraulic models have been developed for the following watercourses; Upper Wey, Middle Wey and tributaries, Blackwater and Upper Arun (including River Lox).

3.2.5 The Upper Wey is made up of the North and South Wey branch tributaries, which meet just upstream of Tilford. The downstream model extent is just downstream of Tilford. The 'Upper Wey' model (Capita/AECOM, 2018)

[12] This includes "all rivers and streams and all ditches, drains, cuts, culverts, dikes, sluices (other than public sewers within the meaning of the Water Industry Act 1991) and passages, through which water flows" according to the Land Drainage Act 1991.
[13] River Blackwater Flood Study, Final Flood Mapping Report, Section 2.1, Peter Brett Associates, 2007

includes both the North Wey and South Wey branches. Most modelling was carried out in 1D with the reach through Farnham modelled in 2D.

3.2.6 The Middle Wey is made up of the main River Wey channel from Tilford to Bowers Lock downstream of Guildford, and the Cranleigh Waters from Flash Bridge to its confluence with the Wey at Bramley. The Middle Wey from Tilford to Godalming and the modelled reach of Cranleigh Waters are both modelled in 1D, which generally does not represent overland flow paths. The section of the Wey from Godalming to Guildford is modelled in 1D/2D, which better represents overland flow and floodplain storage. The tributary modelling has been completed in 1D.

3.2.7 The Wey models which cover Waverley BC include:

- Upper Wey
- Middle Wey
- Farnham Park Stream
- Farnham Bourne
- Frensham Vale
- River Ock
- Hascombe Stream
- Haslemere
- Cranleigh

3.2.8 For the Upper and Middle Wey modelling the following modelled outlines have been mapped in Appendix B Figure 3A-3D; 5% AEP (1 in 20 year), 1% AEP (1 in 100 year) and 0.1% AEP (1 in 1000 year).

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Wey Modelling

The modelling of the Upper and Middle Wey and associated tributaries presented within this SFRA is DRAFT and subject to change following internal review by the Environment Agency. The outputs from the final modelling will be used to update the 'Flood Map for Planning' in due course.

3.2.9 The River Blackwater model was developed by Peter Brett Associates in 2007 and is modelled in 1D. The following modelled outlines have been mapped in Appendix B Figure 3A-3D; 5% AEP (1 in 20 year), and 1% AEP (1 in 100 year).

3.2.10 The Upper Arun model was developed by Peter Brett Associates in 2003, and was rerun in 2017 to provide revised outlines in line with the updated guidance on climate change allowances. This models the River Lox and its tributaries in 1D. The following modelled outlines have been mapped in Appendix B Figure 3A-3D; 4% AEP (1 in 25 year) and 1% AEP (1 in 100 year).

3.2.11 The modelled flood outlines are shown in **Appendix B Figure 3A-3D**.

Climate change

3.2.12 The NPPF requires LPAs to consider the impact of climate change on flood risk and take this into account in land use planning. In hydraulic modelling studies to date, recommended national precautionary sensitivity ranges for use in the planning system included a 20% increase for peak river flows. As a result a 20% increase was typically applied to the 1% AEP (1 in 100 year) design event, and mapped to provide an indication of the extent of flood risk including climate change.

3.2.13 In February 2016 the Environment Agency published revised guidance on climate change allowances in an update to the document 'Adapting to Climate Change: Advice to Flood and Coastal Erosion Risk Management Authorities'[14]. This version of the document reflects an assessment completed by the Environment Agency

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

between 2013 and 2015 using United Kingdom Climate Projections 2009 (UKCP09) data, to produce more representative climate change allowances for river basin districts across England. The allowances for the Thames and South East England river basin districts are of relevance to Waverley Borough and are set out in Table 3-2.

Table 3-2 Peak river flow allowances for Thames River Basin District (use 1961 to 1990 baseline)

River basin district	Allowance category	Total potential change anticipated for '2020s' (2015 to 2039)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
Thames	Upper end (90th)	25%	35%	70%
	Higher central (70th)	15%	25%	35%
	Central (50th)	10%	15%	25%
SE England	Upper end (90th)	25%	50%	105%
	Higher central (70th)	15%	30%	45%
	Central (50th)	10%	20%	35%

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

3.2.15 In Flood Zone 2

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

3.2.16 In Flood Zone 3a

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

3.2.17 In Flood Zone 3b

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

3.2.18 The lifetime of the development should also be considered when determining which future climate change allowance time period should be used. The lifetime of a proposed development should be judged based on the characteristics of the development. In the case of residential developments, a minimum lifetime of 100 years should be taken when selecting climate change allowance percentages. For other types of development, the applicant should assess how long they anticipate the development to be in place for, and justify the lifetime of the development. Otherwise, a 75 year lifetime should be used. For the purposes of strategic planning, the '2070 to 2115' allowances in Table 3-2 should be used.

3.2.19 Flood outlines including an allowance for climate change are presented in **Appendix B Figures 4A-4D**.

3.2.20 In the hydraulic modelling supplied by the Environment Agency, a range of climate change allowances have been considered by increasing the fluvial flows for the 1 in 100 year (1% AEP) scenario across three climate change epochs in line with the guidance set out above. For the purpose of clarity within the mapping, only the allowances for the three greatest magnitude allowances have been mapped; namely 25%, 35% and 70% in the Thames river basin district, and 35%, 45% and 105% for the South East England river basin district, as detailed in Table 3-3.

Table 3-3 Mapped climate change scenarios

Watercourse	Mapped climate change allowances for the 1 in 100 year event (1% AEP)
Upper Wey	For the 2080s: Central 25%, Higher Central 35%, and Upper End 70%
Middle Wey and tributaries (with the exception of Cranleigh Waters)	For the 2080s: Central 25%, Higher Central 35%, and Upper End 70%
Cranleigh Waters	Central 2020s (10%), Central 2040s (15%)
Blackwater	20% (based on former climate change guidance)
Upper Arun (River Lox)	For the 2080s: Central 35%, Higher Central 45%, and Upper End 105%

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River Blackwater

The River Blackwater was modelled in 2007 and a 20% increase in flows has been applied to the 1% AEP (1 in 100 year) event. It is not currently within the scope of this SFRA to re-run the River Blackwater model to account for the new climate change allowances.

It is therefore proposed to use the 0.1% AEP (1 in 1000 year) outline as a proxy for the climate change outline within this Level 1 SFRA. Upon identification of potential development sites for assessment, it may be possible to undertake a stage-discharge analysis of the modelling results to analyse on a local scale the available model results but this will be agreed at the time.

Historic Flooding

3.2.21 Table 3-4 sets out details of known historical flooding instances in the Borough of Waverley. Historical flood outlines recorded by the Environment Agency are provided in **Appendix B Figure 6**. Note that this list is not intended to be exhaustive – additional flood events may have taken place in the area but the timing and extents were not recorded.

Table 3-4 Historical flooding summary

Event	Details
March 1947	River Wey flooded from Elstead to Shalford, including through Godalming. An area south of Milford flooded from the Ock. A small area of Farncombe in Godalming flooded from a small watercourse in that area.
June 1960	River Wey flooded in Central Farnham
September 1968	Extensive flooding throughout the catchment. The North Wey flooded throughout central Farnham. South Farnham was affected by flooding from Farnham Bourne and the River Blackwater flooded Weybourne. The South Wey flooded from upstream of Frensham to Tilford and the Wey flooded from Tilford to the River Thames at Weybridge. Cranleigh Waters flooded along its entire length from upstream of Vanchery pond to the confluence with the River Wey. Cranleigh itself was badly affected by surface water flash flooding, although not from fluvial flooding. Fluvial flooding was reported on the ordinary watercourse in Grafham, the Ock, Truxford Brook and on the River Lox near Chiddingfold. Localised flooding occurred in Chiddingfold itself, although the source was not recorded. Godalming was also affected by flooding from the River Wey.
1974 (month unknown)	River Lox flooded south of Chiddingfold

December 1981	River Wey flooded central and north Godalming
February 1990	Extensive flooding along the River Wey from east of Tilford onwards, including Elstead and Godalming. Weybourne and north Farnham flooded from the River Blackwater
December 1999	Tilford and Elstead experienced localised flooding from the River Wey
Autumn 2000	Flooding from Cranleigh Waters affected the Bramley/Wonersh area. Flooding from the Blackwater affected Weybourne. Godalming flooded from the River Wey.
August 2006	Flooding from the River Blackwater affected Weybourne
January 2003	River Wey flooded through central Godalming. Sewer flooding reported in Wheeler Street.
July 2007	Fluvial flooding recorded in the existing Waverley BC Level 2 SFRA[15] but no location details included
Winter 2008-09	Fluvial flooding in Bramley from Cranleigh Waters noted in existing Waverley BC Level 2 SFRA
Winter 2013/14	Extensive flooding of the River Wey, Cranleigh Waters and Hascombe Stream, accompanied by flooding from drainage ditches, small watercourses, highways drainage systems and sewers (see below for more details).

3.2.22 SCC is the LLFA for Waverley and has responsibility for carrying out investigations into flooding under Section 19 of the Floods and Water Management Act (2010). SCC has carried out a number of flood enquiries for flood events in Waverley BC, which have been mapped in **Appendix B Figures 8A-8D.** Further to these flood enquiries SCC have published a report on one flood event in Waverley BC: the widespread fluvial and surface water flooding which occurred in winter 2013-2014 due to extreme rainfall (275% of the long term winter average). The flooding affected approximately 120 properties in the following locations:

- **Farnham:** Middle Oak Road, Boundary Road, Alton Road, River Lane and Ridgeway Road. This may have been surface water flooding or (in Farnham Centre) fluvial flooding from the River Wey. There were also reports of sewer flooding in the area.
- **Tilford and Churt:** Tilford Street (Tilford), Priory Lane (Millbridge), Lampart Lane (Churt). Cause not noted but levels on the River Wey at Tilford were the highest ever recorded.
- **Elstead:** Elstead Bridge, Farnham Road, Shackleford Road and Fulbrook Lane were flooded from the River Wey. Groundwater flooding affected properties in Upper Springfield, Hill Crest and Orchard Close.
- **Milford:** Flooding occurred in the Webb Road area due to overland flows over water following failure of road culvert. Merry Acres and Station Lane were also affected by overland flows and highway runoff.
- **Godalming:** A 1 in 15-20 year AEP flood of the River Wey affected 22 roads including Kings Road, Wey Court and Meadrow, including internal flooding of properties. Sewer flooding was also reported in the days previously. Fluvial flooding from a surcharged stream and the Wey Navigation also affected the area around Tithams Green and Birch Road. Fluvial flooding affected over 90 properties in the areas of Meadrow and Catteshall. Surface water flooding may have been responsible for flooding on Catteshall Road and Old Station Way.
- **Chiddingfold:** Pook Hill and area around Woodside Road flooded. The mechanism was not recorded but is not believed to be fluvial), Ridgely Road flooded when a highways culvert became blocked and surface flows resulted. Mill Lane to South Bridge flooded due to surface runoff from high land, with additional flows from South Bridge area, accompanied by and failure of a Sewage Pumping Station. Coxcombe Lane was also affected but, again, the mechanism was not recorded.
- **Bramley:** High Street, Brambles Park, Linersh Wood, Linersh Drive, Barton Road, Fisher Rowe Close, Station Road, Tannery Lane were all affected. This was a mixture of fluvial flooding from Hascombe Stream and Cranleigh Waters and surface water flooding.
- **Alfold:** Loxford Road and Clappers Meadow flooded from ditches and small watercourses with surface flows and sewer flooding.

[15] Waverley Borough Council Level 2 SFRA, Capita, August 2016 (Updated December 2016), Section 2.2

- **Cranleigh:** Elmbridge Road, among others (not specified), was affected by flooding from Holdhurst Brook, which flooded eight properties. Flooding was also recorded from highways runoff, Cranleigh Waters and the Wey and Arun Canal.

3.2.23 Surrey CC provided more detailed information for the winter 2013-2014 flood event, stating whether or not properties were affected or roads closed on affected streets. Appendix B Figure 8A-8D show the locations of the roads affected. It should be noted that information about the source of flooding was not included with this dataset, and it is possible that not all streets were affected by fluvial flooding but by flooding by ground or surface water or by sewer flooding.

Flood Defences

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

3.2.25 The Environment Agency Asset Information Management System (AIMS) contains details of flood defence assets associated with Main Rivers. The only known flood defences within the Borough of Waverley provide protection to Farnham from flooding of the North Wey (**Appendix B Figure 2**). These defences consist of the following[16]:

- a two stage channel which was constructed in 1975;
- two weirs, one at Catteshall and another at Unstead, were constructed as part of the River Wey Improvement scheme; and,

3.2.26 Other local defences constructed as part of the Farnham Flood Alleviation Scheme (FAS).The National Flood and Coastal Defence Database (NFCDD) also contains detailed of multiple additional localised flood defences in Farnham[17], including earth embankments, sections of wall, bank protections, four flood relief channels along the Farnham Park Tributary at Shepherd and Flock roundabout and two stage flood relief channels at Long Bridge Road and Borelli Park. Since these are not listed in the AIMS database it is assumed that theses defences are in private ownership. Site specific FRAs carried out for sites within Farnham should consider the existence of defences and their impact on the risk of flooding.

3.2.27 Additional flood defences have also been proposed following the 2013-14 winter flood event. The following schemes are proposed or in progress and should be taken into account in future development proposals:

- Godalming FAS – due to start late 2018. A 525m long flood wall at Meadrow/Catteshall Road Bridge with demountable defence along Catteshall Bridge will protect at least 90 homes;
- Bishop's Meadow Farnham (floodplain restoration); and,
- River Wey Weir Refurbishment project – includes removing trees and debris from the River Wey downstream of Tilford.

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

3.2.29 No informal raised flood defences in the form of boundary walls and/or existing buildings, providing protection from flooding, have been identified in the Waverley Borough. It is recognised however that infrastructure,

[16] Information on flood defences taken from Waverley Borough Council Strategic Flood Risk Assessment, Final Draft, Volume 2, Technical Report, July 2015, Section 3.4, JBA Consulting
[17] Information on flood defences taken from Waverley Borough Council Strategic Flood Risk Assessment, Final Draft, Volume 2, Technical Report, July 2015, Section 3.4, JBA Consulting

including for example road and/or rail embankments, may alter the flow of floodwater throughout the Borough. For the purposes of the SFRA process, these have not been assessed as 'informal' defences. This is because the height and breadth of the embankments are such that the likelihood of a sudden catastrophic failure of the structure (i.e. potentially posing a risk to life) is virtually negligible.

Flood Risk Management Strategies

3.2.30 A Catchment Flood Management Plan (CFMP) is a high-level strategic planning document that provides an overview of the main sources of flood risk and how these can be managed in a sustainable framework for the next 50 to 100 years. The Environment Agency engages stakeholders within the catchment to produce policies in terms of sustainable flood management solutions whilst also considering local land use changes and effects of climate change. CFMPs were consolidated into Flood Risk Management Plans (FRMPs) in 2015.

3.2.31 The CFMPs are used to inform and support planning policies, statutory land use plans and implementation of the Water Framework Directive, so that future development in the catchment is sustainable in terms of flood risk. The approach that the Environment Agency would like to see taken to flood risk management within the Study Area is outlined in the Thames CFMP (2009) for the River Wey catchment and the Arun and Western Streams CFMP for the River Lox catchment[18]. The CFMP aim to identify flood risk management policies for the catchment and sets out the preferred plan for sustainable flood risk management in the subject region over the next 50 to 100 years.

3.2.32 The majority of the Waverley BC study area falls within the River Wey catchment. The preferred policy for this area in the CMFP is Policy 2: **Ensure the flood risk management actions being taken are proportionate to the level of risk.** The overall level of risk in the area is considered to be low to moderate as the majority of the floodplain I s undeveloped and it is considered that there is little opportunity to reduce the likelihood of flooding. Flood management options will therefore focus on reducing the consequences of flooding, particularly in the existing urban centres, potentially by allowing the undeveloped areas of floodplain to flood more often.

3.2.33 The southeastern area of the Borough of Waverley falls within the River Lox catchment, which is considered within the Arun and Western Streams CFMP. The preferred policy for this area in the CMFP is Policy 6: **Take actions to store water or manage runoff in locations that provide overall flood risk reduction or environmental benefits.** This policy would only be implemented in specific locations after detailed assessment and consultation.

3.2.34 The impact of the winter 2013-14 event demonstrated the need to manage flood risk within the Borough of Waverley, including through proper management and maintenance of water conveyance infrastructure and provision of flood warnings. The following actions have since been carried out[19]:

3.2.35 Environment Agency led flood risk management measures:

- River Wey Channel Capacity Restoration project – work has been completed in Godalming, Elstead and Unstead to remove accumulated sand and blockages within the River Wey and Hell Ditch, that occurred during the winter floods.
- Godalming Flood Alleviation Scheme – see above.
- River Wey weirs operation review – acting to improve on the compliance of weir operators with the procedures in the River Wey weirs operating agreement, and ensuring 24/7 communication during flood events.
- Flood Warning improvements – this includes the installation of a radar gauge at Westbrook Mill and river gauge at Catteshall Road Bridge, and lowering flood thresholds for Godalming, Tilford, Elstead and Eashing, after a review of the winter 2013 flood warnings.

3.2.36 Waverley BC-led flood risk management measures:

- Ditch Clearance – Ditches cleared within the following localities: Gaston gate, Rushett Common, Corner Cottage (Guildford Road), Alford Road (Alford), Guildford Road (Cranleigh).

[18] Environment Agency (2009) Thames Catchment Flood Management Plan. Available from: https://www.gov.uk/government/publications/thames-catchment-flood-management-plan
[19] Waverley Borough Council Strategic Flood Risk Assessment, Final Draft, Volume 2, Technical Report, July 2015, Section 3.6

- Local improvement schemes – at Lammas Land flood meadows, ditches connectivity to culverts have been restored; Elmbridge Road, desilting and dredging the Cranleigh Waters channel; Clappers meadows in Alford, consulting in regards to pump station failure; Webb Road in Witley and North Avenue/Brooklands Road in Farnham, where a screen wall has been erected for the regular collection of calculated debris.
- Culverted land drainage assets – commissioned condition survey of culverted land drainage assets.

3.2.37 Surrey CC-led flood risk management measures:

- Ditch Clearance along Gasden Lane, Witley – work underway involving National Trust and residents. Additionally, a new culvert has been installed under Haslemere Road (A286).

Flood Warning Areas

3.2.38 The Environment Agency operates a free Flood Warning Service[20] for many areas at risk of flooding from rivers and the sea. In some parts of England the Environment Agency may also be able to tell when flooding from groundwater is possible. The Environment Agency has provided a GIS layer of Flood Warning Areas in Waverley and these are mapped in **Appendix B Figure 7**.

3.2.39 There are eight flood warning areas within the Borough, as detailed in Table 3-5. The Environment Agency issues flood warnings to residents and businesses that have registered for the service in these specific areas when flooding is expected.

Table 3-5 Environment Agency Flood Warning Areas in Waverley

Flood Warning Area Name	Description
River Wey at Farnham	North Wey from upstream of Farnham to Tilford
River Wey at Passfield Mill Business Park, Standford, Frensham and Millbridge	South Wey from upstream of Frensham to Tilford
River Wey at Tilford	River Wey from Tilford to upstream of Elstead
River Wey at Elstead and Eashing	River Wey from upstream of Elstead to Upper Eashing
River Wey at Godalming, Peasmarsh and Shalford	River Wey through Godalming
Cranleigh Waters near Cranleigh and Shamley Green	Cranleigh Waters from north of Wildwood Lane to Bramley and Wonersh
Cranleigh Waters at Bramley	Cranleigh Waters from Bramley and Wonersh to the River Wey
Littlemead Brook at Cranleigh	Littlemead Brook from source to Cranleigh Waters

Residual Risk

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

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

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

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

3.2.42 Steps should be taken to manage these residual risks through the use of flood warning and evacuation procedures, as described in Section 5.5.

3.3 Flooding from Surface Water

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

Risk of Flooding from Surface Water (RoFfSW)

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

3.3.3 The RoFfSW provides all relevant stakeholders with access to information on surface water flood risk which is consistent across England and Wales and can assist in duties relating to assessment and management of surface water flood risk. The modelling represents a significant improvement on previous mapping, namely the Flood Map for Surface Water (FMfSW) (2010) and the Areas Susceptible to Surface Water Flooding (AStSWF) (2009). The RoFfSW map has increased model resolution, representation of buildings and flow routes along roads, uses a range of storm scenarios and incorporates local mapping, knowledge and flood incident records.

3.3.4 However, it should be noted that the mapping has significant limitations, including use of a single drainage rate for all urban areas, loss of accuracy in flat catchments and no explicit modelling of the interaction between the surface water network, the sewer systems and watercourses. In a number of areas, modelling has not been validated due to a lack of surface water flood records; and, as with all models, the RoFfSW is affected by a lack of, or inaccuracies, in available data. As a result, while the map can be used to assess the relative risk to areas across a catchment, it does not show the susceptibility of individual properties to surface water flooding and cannot be used in place of a site specific risk assessment for surface water flooding.

3.3.5 The RoFfSW mapping for the Waverley BC study area, presented in **Appendix B Figure 8A-8D,** illustrates that the risk of surface water flooding is concentrated along river valleys but can also affect roads in low-lying urban areas.

Historic Records

3.3.6 In their role as the LLFA, SCC has duties to record and investigate flood incidents relating to local sources of flooding, namely flooding from surface water, groundwater and ordinary watercourses. SCC has provided a number of GIS layers to inform the SFRA that relate to past flood events. These datasets are presented spatially in **Appendix B Figure 8A-8D**. A summary of each dataset as provided below.

3.3.7 **Historical Flooding Incidents**: indicative road locations along which a flood event has occurred that has been investigated by SCC and a Section 19 Flood Investigation Report has been prepared. This information is presented in **Appendix B Figure 8A-8D** since the only Section 19 report which Surrey CC have been required to produce so far relates to the winter 2013-2014 event.

3.3.8 **Internal property flooding**: road locations along which internal property flooding has been reported to SCC. The date of flooding is not included in this dataset, which mainly reflects the extent of flooding in the winter 2013-2014 event in that the same roads which flooded in that year are listed in the Internal Property Flooding database. The following roads are recorded as having internal property flooding in the past but are not recorded as having flooded in 2013-2014:

- Farnham: Brook Avenue, Holbrook Close, Mill Lane
- Godalming: Haslemere Road, Warren Road

3.3.9 **External property flooding**: road locations along which external property flooding has been reported to SCC. The locations are highlighted in **Appendix B Figure 8A-8D**.

3.3.10 **Record of Highways Flooding Reports**: Surrey CC have also provided a record of all reports of highways flooding received since 2014. This includes some details of flooding cause (watercourse flooding, blocked drains, other carriageway failure) and severity (minor, major). The locations are shown in **Appendix B Figure 8A-8D**.

3.3.11 **Surrey CC Wetspots**: 'Wetspot' is a term used by Surrey CC as the LLFA to describe the location of a surface water flood incident that has been reported. The wetspot database is continually updated to produce a comprehensive map and record of all the identified wetspots in Surrey. The locations of the wetspots are shown in **Appendix B Figure 8A-8D**.

3.3.12 In addition to the data provided by Surrey CC, a search of local flooding records shows that the steep topography in some areas of the Borough of Waverley can results in flash flooding. For example, two days of heavy rain on 15-16th September 1968 caused considerable flash flooding in the centre of Cranleigh due to surface runoff. Flood alleviations works were later undertaken to try to lessen the risk.

Climate Change

3.3.13 The RoFfSW mapping does not include a specific scenario to determine the impact of climate change on the risk of surface water flooding. However a range of three annual probability events have been undertaken, 1 in 30 (3.3%) AEP, 1 in 100 (1%) AEP and 1 in 1000 (0.1%) AEP and therefore it is possible to use with caution the 0.1% AEP outline as a substitute dataset to provide an indication of the implications of climate change.

3.3.14 In this case, the extent of the area at risk of surface water flooding increases significantly, particularly in urban areas where a far greater area of the road network may be affected. Future development should seek to ensure that surface water is managed in line with NPPF and takes the potential impacts of climate change into account.

3.4 Flooding from Groundwater

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

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

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

3.4.3 The main impacts of groundwater flooding are:

- Flooding of basements of buildings below ground level – this can range from seepage of small volumes of water through walls and temporary loss of services to larger volumes of water, catastrophic loss of belongings and failure of structural integrity;
- Overflowing of sewers and drains – surcharging of drainage networks can lead to overland flows causing localised damage to property. Sewer surcharging can lead to inundation of property by polluted water. However it is difficult to differentiate between groundwater flooding and other sources (surface water or sewer flooding);

- Flooding of buried services or other assets below ground level – prolonged inundation of buried services can lead to interruption and disruption of supply;
- Inundation of roads, commercial, residential and amenity areas – inundation of hard-standing areas can lead to structural damage and the disruption of commercial activity; and,
- Flooding of ground floors of buildings above ground level – can result in structural damage. In addition, a groundwater flood event will typically have a long duration (compared to other flood sources), adding to the disruptive nature of the flood event.

Areas Susceptible to Groundwater Flooding (AStGWF)

3.4.4 The Environment Agency dataset 'Areas Susceptible to Groundwater Flooding' has been provided for the study area and is presented in **Appendix B Figure 9**. This dataset indicates where groundwater may emerge due to certain geological and hydrogeological conditions. This information is shown as a proportion of 1km grid squares where there is potential for groundwater emergence. The data does not show where flooding is likely to occur, but instead should be used at a strategic level to indicate areas for further investigation. This is due to the coarse nature of the dataset, being based largely on underlying geology, which in itself is a broad-scale dataset.

3.4.5 According to the AStGWF map, the principle areas of elevated risk in Waverley are north Farnham, Elstead, Godalming as well as the small settlement of Ridgebridge Hill and land around Utworth Manor, to the west of Cranleigh.

3.4.6 The Environment Agency have flood alert areas for groundwater flooding for the following areas:

- The small settlement of Stoneyside, between Churt and Rushmoor;
- Land to the north of Elstead;
- Central Godalming, between Holloway Hill and Farncombe; and,
- The small settlement of Hambledon.

3.4.7 The location of these areas is shown in **Appendix B Figure 9**.

Historic records

3.4.8 Surrey CC's Flood Investigation report into the floods of winter 2013-2014 noted groundwater flooding in Elstead which affected properties in Upper Springfield, Hill Crest and Orchard Close.

3.5 Flooding from sewers

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

(i). The rainfall event exceeds the capacity of the sewer system/drainage system:
- Sewer systems are typically designed and constructed to accommodate rainfall events with a 1 in 30 years (3.33% AEP) or less. Therefore, rainfall events with a return period of frequency greater than 3.3% AEP would be expected to result in surcharging of some of the sewer system. While Thames Water is concerned about the frequency of extreme rainfall events, it is not economically viable to build sewers that could cope with every extreme rainfall event.

(ii). The system becomes blocked by debris or sediment:
- Over time there is potential that road gullies and drains become blocked from fallen leaves, build-up of sediment and debris.

(iii). The system surcharges due to high water levels in receiving watercourses:
- Where the local area is served by 'combined' sewers i.e. containing both foul and storm water, if rainfall entering the sewer exceeds the capacity of the combined sewer and storm overflows are blocked by high water levels in receiving watercourses, surcharging and surface flooding may again occur but in this instance floodwaters will contain untreated sewage.

3.5.2 The majority of Waverley BC is served by a Thames Water combined surface and foul water sewer system, which is typically designed and constructed to accommodate rainfall events with a 1 in 30 year (3.33% AEP)

event or less. Therefore, rainfall events with a return period of frequency greater than 3.3% AEP would be expected to result in surcharging of some of the sewer system.

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

3.5.4 Thames Water Sewer Flood records, presented in Table 3-6 and **Appendix B Figure 10** indicate that 151 reported sewer flooding incidents, both internal and external, have occurred in Waverley over the last 20 years. The majority of the flooding events have taken place in Cranleigh (GU6 8), Farncombe (GU7 3) and Farnham (GU9 9).

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

Local Authority				Register Type			
Waverley	**Internal flooding to property**			**External flooding property/areas**			
Post code area	AI (2 in 10)	BI (1 in 10)	CI (1 in 20)	AE (2 in 10)	BE (1 in 10)	CE (1 in 20)	Grand Total
E11 1	0	0	5	0	0	0	5
GU1 3	0	0	0	0	0	0	0
GU102	0	0	0	0	2	3	5
GU103	0	0	3	0	3	0	6
GU104	0	0	2	0	0	1	3
GU105	0	0	0	0	0	1	1
GU111	0	0	3	0	0	0	3
GU113	0	1	0	0	0	0	1
GU124	6	0	2	0	0	0	8
GU148	0	0	0	0	1	0	1
GU152	0	0	0	0	2	0	2
GU153	0	0	0	0	0	0	0
GU217	0	0	1	0	0	0	1
GU228	0	0	0	0	0	0	0
GU266	0	0	2	0	2	0	4
GU271	0	1	0	1	2	2	6
GU272	0	1	0	0	1	0	2
GU3 1	0	0	0	0	1	4	5
GU5 0	0	0	0	0	0	1	1
GU513	0	0	3	1	0	2	6
GU515	0	0	0	0	0	1	1
GU520	0	0	0	0	0	0	0
GU6 7	1	0	4	0	3	1	9
GU6 8	1	1	5	0	7	5	19
GU7 1	0	0	0	1	2	1	4
GU7 2	0	0	0	0	2	0	2
GU7 3	0	1	1	0	7	1	10
GU8 4	0	0	1	0	0	0	1
GU8 5	0	0	2	1	1	1	5
GU8 6	0	0	0	2	0	3	5
GU9 0	0	0	1	0	1	1	3
GU9 7	0	0	1	0	0	1	2
GU9 8	0	0	4	0	1	2	7
GU9 9	0	2	3	4	4	8	21
OX296	0	0	0	0	0	0	0
RH103	0	0	0	0	0	0	0

Local Authority				Register Type			
RH5 6	0	0	0	0	2	0	2
Grand Total	**8**	**7**	**43**	**10**	**44**	**39**	**151**

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

3.5.5 Parts of southern Waverley are served by Southern Water Services Ltd (SWSL). SWSL have provided their sewer flooding records for the last five years for this SFRA. These records show four records of public foul sewer flooding, all in Chiddingfold, of which three were reported during the winter 2013-14 flood event and one was reported in 2016. Only one of these is internal property flooding and occurred in 2014.

3.5.6 Surrey CC holds records of sewer flooding reported during the winter 2013-14 flood event in Farnham, Godalming, Chiddingfold and Alfold. Flooding from the highways drainage system was also reported in many areas. Additional information on highways flooding is provided in Section 3.3 above.

3.6 Flooding from artificial sources

3.6.1 An artificial source is any water body which is not covered under other categories and typically includes canals, lakes and reservoirs. The failure of a reservoir or artificial source has the potential to cause catastrophic damage due to the sudden release of large volumes of water. The PPG encourages LPAs to identify any reservoirs and evaluate how they might modify the existing flood risk in the event of a flood in the catchment is located within, and/or whether emergency draw-down of the reservoir will add to the extent of flooding. The Environment Agency dataset 'Risk of Flooding from Reservoirs' (available at https://flood-warning-information.service.gov.uk/long-term-flood-risk/map) identifies areas that could be flooded if a large reservoir were to fail and release the stored water.

3.6.2 There are a large number of small impounded reservoirs in the upper reaches of watercourses in the Borough of Waverley. These were constructed for a variety of reasons, including supplying water to mills, to retain water for irrigation, for ornamental purposes and for fishing. Most of these impounded water bodies are in private ownership so the condition and maintenance arrangements for impounding structures are difficult to determine. Table 3-7 gives details of the larger water bodies, ownership and potential areas at risk of flooding should the retaining walls be breached. There are areas at risk along the South Wey, River Wey, Cranleigh Waters and Hascombe Stream.

Table 3-7 Artificial Waterbodies in Waverley Borough Area

Water Body	Ownership[21]	Settlements Downstream[22]
Frensham Little Pond	The National Trust	Tilford Green. Extent of flooding limited to areas along the South Wey and River Wey channels. Water from Frensham Great Pond could propagate as far as Godalming[23].
Frensham Great Pond	Waverley Borough Council	
Wishanger Lake	Unknown	
Long Pond, Warren Pond, The Tarn, Cutmull Pond	The Trustees of Hampton Estate	There are no settlements between the impoundments and the River Wey. Floodwaters would then travel along the River Wey and may affect the settlements around Shackleford Road, although the extent of flooding would be limited to the River Wey floodplain.
Upper Lake, Thursley Lake and Stable Lake	Witley Park Holdings Ltd	Warren Park, rural land down to Elstead Road (B3001). The extent of flooding is limited to areas around the watercourse.
Upper Enton Lake, Lower Enton Lake	Kirk	Development at Wheelerstreet and Mousehill, areas adjoining the Ock to the Wey at Godalming, including properties around the railway station
Large Enton Lake (Johnsons Lake)	Godalming Angling Society	

[21] Capita, Waverley Borough Council Strategic Flood Risk Assessment, Final Draft, Volume 2, Technical Report, July 2015, Table 8-1
[22] From the EA's Risk of Flooding from Reservoirs Map
[23] Based on modelling undertaken for Waverley Borough Council, confirmed in correspondence for this SFRA

Varchery Pond	Cook	There is little development shown in the area potentially affected by flooding. Flooding may affect areas down to Bramley where the flood extent mainly reflects the Cranleigh Waters floodplain.
Artificial rectangular lake south of Tuesley	Unknown	Properties in south Tuesley
Lower Bushbridge Lake at Busbridge	Godalming Angling Society	Areas adjoining the Ock to the Wey at Godalming, including properties around the railway station
Rowe's Flashe Lake and Philmore at Winkworth Arboretum	The National Trust	Areas around the High Street, Bramley
Broadwater Lake in Godalming	Waverley Borough Council	Areas around Tilthams Green. Flooding would be constrained by the A3100 road embankment[24].

3.6.3 This list is not exhaustive and there are many other small impounded water bodies in the area, such as at Birch Copse and Silk Mill Fish Farm near Warren Park, which are not included in the Environment Agency's Risk of Flooding from Reservoirs Map. Imbhams Farm Ponds, east of Haslemere in the River Lox catchment, are not considered in the Environment Agency's map but have suffered a historical breach[25]. Floodwaters did not affect any properties in this case due to the rural nature of the land downstream. However, this highlights the importance of assessing flood risk from impounded waterbodies as part of a site specific FRA if development is proposed in the areas downstream. Note that no other records of breach events from impounded water bodies in Waverley Borough have been identified.

3.6.4 In addition to these impounded lakes, there are both existing and disused canal sections in the Borough.

3.6.5 The Wey Navigation is existing and extends from Guildford to Godalming. It consists of sections of canal which link at either end to navigable sections of the River Wey, allowing boats to bypass the meandering sections of the River and to manage changes in level. The River Wey Navigation is owned and managed by the National Trust. Since the Navigation is part of the River Wey system, the risk of flooding mirrors that of the River Wey and is accounted for in the existing modelled flood outlines. The River Wey Navigation is known to have flooded properties in Godalming in the winter 2013-2014 flood event when water levels in the River Wey were also extremely high[26].

3.6.6 The Wey and Arun canal is disused but some sections of channel remain open. The line of the canal generally follows the course of Cranleigh Waters south from Bramley. Only one of these open sections (near Dunsfold Aerodrome) contains significant quantities of water under normal conditions. Surface water can collect in all open channel sections, which can reduce flooding from surface water overland flows, but which has also caused localised flooding on Dunsfold Road, Alfold[27]. Further flood risk may result from breaches of the embanked sections of canal should these contain water at the time of the breach. The map in **Appendix B Figure 11** was provided by Waverley BC for this SFRA and shows the areas of land which may be affected by a breach; these areas are localised and only affect land immediately adjoining the canal.

[24] Broadwater Lake Final Report Jacobs (2009) report Table 3.4.
[25] Based on information provided by Waverley Borough Council
[26] See Section 3.2 above
[27] Waverley Borough Council Strategic Flood Risk Assessment, Final Draft, Volume 2, Technical Report, July 2015, Section 10.4.2

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

4.1 Overview

4.1.1 This Section guides the application of the Sequential Test and Exception Test in the Plan-making and planning application processes. Not all development will be required to undergo these tests, as described below, but may still be required to undertake a site specific FRA, guidance about which is included in Section 6.

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

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

4.2 Applying the Sequential Test for the Local Plan

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

4.2.2 The Sequential Test requires an understanding of the Flood Zones in the study area and the vulnerability classification of the proposed developments. Flood Zone definitions are provided in Table 3-1 and mapped in the figures in **Appendix B Figure 2.** Flood risk vulnerability classifications, as defined in the PPG are presented in Table 4-1.

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

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

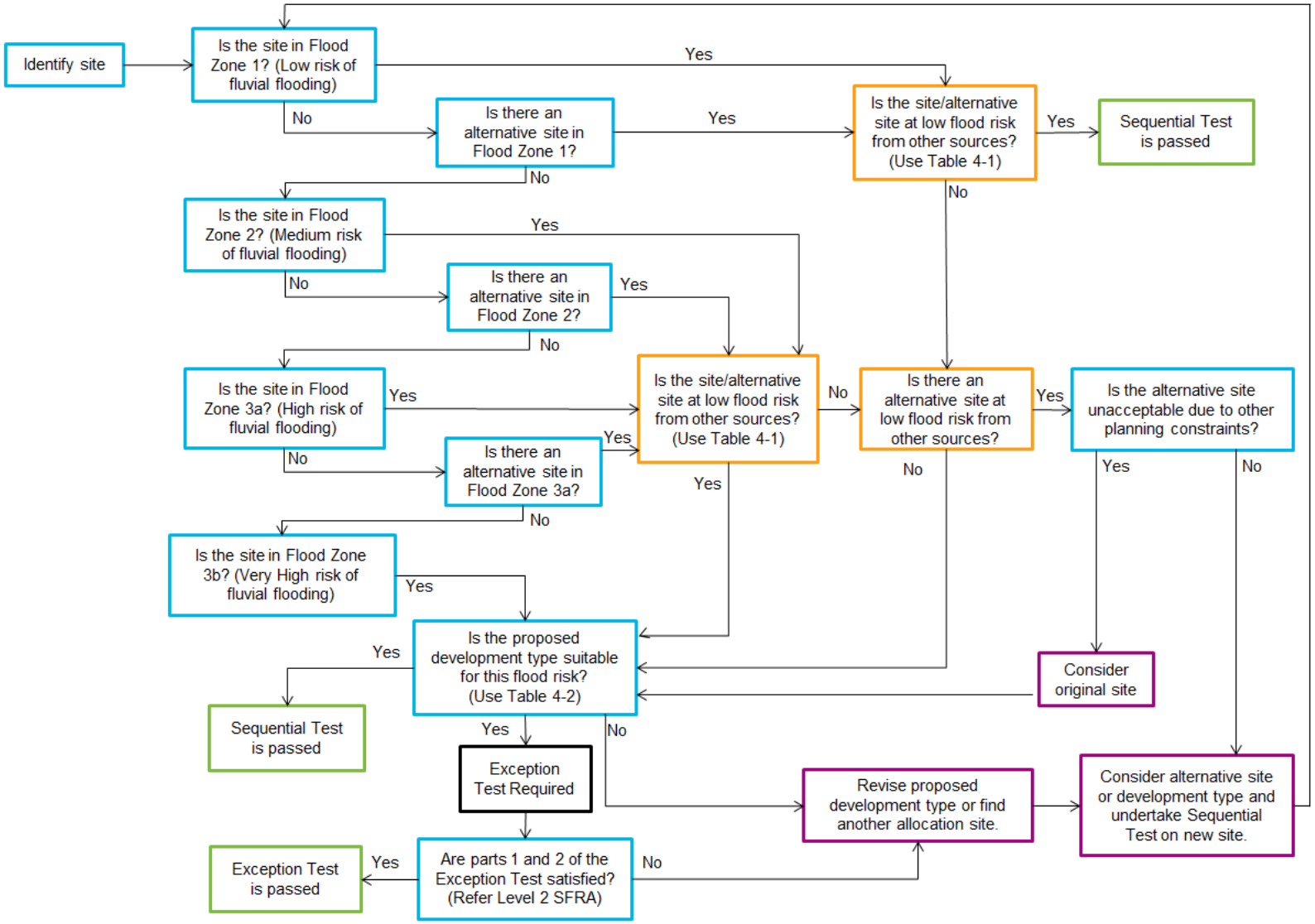

Figure 4-1 Application of Sequential Test for Local Plan preparation

Table 4-1 Flood Risk Vulnerability Classification (PPG)

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

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

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

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

✓ – Development is appropriate ✗ – Development should not be permitted

4.2.6 The recommended steps in undertaking the Sequential Test are detailed below. This is based on the Flood Zone and the Flood Risk Vulnerability.

Recommended Stages for LPA Application of the Sequential Test

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

(i). Assign potential developments with a vulnerability classification (Table 4-1).
(ii). Where development is mixed, the development should be assigned the highest vulnerability class of the developments proposed.
(iii). The Flood Zone classification of potential development sites should be determined based on a review of the Flood Map for Planning (Rivers and Sea). Where these span more than one Flood Zone, all zones should be noted, preferably using percentages.
(iv). Within each Flood Zone, sites can be ranked in order of preference in terms of flood risk from other sources (e.g. susceptibility to groundwater flooding, risk of surface water flooding), as indicated by the information contained in this SFRA, historical flood records and other sources of information such as LLFA records and site specific FRAs, if available.
(v). All sources of flood risk must be considered when planning for new development including: flooding from surface water runoff; groundwater; sewers; and artificial sources. If a location is recorded as having experienced repeated flooding from the same source this should be acknowledged within the Sequential Test.
(vi). The 2016 Level 2 SFRA included Sequential Testing of sites for the Waverley Local Plan. In order to ensure that the Sequential Test took account of flood risk from all sources, the risks were first categorised in Table 4-3, where the categories are defined by the percentage of land which is at risk of flooding.

Table 4-3 Flood Risk Categories by Flood Type

	Very High	High	Medium	Low
Fluvial Flood Zones	>35% in FZ3b	>35% in FZ3a	>50% in FZ2	>50% in FZ1
Fluvial Flood Zones (Detailed modelling)	>30% at risk of 1 in 20yr RP event	>30% at risk of 1 in 30yr RP event	>50% at risk of 1 in 100yr RP event	>50% not at risk from 1 in 100yr RP event or greater
Surface Water/Sewer	>50% at risk of 1 in 30yr RP Event	>50% of risk of 1 in 100yr RP event	>50% at risk of 1 in 1000yr RP event	>50% not at risk from 1 in 1000yr RP event or greater
Artificial Sources	>75% max reservoir or canal outline	50-75% max reservoir or canal outline	25-50% max reservoir or canal outline	<25% max reservoir or canal outline

(vii). The sites were then assigned to a category (Table 4-4) based on the risk from the various sources. Sites in a higher number category were preferred for development.

Table 4-4 Flood Risk Suitability Assessment Criteria[28]

Score	Flood Risk Criteria
1	Flood Zone 3b or equivalent over 50% of the site
2	Flood Zone 3 or equivalent in over 35% of the site or medium or high risk of surface water flooding **and** reservoir flooding in the majority of the site
3	Flood Zone 3 or equivalent in any part of the site or medium risk of flooding from any source
4	Over 50% of the site is at low risk of flooding from all sources
5	100% of the site is entirely at low risk of flooding from all sources

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

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

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

(x). Highly Vulnerable developments to be accommodated within the Borough should be located on those sites identified at a higher flood risk suitability score (5). If these cannot be located in an area with the lowest flood risk suitability score, then the next score (4) can then be considered.

(xi). In the first instance More Vulnerable development should be located on sites with a score of 5. Where these sites are unsuitable or there are insufficient sites remaining, sites with a score of 4 can be considered, and so on. If there are insufficient sites in areas of Flood Zone 1 or 2 to accommodate More Vulnerable development, sites in Flood Zone 3a can be considered. More Vulnerable developments in Flood Zone 3a will require application of the Exception Test.

(xii). In the first instance Less Vulnerable development should be located in areas with a score of 5, continuing sequentially to those areas of 4 and 3. Less Vulnerable development types are not appropriate in Flood Zone 3b – Functional Floodplain.

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

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

(xv). When applying the Sequential Test, sites may need to be referred for more detailed assessment of flood risk within a Level 2 SFRA. This assessment should enable the Exception Test to be undertaken

[28] Waverley Borough Council Level 2 SFRA, Capita 2016, Table 5-2

for Highly Vulnerable Development within Flood Zone 2 and More Vulnerable Development within Flood Zone 3. However, where a site is found to be impacted by a risk of flooding other than tidal or fluvial in step iii above, the site and food sources should be investigated further regardless of the Flood Zone and any requirement of the Exception Test. In this case, the risk of flooding from other sources may be sufficient to make a site inappropriate for development irrespective of the fluvial or tidal flood zone.

(xvi). The more detailed study in the Level 2 SFRA should consider the nature of flood hazard to allow a sequential approach to site allocation within a Flood Zone and to consider mitigation of the risk of flooding from all sources. The more detailed study would include:

- Source of flooding,
- History of flooding,
- Probability of flooding (if available, this is often difficult to determine for surface water and groundwater flooding,
- Flood risk management measures,
- The rate of flooding,
- Flood water depth,
- Flood water velocity.

Windfall Sites

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

4.3 Applying the Sequential Test for Planning Applications

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

- The proposed development is in Flood Zone 2 or 3.
- A sequential test hasn't already been done for a development of the type proposed.

4.3.2 The Environment Agency publication 'Demonstrating the flood risk Sequential Test for Planning Applications[29]' sets out the procedure for applying the sequential test to individual applications as follows:

- Identify the geographical area of search over which the test is to be applied; this could be the Borough area, or a specific catchment if this is appropriate and justification is provided (e.g. school catchment area or the need for affordable housing within a specific area).
- Identify the source of 'reasonably available' alternative sites; usually drawn from evidence base / background documents produced to inform the Local Plan.
- State the method used for comparing flood risk between sites; for example the Environment Agency Flood Map for Planning, the SFRA mapping, site-specific FRAs if appropriate, other mapping of flood sources.
- Apply the Sequential Test; systematically consider each of the available sites, indicate whether the flood risk is higher or lower than the application site, state whether the alternative option being considered is allocated in the Local Plan, identify the capacity of each alternative site, and detail any constraints to the delivery of the alternative site(s).

[29] Environment Agency (2012) Demonstrating the flood risk Sequential Test for Planning Applications, Version 3.1. Available from: https://www.gov.uk/guidance/flood-risk-assessment-the-sequential-test-for-applicants

- Conclude whether there are any reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed.
- Where necessary, as indicated by Table 4-2, apply the Exception Test.
- Apply the Sequential approach to locating development within the site.

4.3.3 It should be noted that it is for Waverley BC, taking advice from the Environment Agency as appropriate, to consider the extent to which Sequential Test considerations have been satisfied, taking into account the particular circumstances in any given case. The Waverley Local Plan Part 1 (2018) attributes a housing target to each town and parish, and as such this should normally be the starting point for identifying the area of search. The developer should justify with evidence what area of search has been used when making the application.

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

Sequential Test Exemptions

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

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

4.4 Exception Test

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

4.4.2 For the Exception Test to be passed:

- Part 1 - It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by the SFRA where one has been prepared; and
- Part 2 - A site-specific Flood Risk Assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

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

4.4.4 In order to satisfy part (a) of the Exception Test, the objectives of the Waverley BC Sustainability Appraisal[30] (SA) can be used to assess each potential development site.

4.4.5 When determining planning applications, Waverley BC should ensure flood risk is not increased elsewhere. In order to consider development to be appropriate in an area at risk of flooding, it should be informed by a site-specific FRA, follow the Sequential Test, and if required the Exception Test, before demonstrating the following:

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

4.4.6 There are a number of ways a new development can be made safe:

- Avoiding flood risk by not developing in areas at risk from floods;
- Substituting higher vulnerability land uses for lower vulnerability uses in higher flood risk locations and locating higher vulnerability uses in areas of lower risk on a strategic scale, or on a site basis;
- Providing adequate flood risk management infrastructure which will be maintained for the lifetime of the development; and
- Mitigating the potential impacts of flooding through design and resilient construction.

4.4.7 Further guidance is provided in Sections 5 and 6.

[30] Atkins, May 2018, Sustainability Appraisal of Waverley Borough Local Plan Part 2, Interim Sustainability Appraisal Report: Non-Technical Summary http://www.waverley.gov.uk/download/downloads/id/6103/sustainablity_appraisal_non-technical_summary.pdf

5. Managing and Mitigating Flood Risk

5.1 Overview

5.1.1 It is appreciated within the NPPF that it may not always be possible to avoid locating development in areas at risk of flooding. This Section provides guidance on the range of measures that could be considered in order to manage and mitigate flood risk. These measures should be considered when preparing a site-specific FRA as described in Section 6.

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

5.2 Site Layout

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

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

5.3 Development Design

Finished Floor Levels

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

5.3.2 Where developing in Flood Zone 2 and 3 is unavoidable, the recommended method of mitigating flood risk to people, particularly with More Vulnerable (residential) and Highly Vulnerable land uses, is to ensure internal floor levels are raised a freeboard level above the design flood level.

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

Flood Resilient and Resistant Construction

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

Construction'[31], the aim of which is to provide guidance to developers and designers on how to improve the resistance and resilience of new properties to flooding through the use of suitable materials and construction details. Figure 5-1 provides a summary of the Water Exclusion Strategy (flood resistance measures) and Water Entry Strategy (flood resilience measures) which can be adopted depending on the depth of floodwater that could be experienced.

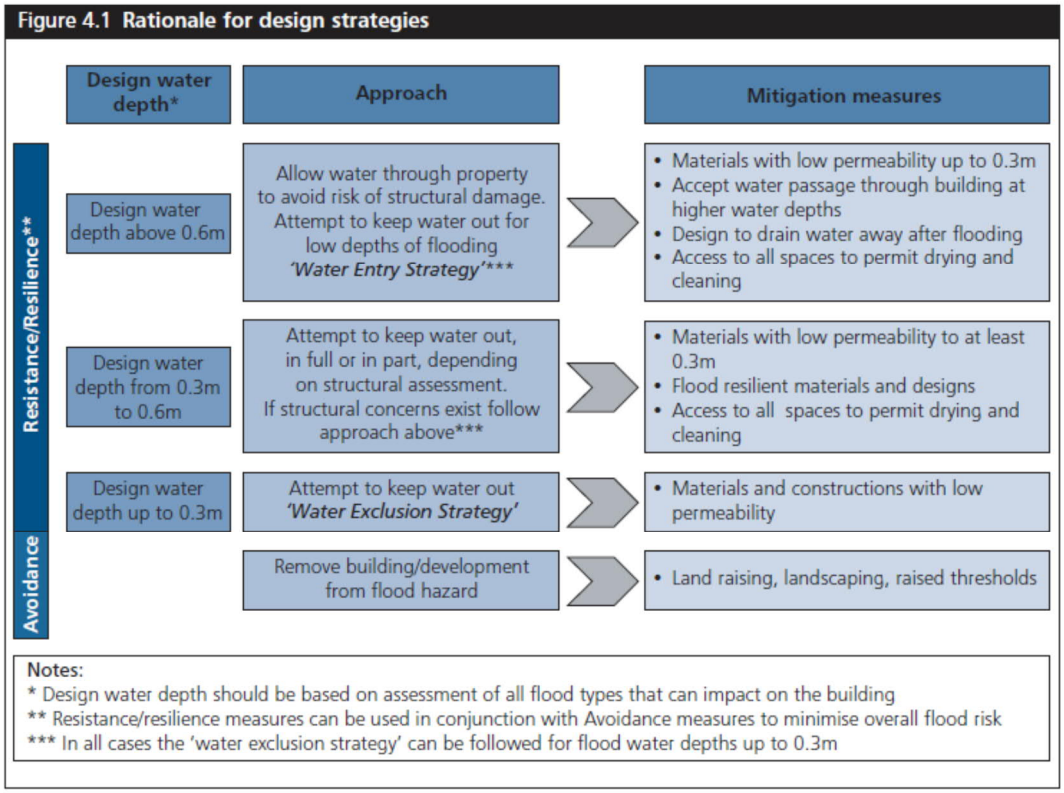

Figure 5-1 Flood Resistant / Resilient Design Strategies, Improving Flood Performance, CLG 2007

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

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

- Using materials and construction with permeability;
- Land raising;
- Landscaping e.g. creation of low earth bunds (subject to this not increasing flood risk to neighbouring properties);
- Raising thresholds and finished floor levels e.g. porches with higher thresholds than main entrance;
- Flood gates with waterproof seals; and,
- Sump and pump for floodwater to remove waste faster than it enters.

5.3.7 There are a range of property flood protection devices available on the market, designed specifically to resist the passage of floodwater. These include removable flood barriers and gates designed to fit openings, vent covers and stoppers designed to fit WCs. These measures can be appropriate for preventing water entry associated with fluvial flooding as well as surface water and sewer flooding.

[31] CLG (2007) Improving the Flood Performance of New Buildings, Flood Resilient Construction. Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/7730/flood_performance.pdf

5.3.8 The efficacy of such devices relies on their being deployed before a flood event occurs. It should also be borne in mind that devises such as air vent covers, if left in place by occupants as a precautionary measure, may compromise safe ventilation of the building in accordance with Building Regulations.

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

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

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

- Use materials with either, good drying and cleaning properties, or, sacrificial materials that can easily be replaced post-flood.
- Design for water to drain away after flooding.
- Design access to all spaces to permit drying and cleaning.
- Raise the level of electrical wiring, appliances and utility metres.
- Coat walls with internal cement based renders; apply tanking on the inside of all internal walls.
- Ground supported floors with concrete slabs coated with impermeable membrane.
- Tank basements, cellars or ground floors with water resistant membranes.
- Use plastic water resistant internal doors.

5.3.12 Further specific advice regarding suitable materials and construction techniques for floors, walls, doors and windows and fittings can be found in 'Improving the Flood Performance of New Buildings, Flood Resilient Construction'[32].

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

5.4 Safe Access / Egress

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

5.4.2 A safe access/egress route should allow occupants to safely enter and exit the buildings and be able to reach land outside the flooded area (e.g. within Flood Zone 1) using public rights of way without the intervention of emergency services or others during design flood conditions, including climate change allowances. This is of particular importance when contemplating development on sites located on dry islands - Areas of slightly higher ground which are less prone to flooding than the land around them and can be surrounded by water in times of flood. During prolonged periods of flooding it may prove difficult to provide resources and emergency services to those living in these areas. In order to reduce the flood risk, these 'dry islands' should be treated the same as for the level of flood risk in the area surrounding them.

[32] CLG (2007) Improving the Flood Performance of New Buildings, Flood Resilient Construction. Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/7730/flood_performance.pdf

5.4.3 Guidance prepared by the Environment Agency[33] uses a calculation of flood hazard to determine safety in relation to flood risk. Flood hazard is a function of the flood depth and flow velocity at a particular point in the floodplain along with a suitable debris factor to account for the hazard posed by any material entrained by the floodwater. The derivation of flood hazard is based on the methodology in Flood Risks to People FD2320, the use of which, for the purpose of planning and development control, is clarified in the above mentioned publication and summarised in Table 5-1.

Table 5-1 Hazard to People Rating *(HR=d x (v +0.5) +DF)* (Table 13.1 FD2320/TR2)

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

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

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

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

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

5.5 Flood Warning and Evacuation

5.5.1 The Environment Agency operates a free Flood Warning Service[34] for many areas at risk of flooding from rivers and the sea (and, in some parts of England, flooding from groundwater). The Environment Agency has provided a GIS layer of Flood Warning Areas in Waverley as discussed in Section 3 and summarised in Table 3-5.

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

[33] Environment Agency (2008) Supplementary note on Flood hazard ratings and thresholds for development planning and control purpose. Clarification of Table 13.1 FD2320/TR2 and Figure 3.2 FD2321/TR1. Available from: http://evidence.environment-agency.gov.uk/FCERM/Libraries/FCERM_Project_Documents/FD2321_7400_PR_pdf.sflb.ashx
[34] Environment Agency Flood Warning Service http://apps.environment-agency.gov.uk/wiyby/37835.aspx

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

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

5.5.5 The Environment Agency has a tool on their website to create a Personal Flood Plan[35]. The Plan comprises a checklist of things to do before, during and after a flood and a place to record important contact details. Where proposed development comprises non-residential extension <250m^2 and householder development (minor development), it is recommended that the use of this tool to create a Personal Flood Plan will be appropriate.

5.5.6 Flood Warning and Evacuation Plans should include:

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

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

5.6 Floodplain Compensation

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

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

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

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

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

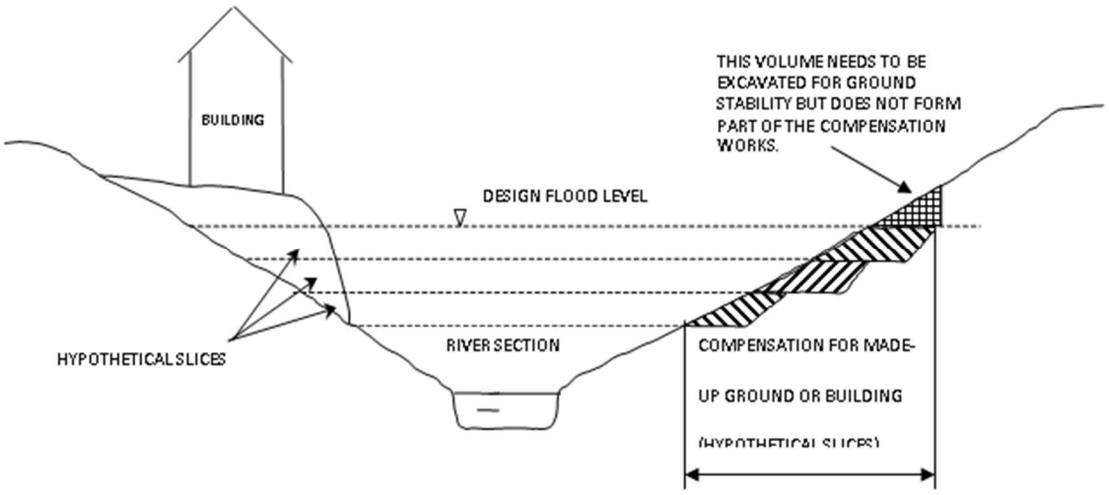

Figure 5-2 Example of Floodplain Compensation Storage (Environment Agency 2009)

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

5.6.6 The use of under-floor voids with adequate openings beneath the raised finished floor levels can be considered for development in Flood Zone 2 and 3. They are generally considered to provide indirect compensation or mitigation, but not true compensation for loss of floodplain storage. The use of under-floor voids will typically require a legal agreement or planning condition and maintenance plan for them to remain open for the lifetime of the development and agreement that Waverley BC will enforce. Sole reliance on the use of under-floor voids to address the loss of floodplain storage capacity is generally not acceptable on undeveloped sites or for individual properties.

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

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

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

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

5.7 Flood Routing

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

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

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

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

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

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

5.8 Surface Water Management

5.8.1 All major developments (10 or more dwellings and 1000m^2 floor space) and other development should not result in an increase in surface water runoff, and where possible, should demonstrate betterment in terms of rate and volumes of surface water runoff.

5.8.2 Sustainable Drainage Systems (SuDS) should be used to reduce and manage surface water run-off to and from proposed developments as near to source as possible in accordance with the requirements of the Technical Standards and supporting guidance published by DCLG and Department for the Environment, Food and Rural Affairs (Defra)[37]. In line with the Waverley Borough Local Plan Part 1, SuDS will be required on all major developments and encouraged for smaller schemes. Development should not increase in either the volume or

[37] Sustainable drainage systems: non-statutory technical standards. Available from: https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards

rate of surface water runoff leaving the site and proposals for brownfield sites should aim to reduce run off rates to those on greenfield sites where feasible. There should be no property or highway flooding, off site, for up to the 1 in 100 year storm return period, including an allowance for climate change[38].

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

- Reduce flood risk (to the site and neighbouring areas);
- Reduce pollution; and,
- Provide landscape and wildlife benefits.

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

- Into the ground (infiltration)
- To a surface water body
- To a surface water sewer, highway drain, or another drainage system
- To a combined sewer

5.8.5 SuDS techniques can be used to reduce the rate and volume and improve the water quality of surface water discharges from sites to the receiving environment (i.e. natural watercourse or public sewer etc.). The SuDS Manual[39] identified several processes that can be used to manage and control runoff from developed areas. Each option can provide opportunities for storm water control, flood risk management, water conservation and groundwater recharge.

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

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

[38] Policy CC4 (Flood Risk Management), Waverley BC Local Plan Part 1: Strategic Policies and Sites, February 2018
[39] CIRIA C697 SuDS Manual. Available from: http://www.ciria.org/Resources/Free_publications/the_suds_manual.aspx

Table 5-2 Typical SuDS Components (Y: primary process, * some opportunities subject to design)

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

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

Suitability for Infiltration SuDS

5.8.8 The use of infiltration techniques is highly dependent on the underlying ground conditions. As part of this SFRA, an assessment of the suitability of using infiltration SuDS techniques across the Borough has been undertaken using the detailed BGS Infiltration SuDS Map.

5.8.9 **Appendix B Figure 12** presents the Infiltration SuDS Map, which shows the following areas:

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

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

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

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

5.8.10 The BGS SuDS map show that most of the Borough of Waverley is highly or probably compatible with SuDS. Only some small areas in Farnham are considered to have very significant constraints.

5.8.11 The suitability for SuDS infiltration of each site should be further considered based on detailed ground investigation information and BRE Digest: 365 test results, The Infiltration SuDS map is only indicative and based on broad scale geological mapping.

Technical Standards and supporting guidance

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

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

Peak flow control

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

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

Volume control

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

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

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

Flood risk within the development

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

S8 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.

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

5.8.14 The NPPF states that all major development should incorporate SuDS unless there is clear evidence that it would be inappropriate. As the LLFA, SCC is a statutory consultee on surface water management drainage issues for all such major developments. In partnership with the 11 LPAs in Surrey, SCC has set out clear advice and guidance documents on their website[40]. This includes a **Surface Water Drainage Summary Pro-forma** which should be completed in full and accompany the submitted drainage statement and supporting evidence. This must be cross-referenced within an FRA where appropriate.

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

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

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

6. Preparing Site Specific FRAs

6.1 What is a Flood Risk Assessment?

6.1.1 A site-specific FRA provides an assessment of flood risk to and from a proposed development, and demonstrates how the proposed development will be made safe, will not increase flood risk elsewhere and where possible will reduce flood risk overall. An FRA must be prepared by a suitably qualified and experienced person and must contain all the information needed to allow Waverley BC to satisfy itself that the requirements have been met at the planning application stage.

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

- All development in Flood Zones 2 and 3.
- In Flood Zone 1, an assessment should accompany all proposals involving:
  - sites of 1 hectare or more;
  - land which has been identified by the Environment Agency as having critical drainage problems;
  - land identified in a strategic flood risk assessment as being at increased flood risk in future; or
  - land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.

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

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

6.2 Level of Detail Required

6.2.1 The PPG states that site specific FRAs should be proportionate to the degree of flood risk, the scale and nature of the development, its vulnerability classification (Table 4-1) and the status of the site in relation to the Sequential and Exception Tests. Site-specific FRAs should also make optimum use of readily available information, for example the mapping presented within this SFRA , although in some cases additional modelling or detailed calculations will need to be undertaken.

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

6.2.3 As a result, the scope of each site-specific FRA will vary considerably. Table 6-1 presents the different levels of site-specific FRA as defined in the CIRIA publication C624[41] and identifies typical sources of information that can be used. Sufficient information must be included to enable the Council and other consultees (where

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

appropriate) to determine that the proposal will comply with the requirements of the NPPF. Failure to provide sufficient information will result in applications being refused.

Table 6-1 Levels of site specific FRA

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

6.3 Detailed Flood Models

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

6.3.2 The information available may include modelled flood levels which can be compared with site levels to confirm the Flood Zone and extent of flood risk. It should be noted that the scope of modelling studies undertaken by the Environment Agency typically cover flooding associated with Main Rivers. However, detailed models are not available for all Main Rivers or for Ordinary Watercourses. Where a proposed development site may be at risk of flooding but no modelling exists, or the available modelling is considered to provide very conservative

estimates of flood extents (due to the use of national generalised JFLOW modelling), applicants may need to prepare a new hydraulic model to enable more accurate assessment of the probability of flooding associated with the watercourse and to inform the site-specific FRA. This should be carried out in line with industry standards and in agreement with the Environment Agency and SCC (as the LLFA).

6.4 Flood Risk Assessment Checklist

6.4.1 Table 6-2 provides a checklist for site-specific FRAs including the likely information that will need to be provided along with references to sources of relevant information. As described earlier in this Section, the exact level of detail required under each heading will vary according to the scale of development and the nature of the flood risk. It is expected that this Checklist is completed for all planning applications. This will be a validation requirement once the Council has updated its validation checklist and proposals that are submitted without the completed Checklist will be regarded as invalid.

Table 6-2 Site specific FRA Checklist (developed from guidance in PPG)

What to include in the FRA		Source(s) of Information
1. Site Description		
Location plan	*Plan of site including geographical features, street names, catchment areas, watercourses and other bodies of water. Include current use and any structures which may influence local hydraulics e.g. bridges, pipes/ducts crossing watercourses, culverts, screens, embankments, walls, outfalls and condition of channel.*	*OS Mapping* *SFRA Appendix B* *Site Survey*
Topography	*Include general description of the topography local to the site. Where necessary, site survey may be required to confirm site levels (in relation to Ordnance datum).* *Plans showing existing and proposed levels.*	*SFRA Appendix B* *Site Survey*
Geology	*General description of geology local to the site.*	*SFRA Appendix B* *Ground Investigation Report*
3. Proposed Development		
Changes to Site	*Plan showing development proposal, including post development land levels. Will the proposals increase the number of occupants / site users on the site such that it may affect the degree of flood risk to these people?*	
Vulnerability Classification	*Determine the vulnerability classification of the development. Is the vulnerability classification appropriate within the Flood Zone?*	*SFRA Table 4-1* *SFRA Table 4-2*
Status	*Is the development in accordance with the Council's Spatial Strategy?*	*See advice from Waverley BC if necessary.*
2. Assessing Flood Risk		
The level of assessment will vary, as previously outlined, and not all of the prompts below will be relevant.		
Flooding from Rivers	*Provide a plan of the site and Flood Zones.* *Identify any historic flooding that has affected the site, including dates and depths where possible.* *How is the site likely to be affected by climate change?* *Determine flood levels on the site for the 1% annual probability (1 in 100 chance each year) flood event including an allowance for climate change.* *Determine flood hazard on the site (in terms of flood depth and velocity).* *Undertake new hydraulic modelling to determine the flood level, depth, velocity, hazard, rate of onset of flooding on the site.*	*SFRA Appendix B* *Environment Agency Flood Map for Planning (Rivers and Sea).* *Environment Agency Data.* *New hydraulic model (where Environment Agency data not available)*
Surface Water Flooding	*Identify any historic flooding that has affected the site.* *Review any available flooding reports developed by SCC.* *Review the local topography and conduce a site walkover to determine low points at risk of surface water flooding.*	*SFRA Appendix B* *Topographic survey.* *Site walkover.*

	Review the Risk of Flooding from Surface Water mapping. *Where necessary, undertake modelling to assess surface water flood risk.*	*Risk of Flooding from Surface Water mapping (Environment Agency website).*
Flooding from Groundwater	*Desk based assessment based on high level BGS mapping in the SFRA.* *Ground survey investigations.* *Identify any historic flooding that has affected the site.*	*SFRA Appendix B* *Ground Investigation Report*
Flooding from Sewers	*Identify any historic flooding that has affected the site.*	*SFRA Appendix B* *Where appropriate an asset location survey can be provided by Thames Water Utilities Ltd or Southern Water Services Ltd:* *http://www.thameswater-propertysearches.co.uk/* *https://www.southernwater.co.uk/drainage-water-searches*
Artificial sources	*Identify any historic flooding that has affected the site.* *Review the Risk of Flooding from Reservoirs mapping.*	*Risk of Flooding from Reservoirs mapping (Environment Agency website)*
4. Avoiding Flood Risk		
Sequential Test	*Determine whether the Sequential Test is required (consult Waverley BC).* *If required, present the relevant information to Waverley BC to enable their determination of the Sequential Test for the site on an individual basis.*	*SFRA Section 4*
Exception Test	*Determine whether the Exception Test is necessary. If so, present details of:* *Part 1) how the proposed development contributes to the achievement of wider sustainability objectives as set out in the Waverley BC Sustainability Appraisal Report.* *Part 2) See part 5 below*	*SFRA Table 4-2* *Refer to Waverley BC sustainability objectives*
5. Managing and Mitigating Flood Risk		
Section 6 of the SFRA presents measures to manage and mitigate flood risk and when they should be implemented. Where appropriate, the following should be demonstrated within the FRA to address the following questions: *How will the site/building be protected from flooding, including the potential impacts of climate change, over the development's lifetime?* *How will you ensure that the proposed development and the measures to protect your site from flooding will not increase flood risk elsewhere?* *Are there any opportunities offered by the development to reduce flood risk elsewhere?* *What flood-related risks will remain after you have implemented the measures to protect the site from flooding (i.e. residual risk) and how and by whom will these be managed over the lifetime of the development (e.g. flood warning and evacuation procedures)?*		
Development Layout and Sequential Approach	*Plan showing how sensitive land uses have been placed in areas within the site that are at least risk of flooding.*	*SFRA Section 5.2*
Finished Floor Levels	*Plans showing finished floor levels in the proposed development in relation to Ordnance Datum taking account of indicated flood depths.*	*SFRA Section 5.3*
Flood Resistance and Resilience	*Details of flood resistance and/or resilience measures that have been incorporated into the design. Include design drawings where appropriate.*	*SFRA Section 5.3*
Safe Access / Egress	*Provide a figure showing proposed safe route of escape away from the site and/or details of safe refuge. Include details of signage that will be included on site.* *Where necessary this will involve mapping of flood hazard associated with river flooding. This may be available from Environment Agency modelling, or may need to be prepared as part of hydraulic modelling specific for the proposed development site.*	*SFRA Section 5.4*
Floodplain Compensation Storage	*Provide calculations or results of a hydraulic modelling study to demonstrate that the proposed development provides compensatory flood storage and either will not increase flood risk to neighbouring*	*SFRA Section 5.6*

	areas or will result in an overall improvement. This should be located and designed to achieve level for level and volume for volume compensation, should be provided on land that is in hydrological continuity with the site within the applicant's ownership and subject to appropriate maintenance regimes for its lifetime. Include cross sectional drawings clearly showing existing and proposed site levels.	
Flow Routing	*Provide evidence that proposed development will not impact flood flows to the extent that the risk to surrounding areas is increased. Where necessary this may require modelling.*	*SFRA Section 5.7*
Riverside Development Buffer Zone	*Provide plans showing how a buffer zone of 8m width will be retained adjacent to any Main River or Ordinary Watercourse in accordance with requirements of the Environment Agency or SCC.*	*SCC guidance on OW consent.* *https://www.surreycc.gov.uk/people-and-community/emergency-planning-and-community-safety/flooding-advice/more-about-flooding/ordinary-watercourse-consents*
Surface Water Management	*Completion of SuDS Proforma for all major development proposals in Flood Zones 1, 2 or 3.* *Details of the following within FRA for all other developments located within Flood Zones 2 and 3:* *Calculations (and plans) showing areas of the site that are permeable and impermeable pre and post-development.* *Calculations of pre and post-development runoff rates and volumes including consideration of climate change over the lifetime of the development.* *Details of the methods that will be used to manage surface water (e.g. permeable paving, swales, wetlands, rainwater harvesting).* *Where appropriate, reference the supporting Outline or Detailed Drainage Strategy for the site.* *Information on proposed management arrangements*	*SFRA Section 5.8* *SCC SuDS planning advice* *https://www.surreycc.gov.uk/people-and-community/emergency-planning-and-community-safety/flooding-advice/more-about-flooding/suds-planning-advice*
Flood Warning and Evacuation Plan	*Where appropriate reference the Flood Warning and Evacuation Plan or Personal Flood Plan that has been prepared for the proposed development (or will be prepared by site owners).*	*SFRA Section 5.5*

6.5 Pre-application Advice

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

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

- Waverley Borough Council http://www.waverley.gov.uk/info/200350/submit_an_application/333/pre-application_planning_advice
- Surrey County Council https://www.surreycc.gov.uk/people-and-community/emergency-planning-andcommunity-safety/flooding-advice/more-about-flooding/suds-planning-advice
- Environment Agency

https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion

https://www.gov.uk/government/publications/planning-advice-environment-agency-standard-terms-and-conditions

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

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7. Recommendations for Policy and Practice

7.1 Using the SFRA

7.1.1 The information contained within the SFRA can be used to inform the preparation of the Waverley Local Plan and in the planning application review process. However, the information may also have wider applications, for example:

- Information on roads at risk of flooding can be used to inform planning of highways maintenance and improvement works.
- Recommendations and methods for assessing risk can be applied to a range of different scenarios for input to Flood Plans, including assessing the vulnerability of facilities such as schools, hospitals and electricity substations.

7.1.2 The SFRA should be made widely available so that all relevant groups and teams can use the information contained and can make recommendations and have input to future updates.

7.2 Emergency Planning

7.2.1 The role of Waverly BC in emergency planning is set out in the Civil Contingencies Act 2004.

7.2.2 Preparedness for flood events requires local management and leadership with clear roles and effective co-ordination between groups and operators who will be working to mitigate the effects of flooding on people and infrastructure affected. Local authorities have a key role in planning and responding to flood events, including producing clear Emergency Plans based on accurate information.

7.2.3 Emergency Plans are essential to provide instructions to those managing the immediate response to the flood event, including coordinating the rescue, transport, treatment and shelter of affected individuals as well as the repair or replacement of affected infrastructure. Organisations involved include the emergency services, council departments, utility companies and the Environment Agency, in addition to individual businesses and households.

7.2.4 The Emergency Plans can also contain information on medium and long term responses to flood events. Medium term actions can include measures to assist people in returning to affected homes or for ongoing shelter of people unable to return until extensive repairs are carried out. Actions may also be taken to assist businesses in flood recovery, such as assistance with rubbish removal and building repairs.

7.2.5 In the long term, the impacts of flooding can be reduced by actions to reduce risk to infrastructure, protect key facilities from flooding and improve public awareness and knowledge.

7.2.6 The information in this SFRA cannot replace an Emergency Plan but can be used to inform actions. For example, the information contained in this report could be used to identify roads which may need to be closed and therefore replacement routes for diversion of traffic during flooding. It can also be used to identify infrastructure and homes which are at increased risk and inform actions which can be taken to reduce flooding impact, including the extent of flood warning areas and recommendations on flood resilient and resistant construction.

7.2.7 Whilst the information in this report can be used to inform a Multi-Agency Flood Plan for Waverly BC, emergency planning is not limited to the Borough Council. Surrey CC also plans for flood events as part of the Surrey Local Resilience Forum and Cranleigh Parish Council also carry out emergency planning at the parish level. This SFRA should be made available at all levels so that the information contained can be used in emergency planning at all levels.

7.2.8 Effective planning for floods will also show where proposed development may increase pressures on emergency services or the risks to the existing population, e.g. through requiring evacuation of additional properties constructed in the floodplain or making access for evacuation of existing development more difficult. This information can then inform the planning decision process or change the proposals for development.

7.2.9 Should development flood risk areas be unavoidable, the emergency plan should identify where additional flood warning systems are needed and consider the most appropriate method of communication. The SFRA can also be used to assess the suitability of evacuation plans, taking into account the specific circumstances of the site users and potential access and egress routes. The SFRA should be provided to the emergency services for reference in any consultation on the appropriateness of flood warning and evacuation plans for proposed or existing development.

7.3 Strategic Planning

7.3.1 This SFRA can be used to inform the application of the Sequential Test for sites considered for allocation with the Waverley BC local plan. It should not be used in insolation but should be combined with additional information on flood risk, should such information be identified following publication, such as local knowledge.

7.3.2 In addition, the SFRA can be used to inform strategic planning for other agencies. This includes:

- Updating Environment Agency Flood Warning Areas and codes;
- Emergency Planning (see above);
- Long term plans for improvements to, and provision of, national infrastructure; and
- Approaches to watercourse maintenance, including recommendations for riparian responsibilities.

7.3.3 The SFRA should be considered a living document and should be periodically updated to incorporate the most up to date information. Information on flooding from all sources should be collected by the relevant agencies to facilitate this process.

7.3.4 The information contained with this SFRA, and the further documents and data sources to which it refers, can be used in catchment planning, such as in CFMPs. This data can also be used to ensure that proposed development does not conflict with the requirements for catchment management and catchment planning but supports the objectives, such as by providing attenuation of flows and runoff in upland catchment areas and thereby reducing flood risk downstream.

7.3.5 The SFRA and other wider development policies can provide an agreed body of evidence for decision making for projects which cross administrative boundaries, providing continuity and consistency between areas such as adjacent LPAs. This will also facilitate projects to, for example, provide flood risk management works on the River Wey, which crosses a number of administrative areas.

7.3.6 This SFRA includes discussion of surface water flooding and managing of surface flows using SuDS. This information can be used to inform discussions between Waverley DC, Thames Water, Southern Water, the Highways Agency, Surrey CC and developers to ensure that surface water is appropriately managed and SuDS are constructed to agreed standards and adopted by the relevant party. The SFRA can be used to inform Surface Water Management Plans for areas at risk of surface water flooding to mitigate the risk in future. The findings of the SFRA concerning sewer flooding and groundwater vulnerability may also be used by Thames Water or Southern Water to assess potential schemes to reduce sewer flooding in future.

7.3.7 The notes and identified data sources included in this report can also be used as a starting point for data collection for site specific FRA. The report brings together information on flooding from a wide range of sources and consulting these sources further for site specific information should ensure that, so far as is possible, flood risk to a site can be adequately assessed and appropriate mitigation measures can be proposed.

7.4 Level 2 SFRA

7.4.1 The information and guidance in this SFRA can be used in the application of the Sequential Test. In areas where development is required on land at risk of flooding, the Exception Test may also be required. This will be

the case for more vulnerable development or essential infrastructure within Flood Zone 3 and highly vulnerable development within Flood Zone 2.

7.4.2 Applying the Exception Test requires more detailed information than is contained within this Level 1 SFRA. If the Exception Test is needed for sites proposed for allocation within the local plan then a Level 2 SFRA will need to be carried out. The Level 2 SFRA will seek to improve the information available for these sites and include and assessment of site safety and the implications for flood risk elsewhere.

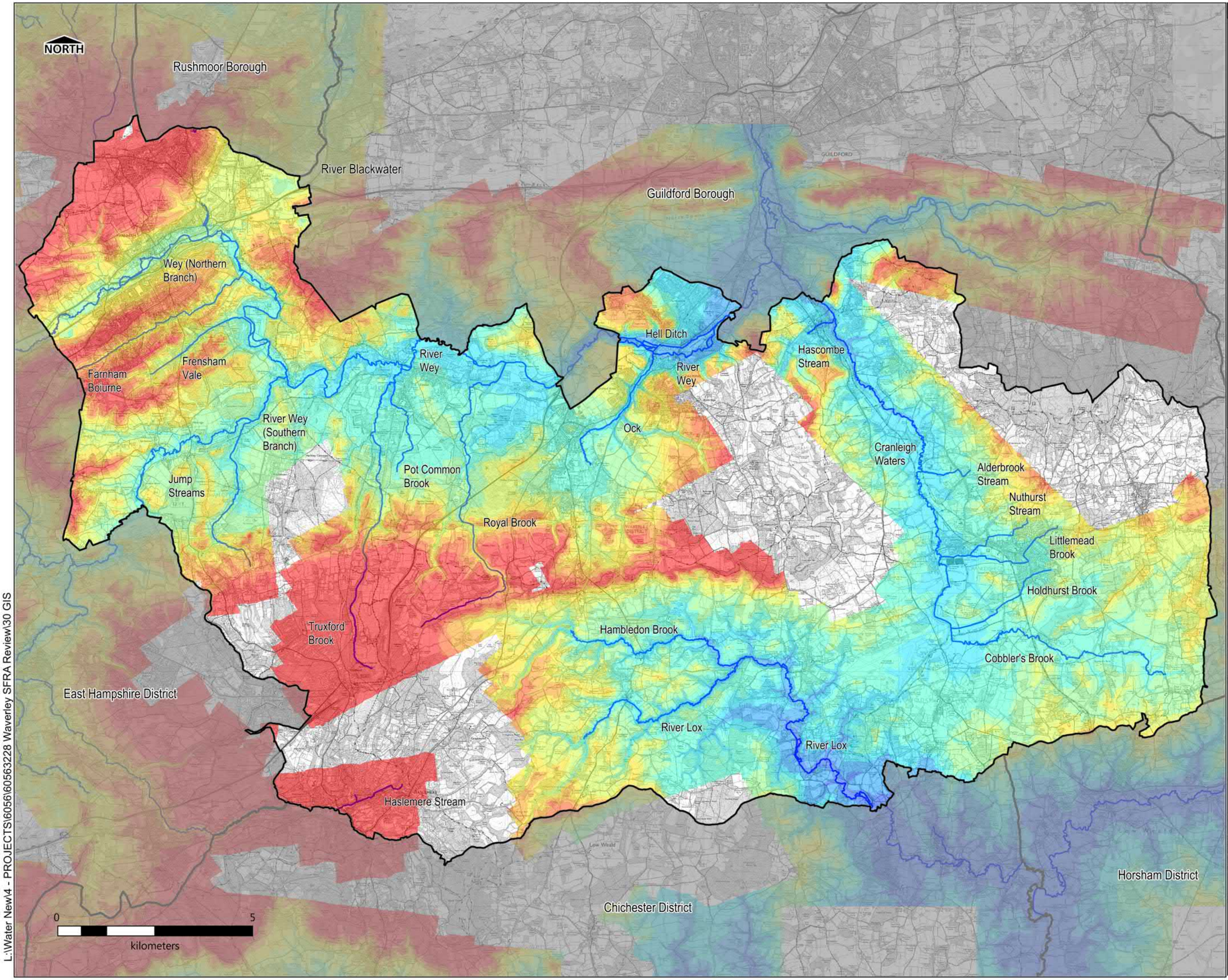
Appendix A Data Register

Appendix B Figures

aecom.com

Appendix A Data Register

Dataset	Provider	Requested	Received	Date Received	Benefits / Limitations
		Yes/No	Yes/No		
OS Background Mapping 1:25,000	WBC	Yes	Yes	17-Jul-18	Provides base mapping for figures within Appendix B.
Administrative boundary	WBC	Yes	Yes	10-May-18	Delineates the extent of Waverley BC administrative area for mapping purposes.
Post code boundaries	WBC	Yes	Yes	30-Jan-18	Extent of post code areas in Waverley BC administrative area. Used to enable mapping of TWUL and SWSL historic flooding datasets which record incidents within post code areas.
Modelling Report and Flood Outlines for Blackwater	Environment Agency	Yes	Yes	09-May-18	*The flood extents for the hydraulic model studies that have been completed for Rivers within the study area have been mapped. These provide indication of flooding from these rivers. The Environment Agency applies the outcomes from these detailed modelling studies to update the Flood Map for Planning (Rivers and Sea) on a quarterly basis. Some watercourses have not been modelled (e.g. some of the tributaries of other the Main Rivers). The flood risk from these is based on broad scale JFLOW modelling and therefore the flood risk from these cannot be as accurately assessed.* Blackwater: Climate change outlines do not take account of new allowances in the Environment Agency guidance (2016). Outlines are based on 100yr flow plus 20% to allow for climate change.
Modelling Report and Flood Outlines for Upper Arun (River Lox)	Environment Agency	Yes	Yes	16-Oct-18	Range of climate change outlines available in line with 2016 climate change guidance.
Modelling Report and Flood Outlines for Upper Wey (Haslemere to Passfield), Middle Wey (Tilford to Jacobs Well), Middle Wey (Cranleigh), River Ock (Godalming), Hascombe Stream, Frensham Vale, Farnham Park Stream, Farnham Bourne	Environment Agency	Yes	Yes	26-Oct-18	Outputs are DRAFT and subject to change following internal review by the Environment Agency. Final outputs will be available in 2019 and will be used to update the Flood Map for Planning. Range of climate change outlines available in line with 2016 climate change guidance.
Flood defence information (Asset Information Management System (AIMS) dataset)	Environment Agency	Yes	No	-	Shows where there are existing defences, structures, heights, type and design standard. However many fields often contain default values.
Details of flood alleviation schemes	Environment Agency	Yes	No	-	-
Flood Map for Planning (Rivers and Sea)	WBC via Environment Agency Partner Catalogue	Yes	Yes	20-Jan-18	A quick and easy reference that can be used as an indication of the probability of flooding from Main Rivers. The original Flood Map was broad scale national mapping typically using JFLOW modelling software that is generally thought to have inaccuracies. This is regularly updated with the result of new modelling studies. It will be updated with the revised Upper and Middle Wey modelling iwhen it is finliased in due course. For those rivers where there is no updated modelling, the Flood Zones from JFLOW modelling may not provide an accurate representation of probability of flooding. Typically watercourses with a catchment area less than 3km2 are omitted from Environment Agency mapping unless there is a history of flooding affecting a population. Consequently there will be some locations adjacent to watercourses that on first inspection, suggest there is no flood risk.
Flood Warning Areas	WBC via Environment Agency Partner Catalogue	Yes	Yes	27-Mar-18	Indicates which areas are covered by the flood warning system.
Main River	WBC via Environment Agency Partner Catalogue	Yes	Yes	08-Feb-18	Identification of the Main River network for which the Environment Agency have responsibility to maintain.
Detailed River Network	WBC via Environment Agency Partner Catalogue	Yes	Yes	08-Feb-18	Identification of the river network including Main Rivers and Ordinary Watercourses for which the Environment Agency and Surrey County Council have discretionary and regulatory powers.
Areas Susceptible to Groundwater Flooding	WBC via Environment Agency Partner Catalogue	Yes	Yes	29-Jan-18	Environment Agency coarse scale dataset that provides the percentage of 1km grid squares that are susceptible to groundwater emergence.
Risk of Flooding from Surface Water	WBC via Environment Agency Partner Catalogue	Yes	Yes	30-Jan-18	Provides an indication of the broad areas likely to be at risk of surface water flooding, i.e. areas where surface water would be expected to flow or pond. This dataset does not show the susceptibility of individual properties to surface water flooding.
Recorded Flood Outlines		Yes	Yes	30-Jan-18	A single GIS layer showing the extent of historic flood events from fluvial, surface water, groundwater sources created using best available information at time of publication. However, some of the data is based on circumstantial and subjective evidence. There is not always available metadata, e.g. date of flood event.
LiDAR Data	AECOM via Data Share website	N/A	Yes	March - July 2018	Provides a useful basis for understanding local topography and the surface water flood risk in the area. Spatial resolution of 1m. Accuracy of +/- 0.25m. The Environment Agency's LiDAR data archive contains digital elevation data derived from surveys carried out since 1998.
Reservoir Maximum Flood Outline	Environment Agency	Yes	No	-	Delineates the areas at potential risk if there were a breach of reservoirs, as shown in the Risk of Flooding from Reservoir mapping on the Environment Agency website.
Canal breach maximum flood outline	WBC from former SFRA	Yes	Yes	11-May-18	From previous Level 1 SFRA Capita 2015.
BGS SuDS Infiltration Map	SCC	Yes	Yes	14-May-18	Dataset produced by the BGS of relevance to professionals who make decisions on SuDS design, construction and approval. The maps will help: (1) make preliminary decisions on the suitability of the subsurface for infiltration SuDS; (2) make preliminary decisions on the type of infiltration SuDS that will likely be appropriate; (3) assess SuDS planning applications to determine whether the necessary factors have been considered; and (4) determine whether infiltration SuDS could be appropriate where a non-infiltrating SuDS technique has been proposed.
BGS Susceptibility to Groundwater Flooding Map	British Geological Survey	Yes	No		Licence not available for this. AECOM will refer to mapping in LFRMS.
SCC Local Flood Risk Management Strategy	Publically available on SCC website.	Yes	Yes	Online	Report prepared by the LLFA SCC detailing their approach for the management of local flood risk in the area, i.e. flooding from surface water, groundwater and ordinary watercourses.
SCC Flood Investigation Report	Publically available on SCC website.	Yes	Yes	Online	Report prepared by the LLFA SCC detailing the flooding of Winter 2013-2014.
SCC SW Drainage Advice Note	Publically available on SCC website.	Yes	Yes	Online	In partnership with the 11 LPAs in Surrey, SCC has set out clear advice and guidance documents on their website . This includes a Surface Water Drainage Summary Pro-forma which should be completed in full and accompany the submitted drainage statement and supporting evidence. This must be cross-referenced within an FRA where appropriate.
SCC Historic flooding datasets	SCC	Yes	Yes	31-Oct-18	SCC have provided records of flooding, including; road locations along which internal property flooding has been reported to SCC; road locations along which external flooding has been reported to SCC; a record of all reports of highways flooding received since 2014; and, details of 'wetspots' (Wetspot' is a term used by Surrey CC as the LLFA to describe the location of a surface water flood incident that has been reported. The wetspot database is continually updated to produce a comprehensive map and record of all the identified wetspots in Surrey).
Southern Water Sewer Flooding Records	Southern Water Services Ltd	Yes	Yes	24-Jul-18	Indicates post code areas that may be prone to flooding as have experienced flooding in the last 10 years due to hydraulic incapacity. However, given that TWUL and SWSL target these areas for maintenance and improvements, areas that experienced flooding in the past may no longer be at greatest risk of flooding. It should be noted that these are flooding incidents that have been reported to TWUL or SWSL by the home owners. This will not account for any incidents that don't get reported and therefore do not show on the register.
Thames Water Sewer Flooding Records	Thames Water Utilities Ltd	Yes	Yes	20-Feb-18	



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LEGEND

Waverley Borough Boundary

Main Rivers

Topography (m AOD)

3 to 30
30 to 40
40 to 50
50 to 60
60 to 70
70 to 80
80 to 90
90 to 100
100 to 110
110 to 278

Notes

1. Light Detection and Ranging (LiDAR) is an airborne mapping technique, which uses a laser to measure the distance between the aircraft and the ground.
2. This dataset has a spatial resolution of 1m. The Environment Agency's LiDAR data archive contains digital elevation data derived from surveys carried out since 1998.
3.Any areas that are unshaded denote locations that currently do not have LiDAR coverage

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Revision Details			Suffix

Purpose of Issue: FINAL

Client: Waverley Borough Council

Project Title: Waverley Borough Council Level 1 Strategic Flood Risk assessment

Drawing Title: Topography and Waterbodies

Drawn	Checked	Approved	Date
HB	SL	SK	October 2018

AECOM Internal Project No.	Scale at A3
60563228	1:86,000

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Drawing Number	Rev
FIGURE 1	01

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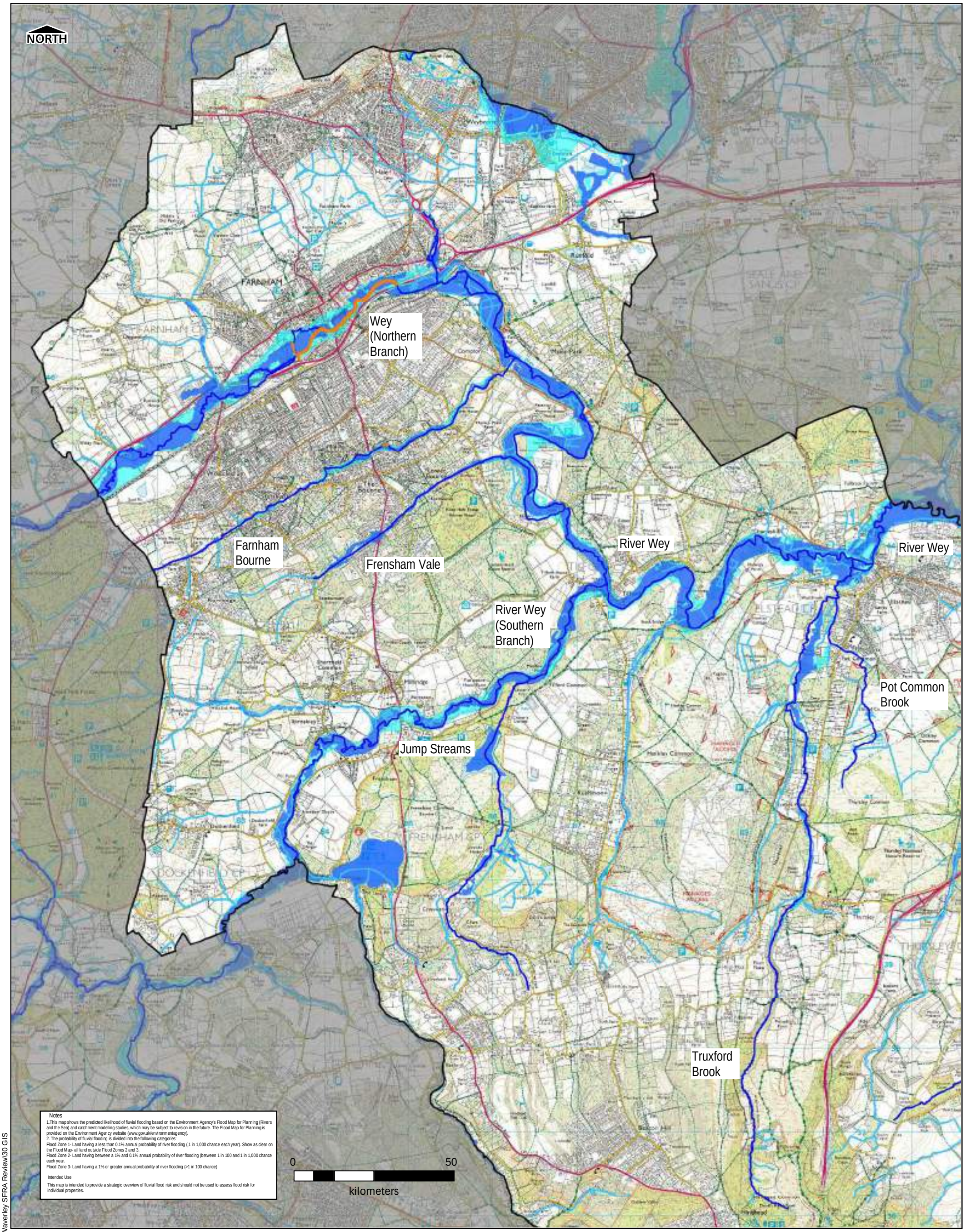

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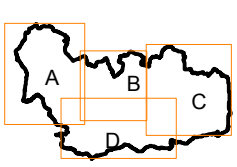
LEGEND

- Waverley Borough Boundary
- Flood Zone 2
- Flood Zone 3
- Flood Defences
- Main Rivers
- Ordinary Watercourses



Purpose of Issue

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Revision Details	By / Chk	Check Date	Suffix

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Approved SK	Date November 2018

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Project Title

Waverley Borough Council Level 1 Strategic Flood Risk Assessment

Client

Waverley

Drawing Title

Flood Map for Planning

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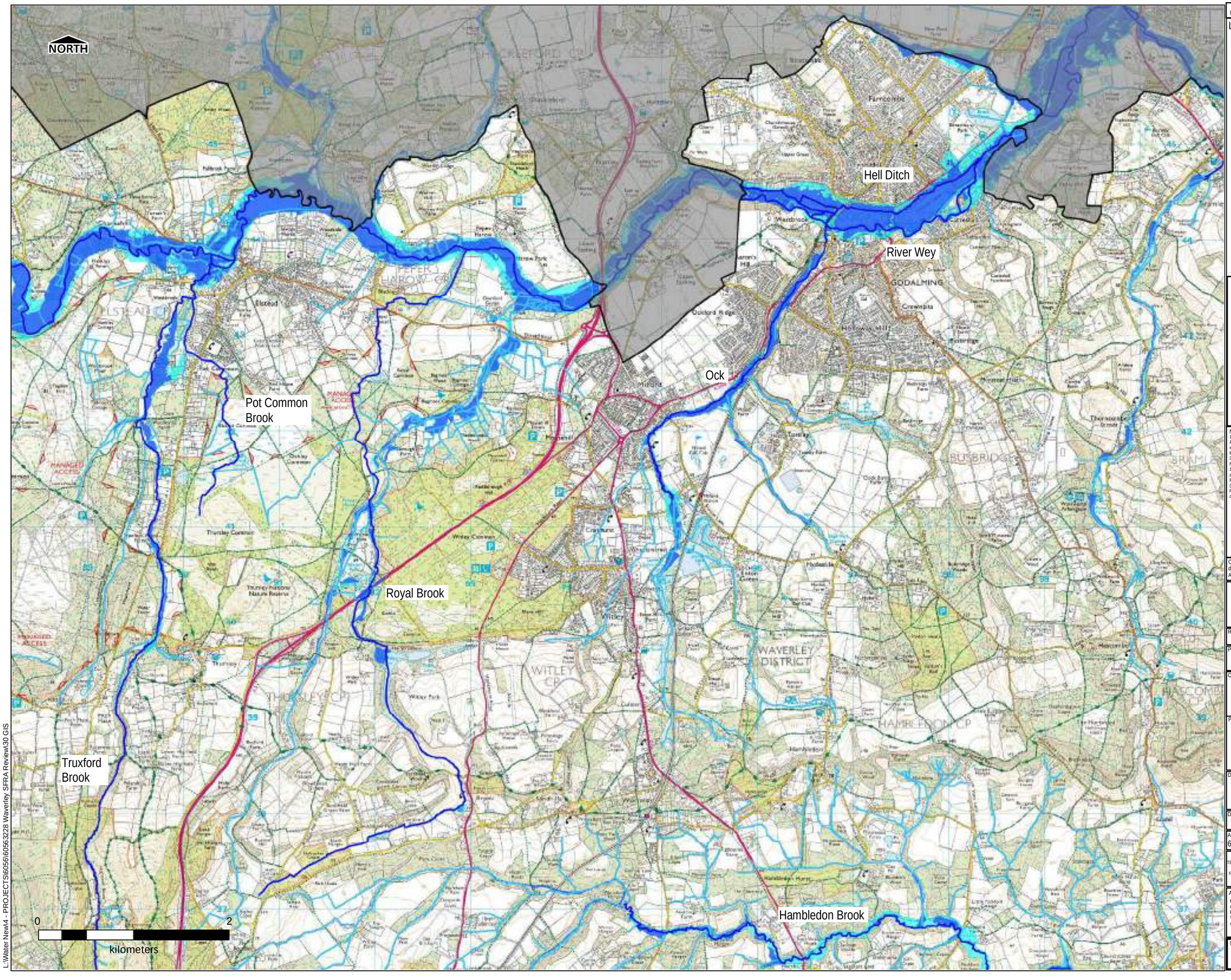
Drawing Number

FIGURE 2A

Rev

01



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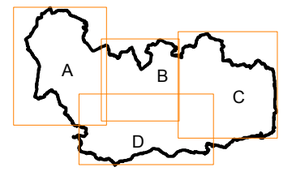
LEGEND

- Waverley Borough Boundary
- Main Rivers
- Ordinary Watercourses
- Flood Defences
- Flood Zone 2
- Flood Zone 3



Notes

1.This map shows the predicted likelihood of fluvial flooding based on the Environment Agency's Flood Map for Planning (Rivers and the Sea) and catchment modelling studies, which may be subject to revision in the future. The Flood Map for Planning is provided on the Environment Agency website (www.gov.uk/environmentagency).

2. The probability of fluvial flooding is divided into the following categories:

Flood Zone 1- Land having a less than 0.1% annual probability of river flooding (.1 in 1,000 chance each year). Show as clear on the Flood Map- all land outside Flood Zones 2 and 3.

Flood Zone 2- Land having between a 1% and 0.1% annual probability of river flooding (between 1 in 100 and 1 in 1,000 chance each year.

Flood Zone 3- Land having a 1% or greater annual probability of river flooding (>1 in 100 chance)

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Revision Details			Suffix

Purpose of Issue: FINAL

Client: Waverley

Project Title: Waverley Borough Council Level 1 Strategic Flood Risk Assessment

Drawing Title: Flood Map for Planning

Drawn	Checked	Approved	Date
HB	SL	SK	October 2018

AECOM Internal Project No.	Scale at A3
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Figure 2B	01

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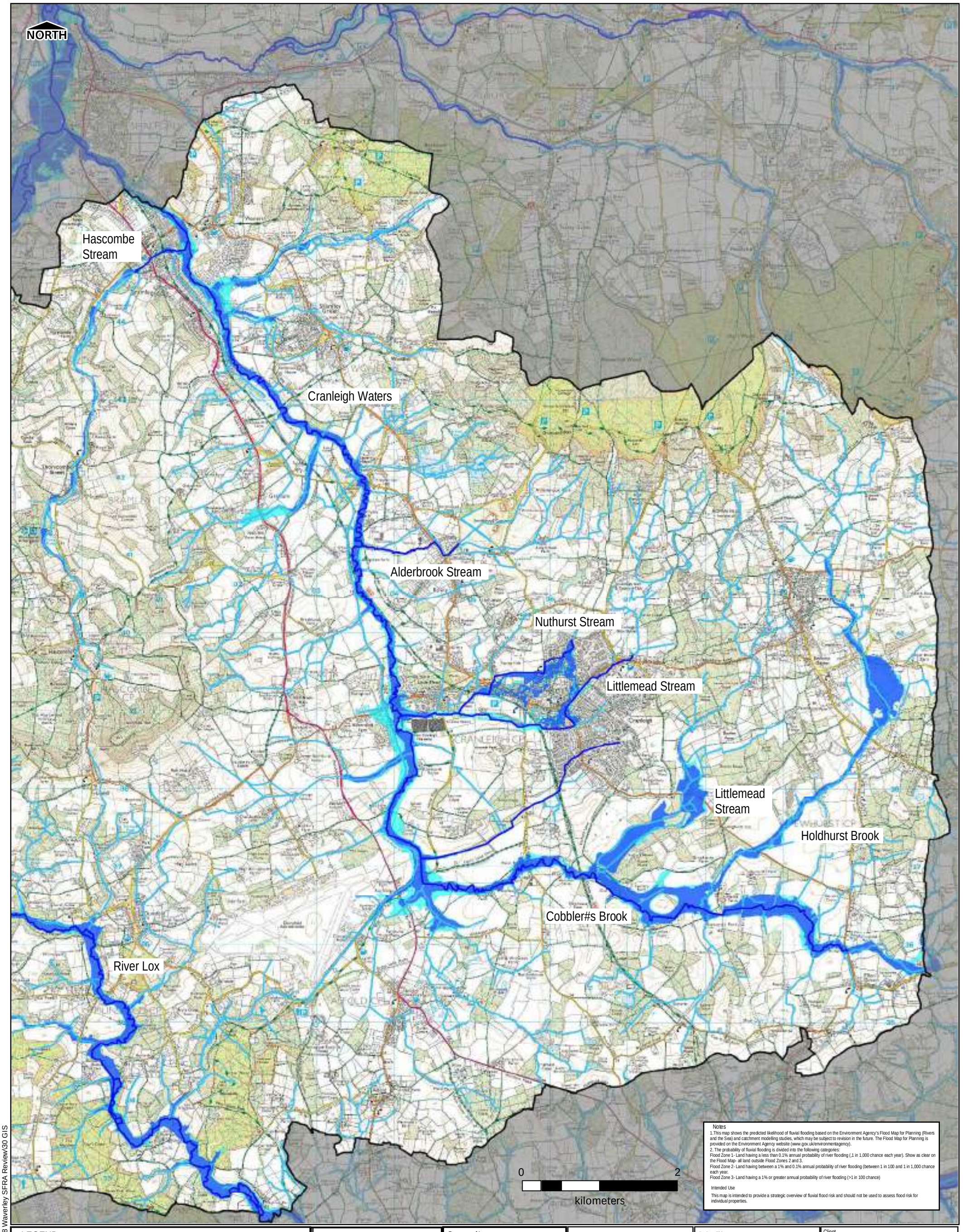
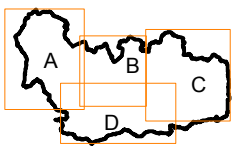


LEGEND

- Waverley Borough Boundary
- Flood Defences
- Flood Zone 2
- Main Rivers
- Flood Zone 3
- Ordinary Watercourses



Purpose of Issue

FINAL

Revision Details	By Chk	Check Date	Suffix

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Drawn	HB	Checked	SL
Approved	SK	Date	October 2018

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Project Title

Waverley Borough Council Level 1 Strategic Flood Risk Assessment

Client

Waverley

Drawing Title

Flood Map for Planning

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Drawing Number	Rev
FIGURE 2C	01

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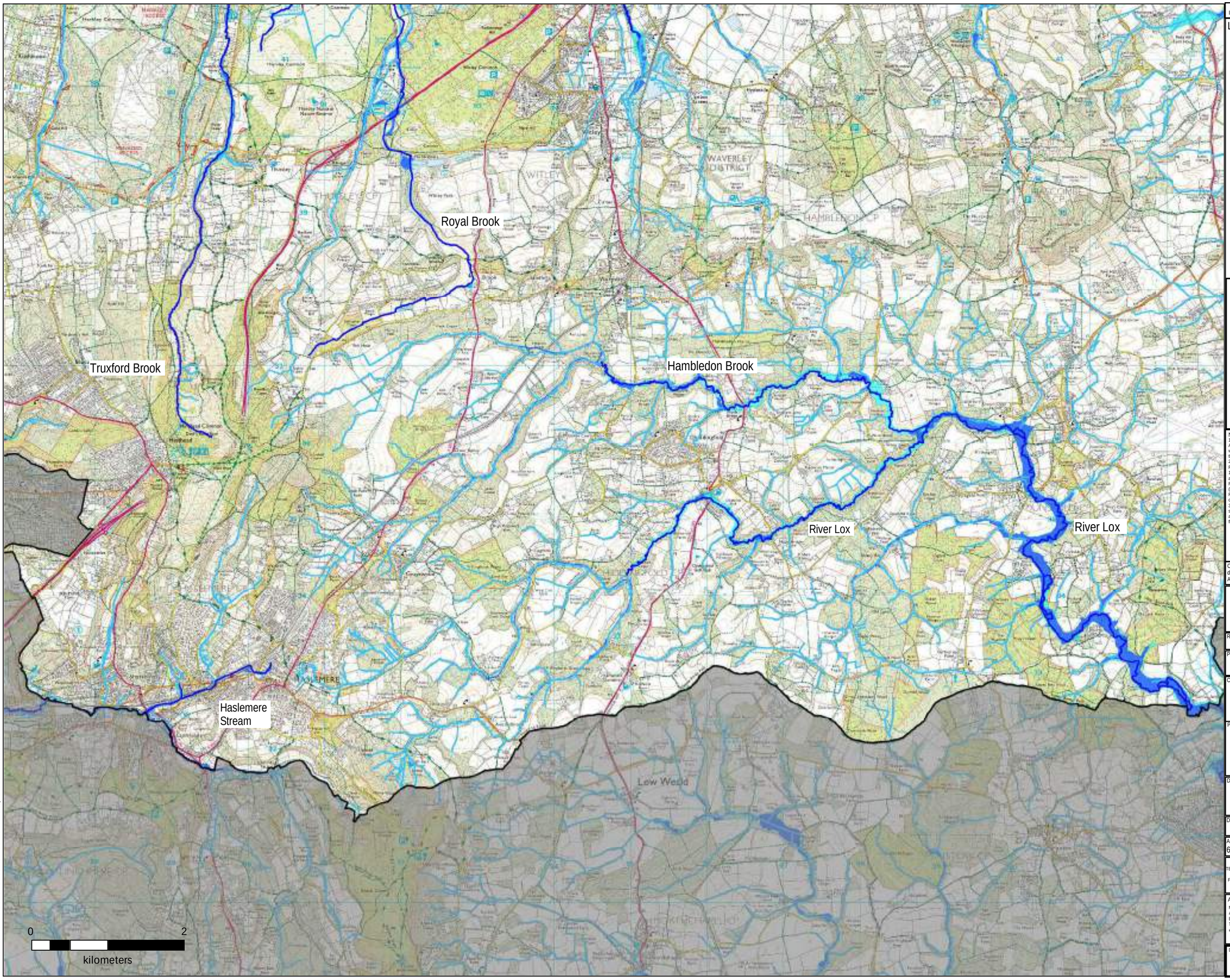

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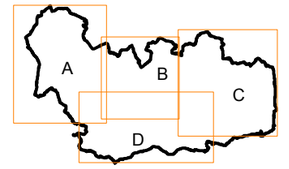
LEGEND

- Waverley Borough Boundary
- Main Rivers
- Ordinary Watercourses
- Flood Defences
- Flood Zone 2
- Flood Zone 3



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Flood Zone 2- Land having between a 1% and 0.1% annual probability of river flooding (between 1 in 100 and 1 in 1,000 chance each year.

Flood Zone 3- Land having a 1% or greater annual probability of river flooding (>1 in 100 chance)

3. Flood Zone 3b- Functional Floodplain is defined as land where water has to flow or be stored in times of flooding, or land purposely designed to flood in an extreme event (0.1% annual probability). For the purpose of this SFRA, land modelled to have a probability of flooding of 5% or greater has been used to identify functional floodplain.

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Revision Details			Suffix

Purpose of Issue: FINAL

Client: Waverley

Project Title: Waverley Borough Council Level 1 Strategic Flood Risk Assessment

Drawing Title: Flood Map for Planning

Drawn	Checked	Approved	Date
HB	SL	SK	October 2018

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Figure 2D	01

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