Flood and Water Management

Submitted to
Rushmoor Borough Council

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Rushmoor Borough Council Level 1 Strategic Flood Risk Assessment Update

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Table of Contents

List of Appendices

List of Tables

List of Figures

List of Acronyms

ACRONYM	DEFINITION
ABD	Areas Benefiting from Defences
AIMS	Asset Information Management System
AOD	Above Ordnance Datum
AStGWF	Areas Susceptible to Groundwater Flooding
BCA	Basingstoke Canal Authority
BGS	British Geological Survey
CFMP	Catchment Flood Management Plan
DCLG	Department for Communities and Local Government
Defra	Department for Environment, Flood and Rural Affairs
FMfSW	Flood Map for Surface Water
FRA	Flood Risk Assessment
FRMP	Flood Risk Management Plan
FSA	Flood Storage Area
FWD	Flood Warning Direct
FWEP	Flood Warning and Evacuation Plan
FWMA	Flood and Water Management Act 2010
GES	Good Ecological Status
HCC	Hampshire County Council
HFM	Historic Flood Map
IDB	Internal Drainage Board
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
LRF	Local Resilience Forum
NPPF	National Planning Policy Framework
PPG	Planning Practice Guidance
RBC	Rushmoor Borough Council

ACRONYM	DEFINITION
RBMP	River Basin Management Plan
SAB	SuDS Approving Body
SCC	Surrey County Council
SFRA	Strategic Flood Risk Assessment
SPD	Supplementary Planning Document
SPZ	Source Protection Zone
SuDS	Sustainable Drainage Systems
TWUL	Thames Water Utilities Limited
uFMfSW	Updated Flood Map for Surface Water
WFD	Water Framework Directive

1 Introduction

1.1 Overview

AECOM, formally URS Infrastructure and Environment UK Ltd ("URS"), has been commissioned to assist Rushmoor Borough Council (RBC) with the preparation of its Strategic Flood Risk Assessment (SFRA) Update.

A Level 1 SFRA was produced by Halcrow Group Limited (consultants for RBC) in 2008. Since then, a number of changes in planning policy have occurred. In addition to this, updated datasets have been made available, namely the Environment Agency's updated Flood Map for Surface Water (uFMfSW) and the British Geological Survey's (BGS) SuDS Infiltration Map. The decision was made within RBC to update the Level 1 SFRA to reflect these changes.

The relevant sections of the National Planning Policy Framework[1] (NPPF) and associated Planning Practice Guidance[2] (PPG) for Flood Risk and Coastal Change emphasise the active role Local Planning Authorities (LPAs) such as RBC should take to ensure that flood risk is understood and managed effectively and sustainably throughout all stages of the planning process.

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 overleaf, reproduced from the PPG, illustrates how flood risk should be taken into account in the preparation of the Local Plan for RBC.

The purpose of the Level 1 SFRA is to collate and analyse the most up to date flood risk information for use by RBC to inform the preparation of robust planning documents as part of the upcoming RBC Local Plan. The Level 1 SFRA will also support prudent decision-making by Development Management officers on a day-to-day basis and support the Sustainability Appraisal.

In order to achieve this, the Level 1 SFRA will be delivered to provide a robust flood risk evidence base, therefore allowing RBC to apply the Sequential Test in the allocation of future development sites within the Borough, as required by the NPPF, taking into account all sources of flooding. AECOM has prepared the SFRA in such a way that it will provide relevant and easily accessible information for applicants preparing site-specific flood risk assessments (FRAs), as well as provide guidance on the suitability of different types of Sustainable Drainage Systems (SuDS) throughout the Borough.

[1] Communities and Local Government (2012) National Planning Policy Framework http://www.communities.gov.uk/documents/planningandbuilding/pdf/2116950
[2] Communities and Local Government (2014) Planning Practice Guidance http://planningguidance.planningportal.gov.uk/

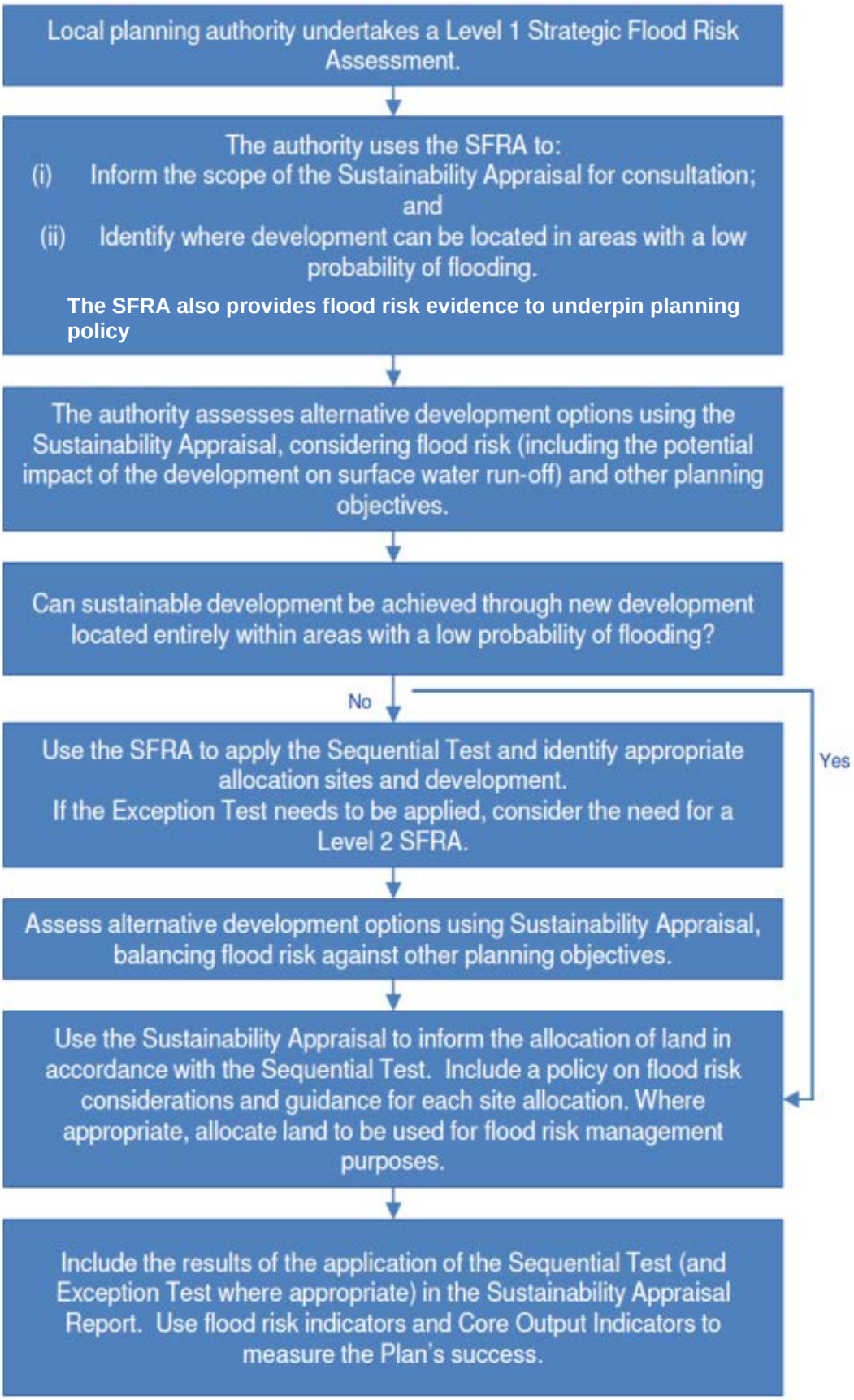

Figure 1.1 - Taking flood risk into account in the preparation of a Local Plan (Adapted from the Planning Practice Guidance for Flood Risk and Coastal Change, p6)

1.2 User Guide

It is anticipated that the 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 RBC SFRA report is set out as follows:

- Section 2: Policy and Local Context
- Section 3: SFRA Methodology
- Section 4: Strategic Assessment of Flood Risk
- Section 5: Flood Risk Management Policy Considerations
- Section 6: Guidance on the application of the Sequential and Exception Tests
- Section 7: Guidance for preparing Site Specific FRAs
- Section 8: Sustainable Drainage Systems
- Appendix A: Data Register
- Appendix B: Flood Risk Mapping

Section 4 provides a strategic assessment of flood risk from all sources within Rushmoor. The suite of figures included within Appendix B should be consulted for further information.

Section 5 outlines a number of flood risk management objectives and policy considerations which may be adopted by RBC as formal policies within the upcoming Local Plan.

RBC is required to carry out the Sequential Test when allocating future development sites as part of the Local Plan process. Section 6 provides detailed guidance on the application of the Sequential Test, including how it should be carried out by developers promoting development on Windfall sites. The strategic assessment of flood risk presented in Section 4 will inform the Sequential Test carried out by RBC.

It should be noted that this document is strategic in nature and only provides an overview of flood risk within Rushmoor. The document should be used as a starting point for developers and RBC's development management officers to gain an understanding of flood risk within the Borough. RBC should ensure that an appropriate site-specific assessment of flood risk is provided within a Flood Risk Assessment (FRA) accompanying all planning applications, where required by the NPPF, PPG and this Level 1 SFRA. Section 7 provides guidance for prospective developers and RBC on the contents of a site-specific FRA.

As discussed in Section 2, RBC will be required to oversee the use of SuDS for new development through enforcement of the planning process. Section 8 provides RBC, as well as developers, with an overview of the potential use of infiltration SuDS within Rushmoor. Whilst this potential should be confirmed at the site-specific level through appropriate investigations, the SuDS mapping will give RBC an indication of where constraints to such techniques may exist.

2 Policy and Local Context

2.1 National Policy

2.1.1 National Planning Policy Framework (2012)

The NPPF was published on 27th March 2012 together with accompanying Technical Guidance[3]. The NPPF revoked most of the previous Planning Policy Statements (PPS) and Planning Policy Guidance. However, the NPPF did not revoke the PPS25: Development and Flood Risk Practice Guide[4]. This was revoked on the 6th March 2014 along with the NPPF Technical Guidance, when it was replaced by the relevant section of the Planning Practice Guidance (PPG) on Flood Risk and Coastal Change.

The NPPF consists of a framework within which councils and local people can produce local and neighbourhood plans that reflect the needs and priorities of their communities.

The overall approach to flood risk is broadly summarised in NPPF Paragraph 103:

"*When determining planning applications, local planning authorities should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where, informed by a site-specific FRA following the Sequential Test, and if required the Exception Test, it can be demonstrated that:*

- *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, and*
- *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 by emergency planning; and it gives priority to the use of sustainable drainage systems."*

2.1.2 Planning Practice Guidance (2014)

The NPPF is supported by a series of Planning Practice Documents referred to as the Planning Practice Guidance. The PPG: Flood Risk and Coastal change document outlines how LPAs should use the SFRA, as follows:

- SFRAs should assess the flood risk to an area from all sources, both in the present day, and in the future. The impacts of climate change should be considered when assessing future flood risk;
- The impact on flood risk of future development and changes to land use should also be considered;
- The SFRA should provide the foundation from which to apply the Sequential and Exception Tests in the development allocation and development control process (see Flood Zone 1- Flood Zone 3b). Where decision-makers have been unable to allocate all proposed development and infrastructure in accordance with the Sequential Test, taking account of the flood vulnerability category of the intended use, it will be necessary to increase the scope of the SFRA (to a Level 2 SFRA) to provide the information necessary for application of the Exception Test;
- The SFRA should inform the sustainability appraisal of the Local Plan;
- The SFRA should outline requirements for site-specific FRAs, with specific requirements for particular locations;
- The SFRA should define the flood risk in relation to emergency planning's capacity to manage flooding;
- Opportunities to decrease the existing flood risk within the study areas should be explored, such as surface water management, provision of flood storage and managing conveyance of flood flows.

SFRAs should be prepared in consultation with the Environment Agency, emergency response and drainage authority functions of the LPA, Lead Local Flood Authorities (LLFAs) and where appropriate Internal Drainage Boards (IDBs).

[3] Communities and Local Government. (March 2012) Technical Guidance to the National Planning Policy Framework.
[4] Department for Communities and Local Government. 2009. Planning Policy Statement 25: Development and Flood Risk Practice Guide. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/7772/pps25guideupdate.pdf

2.1.3 The Flood and Water Management Act (2010)

Following the devastating national floods of 2007, one of the recommendations from Sir Michael Pitt's review[5] was that "*the role of local authorities should be enhanced so that they take on responsibility for leading the co-ordination of flood risk management in their areas*".

The Flood and Water Management Act (FWMA)[6] (2010) brings in new roles and responsibilities for local authorities. In particular, the Act defines the role of the LLFA, which includes Unitary Authorities or County Councils. Hampshire County Council (HCC) is the LLFA for Hampshire, which includes Rushmoor Borough. LLFAs are encouraged to bring together relevant bodies and stakeholders to effectively manage local flood risk, which may include County, City and District/Borough Councils, IDBs, highways authorities, water companies and the Environment Agency. Local flood risk is defined as the risk of flooding from surface water runoff, groundwater and small ditches and watercourses (collectively known as ordinary watercourses).

The Act also formalises the flood risk management roles and responsibilities for other organisations including the Environment Agency, water companies and highways authorities. The responsibility to lead and co-ordinate the management of tidal and fluvial flood risk remains that of the Environment Agency.

2.1.4 Amendments to policy on Sustainable Drainage Systems

Following a consultation by Defra on the delivery of SuDS[7] in 2014 the Department for Communities and Local Government (DCLG) issued a Written Statement[8] outlining the Government's response regarding the future of SuDS. This was followed by a consultation exercise carried out in December 2014[9] by DCLG on the proposal to make LLFAs statutory consultees for planning applications with regards to surface water management, and the Government published its formal response in March 2015[10]. The PPG has subsequently been amended to reflect the new approach to implementation of SuDS in development.

The proposed approach is to strengthen the planning system as a way of delivering SuDS, rather than implement Schedule 3 of the FWMA, as written, which would establish a new SuDS Approval Body (SAB) that would sit outside the existing planning system. This will be achieved principally by amending planning policy so that LPAs can give increased weight to the provision and maintenance of SuDS, alongside other material considerations, during the determination of a planning application.

From 6 April 2015 LPAs, including RBC, will be expected to ensure that local planning policies and decisions on planning applications relating to major development[11] include SuDS for the management of run-off, unless demonstrated to be inappropriate. Minor developments with drainage implications would continue to be subject to existing planning policy (Section 103 of the NPPF) and smaller developments in flood risk areas should still give priority to the use of SuDS.

The PPG has been amended to state:

"Sustainable drainage systems may not be practicable for some forms of development (for example, mineral extraction). New development should only be considered appropriate in areas at risk of flooding if priority has been given to the use of sustainable drainage systems. Additionally, and more widely, when considering major development, sustainable drainage systems should be provided unless demonstrated to be inappropriate."

LPAs, including RBC, should consult the relevant LLFA when considering major development. In considering planning applications RBC will need to:

- Consult HCC, as the LLFA, on the management of surface water for major development,
- Satisfy themselves that the proposed minimum standards of operation are appropriate, and
- Ensure through the use of planning conditions or planning obligations that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.

"Local planning authorities are also advised to consult as appropriate:

[5] Cabinet Office (2008) The Pitt Review - Learning Lessons from the 2007 Floods
[6] HMSO (2010) The Flood and Water Management Act
[7] Defra / DCLG (September 2014) Delivering Sustainable Drainage Systems: Consultation
[8] Department for Communities and Local Government (Dec 2014) House of Commons Written Statement (HCWS161) Sustainable Drainage Systems.
[9] DCLG (December 2014) Consultation on Further changes to statutory consultee arrangements for the planning application process
[10] DCLG (March 2015) Further changes to statutory consultee arrangements for the planning application process: Government response to consultation.
[11] The definition for Major and Minor developments are set out in the Town and Country Planning Order 2010

- *The relevant sewerage undertaker where a connection with a public sewer is proposed.*
- *The Environment Agency, if the drainage system directly or indirectly involves the discharge of water into a watercourse*
- *The relevant highway authority for an affected road*
- *The Canal and River Trust, if the drainage system may directly or indirectly involve the discharge of water into or under a waterway managed by them*
- *An Internal Drainage Board, if the drainage system may directly or indirectly involve the discharge of water into an ordinary watercourse (within the meaning of section 72 of the Land Drainage Act 1991) within the board's district."*

"The decision on whether a sustainable drainage system would be inappropriate in relation to a particular development proposal is a matter of judgement for the local planning authority. In making this judgement the local planning authority will seek advice from the relevant flood risk management bodies, principally the lead local flood authority."

HCC, as the LLFA, will become a statutory consultee for planning applications for major developments that have a drainage implication. As a statutory consultee, the LLFA will be under a duty to respond to the LPA and report on their performance on providing a substantive response within deadlines set out in legislation.

2.2 Local Policy

2.2.1 Rushmoor Borough Council Core Strategy (2011)

The RBC Core Strategy[12] provides the overarching strategy for planning policies in Rushmoor. The Core Strategy includes a number of policies relevant to flood risk and management, and water quality:

2.2.1.1 Policy CP1 – Sustainable Development Principles

Development will be permitted subject to:

- *"Including measures to address flooding and the risks from flooding, particularly close to the River Blackwater and Cove Brook;*
- *Protecting, and where opportunities arise, enhancing the quality of natural resources including water, air and soil, particularly water quality at the River Blackwater and Cove Brook."*

2.2.1.2 Policy CP4 - Surface Water Flooding

- *"All new buildings, and the development of car parking and hard standing, will incorporate SuDS with the aim of returning runoff rates and volumes back to the original greenfield discharge to prevent flooding and to ensure the quality of local water.*
- *Development in areas most at risk of surface water flooding will include mitigation measures to limit the amount of property damage caused.*
- *Details of proposed SuDS and how they will be maintained will be submitted as part of any planning application and will need to be agreed to the satisfaction of Rushmoor Borough Council or any other relevant approving Authority."*

The Core Strategy also recognises the impact of surface water flooding on water quality. Water quality issues within the River Blackwater and Cove Brook are acknowledged, with the low level of natural flow of the watercourses, large number of sewerage treatment works discharges and pollutants within surface water identified as the primary causes of these issues.

In October 2014 RBC took the decision to develop a new Local Plan to outline the overall spatial strategy for Rushmoor and, once adopted, the Local Plan will replace the Core Strategy. The Rushmoor Local Development Scheme[13] provides a programme for RBC's future planning documents, and states that the final Local Plan is scheduled to be adopted and published in late 2016.

All policies within the Core Strategy will be replaced by the Local Plan and this Level 1 SFRA Update will provide a robust evidence base to support relevant sections of the Local Plan.

[12] Rushmoor Borough Council (2011) Rushmoor Borough Council Core Strategy
[13] Rushmoor Borough Council (2014) Rushmoor Plan: Local Development Scheme

2.3 Additional Guidance and Strategy Documents

2.3.1 Thames Catchment Flood Management Plan

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 are due to be replaced by Flood Risk Management Plans (FRMPs) in 2015.

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. Awareness of the role of CFMPs among land-use planners is in its infancy at the time of this report.

The approach that the Environment Agency would like to see taken to flood risk management within Rushmoor is outlined in the Thames CFMP (2009).

The policies listed below are used to identify the appropriate approach to flood risk management across all CFMPs, and will continue to be used in the FRMPs:

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

The preferred policy for RBC in the CFMP is Policy 4 - Take further action to sustain the current level of flood risk into the future. The CFMP states that this policy is typically applied in areas where flood risk is assessed as being currently managed appropriately but where climate change is expected to increase the flood risk significantly in the future.

2.4 Study Area Overview

2.4.1 Location

Rushmoor is located in the very north-east of the County of Hampshire, approximately 30 miles south-west of London and is bordered by the administrative areas of Hart District Council, Surrey Heath Borough Council, Guildford Borough Council and Waverley Borough Council.

Rushmoor is a small borough with an area of approximately 3,900 hectares (ha) (39km^2). It is a highly urbanised borough with two major urban settlements; Farnborough in the north and Aldershot in the South. Farnborough Airport is a business airport located to the south-west of Farnborough. The majority of the west of the Borough comprises Ministry of Defence training land or conservation areas of local, national or international importance.

2.4.2 Topography

Figure B1 in Appendix B shows the topography of the study area. The south-west of the Borough lies at a maximum elevation of approximately 180m above ordnance datum (AOD). The Borough slopes relatively steeply to the east and north. The north of the Borough lies at a minimum elevation of approximately 60m AOD. Broadly, the south-west of the Borough drains towards the Basingstoke Canal, the north-west of the Borough drains towards Cove Brook, whereas the east of the Borough drains towards the River Blackwater.

2.4.3 Geology

The underlying geology can influence the presence and nature of groundwater in an area, and therefore the potential flood risk from groundwater. The geology can also impact on the potential for infiltration based drainage systems. The geology information has been obtained from the British Geological Survey and Environment Agency data. Appendix B Figures B7a and B7b show the underlying geology within RBC.

The bedrock geology of RBC consists of a number of different formations. The northern two-thirds of the Borough comprise Camberley Sand Formation and Windlesham Formation consisting of sand silt and clay. The majority of Farnborough is underlain by Camberley Sand Formation.

The southern third of the Borough is underlain by a succession of formations which run approximately from west to east consisting of Windlesham Formation, Swinley Clay Member, Bagshot Formation comprising sand and London Clay Formation in the very south-east of the Borough.

Superficial deposits are dispersed throughout the Borough. Sections of Alluvium are found in corridors following the paths of Cove Brook and the River Blackwater. River Terrace Deposits are also present along the River Blackwater and adjacent areas, as well as an area of South Farnborough. Isolated sections of Head are dispersed across the Borough. The BGS states that Head deposits in Rushmoor were formed through the accumulation of material as a result of down-slope movements such as landslides, hill wash and debris flow. The majority of Head deposits in Rushmoor consist of sand and gravel, with the exception of deposits in an area north of the Basingstoke Canal in St Mark's ward.

Superficial deposits are also absent in large sections of the Borough.

2.4.4 Hydrogeology

The majority of the Borough is designated by the Environment Agency as a Secondary A Aquifer associated with the bedrock geology. The south of the Borough, covering the south of Aldershot, does not have an aquifer designation. The majority of the superficial deposits are classified as Secondary A Aquifer, with the exception of areas of Head deposits which are defined as Secondary (undifferentiated) Aquifer.

Aquifer designation relates to the importance of aquifers as groundwater resources such as drinking water supply, as well as for supporting surface water flow[14]. The use of infiltration techniques will be dependent on the ground and groundwater conditions. However, other SuDS techniques may be suitable even if groundwater conditions preclude infiltration.

The Environment Agency provides the following definitions for the Aquifer Designations:

- "Principal Aquifer - layers of rock or drift deposits that…usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer;
- Secondary A Aquifer - permeable layers 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. These are generally aquifers formerly classified as minor aquifers;
- Secondary B Aquifer - predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers;
- Undifferentiated Strata - has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type."

Factors that will influence the vulnerability of an aquifer to contamination include whether the aquifer is classed as confined or unconfined; the depth of the aquifer; whether a pathway exists to the aquifer i.e. if impermeable layers lie above an aquifer; and the soil vulnerability.

Some strata have a high leaching potential and have very little ability to slow or halt the progress of contaminants and transmit them readily to the underlying aquifer. Other strata have a low leaching potential and are thus either impermeable or have a number of natural factors that can slow or stop the leaching of contaminants. Principal Aquifers with a high vulnerability tend to be those with a more permeable surface geology.

It is important to note that Aquifer Designation mapping is intended to be used at a strategic scale and further site-level investigation may be necessary.

2.4.5 Waterbodies

The hydrology of Rushmoor is dominated by the Blackwater River and its tributary Cove Brook. The River Blackwater flows eastward along the majority of the southern border before flowing roughly northwards along the entirety of the eastern boundary of the Borough. The majority of the northern half of the Borough drains into the Blackwater River via the

[14] Environment Agency (2015) Aquifer Designation Maps. http://apps.environment-agency.gov.uk/wiyby/117020.aspx

Cove Brook which flows approximately in a northwards direction to its confluence with the Blackwater River at the very north of Rushmoor. Marrow Brook, Hawley Lake Stream and Iveley Brook, all tributaries of Cove Brook, are also designated as Main Rivers.

2.4.6 Canals

In addition to the natural watercourses described, the Basingstoke Canal also runs across the Borough in a roughly east-west direction. The Environment Agency's Detailed River Network (DRN) indicates that a number of ordinary watercourses in the south-west of Rushmoor drain into the Basingstoke Canal. The canal flows over the A331, located in the east of the Borough, along an aqueduct bridge.

2.4.7 Water Quality

Discussion with the Environment Agency at the Level 1 SFRA Update project inception meeting emphasised statements included within the RBC Core Strategy that water quality in the Blackwater River and Cove Brook is an issue in Rushmoor. Whilst water quality is not a flood risk issue, flood risk management, particularly surface water management, can have additional benefits with regards to improving water quality as well as mitigating flood risk. The Environment Agency supplied Water Framework Directive (WFD) Investigation Reports for Cove Brook and the Blackwater River; the two primary watercourses located in Rushmoor. The reports outline the key pollution pressures placed on the watercourses.

The Environment Agency website provides information on the current condition of key waterbodies within the UK, as required by the WFD[15]. The chemical quality status obtainable by a watercourse is either 'Good' or 'Fail' and the ecological quality status obtainable ranges from 'High' to 'Bad'. The target for all watercourses should be to achieve at least 'Good' chemical and ecological status.

The WFD established a framework for the protection and improvement of inland surface waters (rivers and lakes), transitional waters (estuaries), coastal waters and groundwater. As set out in the WFD development must not result in the deterioration of the water quality status of a waterbody and must not prevent the future attainment of WFD Good Ecological Status (GES) or, in the case of artificial or heavily modified waterbodies, Good Ecological Potential. SuDS, in addition to their role in flood risk management, also have a key role in treatment of surface water runoff and therefore may contribute towards the attainment of GES.

The Thames River Basin Management Plan (RBMP)[16] defined a list of measures, relating to water quality, required for each WFD waterbody within Rushmoor. The Environment Agency requires all development proposing works to watercourses to request the relevant list of RBMP measures when formulating a FRA to ensure that proposed development is acceptable in relation to WFD requirements. The Environment Agency can be contacted on WTenquiries@environment-agency.gov.uk.

2.4.7.1 Cove Brook

The Environment Agency website[17] indicates that Cove Brook is currently achieving good chemical status and moderate ecological status. The Environment Agency WFD Investigation Report for Cove Brook[18] indicates that at the time of writing, the biological status of the watercourse was poor, and low dissolved oxygen concentrations were reported. The report states that the key pressure on water quality in the Cove Brook is low flow. However other potential pollution issues are also reported as follows:

- Permitted discharges;
- Urban run-off and potential sewer misconnections, particularly where culverted watercourses bisect foul and surface water sewers;
- Diffuse pollution incidents;
- Run-off from Farnborough Airport; and
- Blackwater River

In addition to the pressures noted in the report, sewer flooding may also impact on water quality within Cove Brook. Records of previous sewer flooding as presented in Figures B6a and B6b in Appendix B.

[15] Commission of the European Communities (2000) Directive 2000/60/EC 'The Water Framework Directive'
[16] Environment Agency (2009) Thames River Basin Management Plan
[17] Environment Agency (2015) Water Framework Directive - River Basin Management Plans - Rivers http://maps.environment-agency.gov.uk/wiyby/wiybyController?lang=_e&topic=wfd_rivers&layer=default&ep=map&layerGroups=default&scale=11&x=484653&y=155969#x=486885&y=154083&lg=1,7,8,9,&scale=6. Accessed 27/01/15
[18] Environment Agency (2012) Water Framework Directive Investigation Report: Cover Brook

2.4.7.2 Blackwater River

The Environment Agency website indicates that the Blackwater River is currently achieving good chemical status. The watercourse is classified as a heavily modified waterbody due to it being modified for a particular use such as water supply, flood protection, navigation or urban infrastructure.

According to the Thames RBMP, by definition, artificial and heavily modified waterbodies are not able to achieve the same condition as natural waterbodies and therefore the Blackwater River is defined as having moderate ecological potential. The Environment Agency WFD Investigation Report for the section of Blackwater River flowing through Rushmoor[19] indicates that the watercourse has experienced a long-term failure to reach good status in relation to ammonia and dissolved oxygen concentrations. The report indicates that sewage treatment works at Aldershot Town, and to a lesser extent, Camp Farm and Ash Vale, are likely to have the greatest impact on ammonia levels in the Blackwater River. However other potential pollution issues are also reported including:

- Low summer flows;
- Tributaries of the Blackwater River may be contaminated with urban run-off and misconnections between surface water and foul water sewers;
- Historic waste sites and industrial areas;
- Diffuse pollution incidents; and
- Permitted discharges.

In addition to the above pressures noted in the report, sewer flooding may also impact on water quality within the Blackwater River. Records of previous sewer flooding as presented in Figures B6a and B6b in Appendix B.

2.4.7.3 Basingstoke Canal

The Basingstoke Canal is designated as an artificial waterbody under the WFD. The Environment Agency website indicates that the Basingstoke Canal is defined as having moderate ecological potential. The chemical quality of the waterbody does not require assessment due to its artificial status. The canal is defined as a Site of Special Scientific Interest (SSSI) and is particularly sensitive with regards to water quality. Any development discharging into the Basingstoke Canal would be expected to ensure that water is of sufficient quality, through employment of SuDS treatment. It is important to note that the Basingstoke Canal also represents a water quality pressure on other watercourses into which it connects.

2.4.7.4 Mytchett Lake and Fleet Pond

Mytchett Lake and Fleet Pond, both designated as large reservoirs under the Reservoirs Act 1975[20], are located within 1km of Rushmoor. Mytchett Lake is designated as an artificial waterbody with good ecological potential whereas Fleet Pond is designated as a heavily modified waterbody with moderate ecological potential. Analysis of local topography indicates that surface water runoff from development within RBC is unlikely to drain towards the two waterbodies.

[19] Environment Agency (2012) Water Framework Directive Investigation Report: Blackwater (Aldershot to Cove Brook confluence at Hawley)
[20] HMSO (1975) The Reservoirs Act

3 SFRA Methodology

3.1 Level 1 SFRA Methodology

The Level 1 SFRA is a desk-based study, using readily available existing information and datasets to enable the application of the Sequential Test and to identify where the Exception Test may be required. The main tasks in preparing the Level 1 SFRA are described below.

3.1.1 Establishing relationships and understanding the planning context

An inception meeting was held to facilitate relationships between the project team, RBC, HCC (LLFA) and the Environment Agency to aid collaborative working and the free exchange of available information and datasets. RBC provided an overview of the current planning context with respect to the preparation of the Local Plan and the main flood risk issues in the area were identified and discussed.

3.1.2 Gathering data and analysing it for suitability

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

In order to provide this assessment of all sources of flooding in Rushmoor, an extensive set of datasets was obtained from the stakeholder organisations. This information was subject to a quality review and gap analysis by the project team to determine the best datasets for inclusion in the Level 1 SFRA update. Further details of the datasets are included in Section 4 and within the data register in Appendix A.

3.1.3 Producing strategic flood risk maps, GIS deliverables and a technical report

A series of GIS maps were produced using the data gathered during the initial part of the study. The mapping deliverables are identified in Table 3.1.

Table 3.1 Strategic Flood Risk Maps

Figure Number	Figure Title
B1	Topography
B2	Surface Waterbodies
B3	Historic Flood Events
B4	Fluvial Flood Zones
B5	Updated Flood Map for Surface Water
B6a	Internal Sewer Flooding
B6b	External Sewer Flooding
B7a	Bedrock Geology
B7b	Superficial Geology
B7c	SuDS drainage potential – infiltration constraints summary
B7d	SuDS drainage potential – drainage summary
B7e	Areas Susceptible to Groundwater Flooding

3.1.4 Providing suitable guidance

Sections of this report provide specific guidance for RBC on policy considerations, the application of the Sequential Test, guidance on the preparation of site specific FRAs and guidance of the application of SuDS in the study area.

3.2 Need for a Level 2 SFRA

Following the application of the Sequential Test by RBC, there may be an insufficient number of suitably available sites for development within areas identified to be at low risk of flooding and it may become necessary to consider the application of the Exception Test. Where this is necessary, the scope of the SFRA may need to be widened to a Level 2 assessment.

The increased scope Level 2 SFRA will need to consider the detailed nature of the characteristics within a Flood Zone including flood probability, flood depth, flood velocity, rate of onset of flooding and the duration of flooding. This may require interrogation of 2D modelling and breach / overtopping analysis for certain locations.

The scope of a Level 2 SFRA cannot fully be determined until the Sequential Test has been undertaken by RBC on all possible site allocations.

4 Strategic Assessment of Flood Risk within Rushmoor

4.1 Introduction

This Section provides the strategic assessment of flood risk across Rushmoor from each of the sources of flooding outlined in the NPPF. For each source of flooding, the datasets used for the assessment are described, details of any historical incidents are provided, and where appropriate, the impact of climate change on the source of flooding is described. This Section should be read in conjunction with the mapping in Appendix B, with historic flooding records shown in Appendix B Figure B3.

4.2 Flooding from Rivers

The Environment Agency 'Detailed River Network' dataset has been used to identify watercourses in the study area and their designation (i.e. Main River or Ordinary Watercourse). The two major watercourses located within Rushmoor are the Blackwater River and Cove Brook.

4.2.1 Historic Records of Fluvial Flooding

The Environment Agency Historic Flood Map (HFM) and Recorded Flood Outlines datasets were obtained to support this Level 1 SFRA Update. The datasets provide outlines for two major fluvial events known to have impacted Rushmoor. The HFM outline is shown in Appendix B Figure B3.

4.2.1.1 September 1968

In September 1968 the channel capacities of the Blackwater River and Cove Brook were exceeded causing flooding of adjacent areas. Flooding of Aldershot is shown to have been minimal with the HFM indicating flooding to have impacted on the very north-east of the town, along Brookfield Road and Green Way.

Adjacent to Farnborough, the area where the A331 is now located is indicated to have experienced extensive flooding, however the rail line running approximately north-south on the eastern boundary appears to have largely restricted the westward flow of flood waters. However flood waters are shown to have extended to an area to the north of King George's Field.

Flooding of Farnborough is shown to have been more extensive as a result of overtopping of Cove Brook with large areas of land within the flood extent.

4.2.1.2 February 1990

In February 1990 the Blackwater River overtopped its banks, causing flooding to the south of Aldershot. However the Environment Agency's HFM indicates that flooding within Rushmoor itself was minimal.

4.2.1.3 Additional Flood Records

The Environment Agency provided records of historic flooding recorded in the period 2006-2014. Approximately 50 records are identified as having a fluvial source, with some internal property flooding as well as flooding of gardens. Whilst a number of flood incidents are recorded to have occurred in Aldershot, associated with the Blackwater River, the majority of incidents occurred in Farnborough as a result of Cove Brook, or its major tributaries Hawley Lake Stream, Marrow Brook and Iveley Brook flowing out of bank. Most of the recorded flood incidents occurred in July 2007, however one incident was recorded in 2009 and two in 2014.

Approximately 50 records of internal flooding in 2006 were recorded; however the source of the flooding is unknown. The flood incidents occurred primarily in the very south of Aldershot, in proximity to the Blackwater River. However a number of records were also recorded in central Aldershot and therefore it would not be appropriate to assume that the records are of a fluvial source.

RBC provided records of flooding experienced in July 2007, which were identified as having either a fluvial, surface water or sewer source. This provides an illustration of the difficulty in identifying one clear flood source during a particularly large storm event.

4.2.2 Flood Zone Maps

The risk of flooding is a function of the probability that a flood will occur and the consequence to the community or receptor as a direct result of flooding. The NPPF 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 4.1 and presented on the 'Flood Map for Planning (Rivers and Sea)' available on the Environment Agency website. These Flood Zones have also been presented in Figure B4 in Appendix B.

Table 4.1 Fluvial Flood Zones (extracted from the PPG, 2014)

Flood Zone	Fluvial Flood Zone Definition	Probability of Flooding
Flood Zone 1	Land having a less than a 0.1% Annual Exceedance Probability (AEP) (1 in 1,000 chance of flooding in any one year). Shown as clear on the Flood Map – all land outside Flood Zones 2 and 3.	Low
Flood Zone 2	Land having between a 1% AEP (1 in 100 chance of flooding in any one year) and 0.1% AEP.	Medium
Flood Zone 3a	Land having a 1% AEP or greater.	High
Flood Zone 3b	Land where water has to flow or be stored in times of flood, or land purposely designed to be flooded in an extreme flood event (0.1% AEP). The identification of the functional floodplain takes into account local circumstances but for the purposes of this SFRA, land modelled to flood during a 5% AEP (1 in 20 chance of flooding in any one year) or greater has been mapped.	Functional Floodplain

4.2.3 Flood Map for Planning (Rivers and Sea)

The 'Flood Map for Planning (Rivers and the Sea)' provides information on the areas that would flood if there were no flood defences or buildings in the "natural" floodplain. The 'Flood Map for Planning (Rivers and Sea)' dataset is available on the Environment Agency website[21] and is the main reference for planning purposes as it contains Flood Zones 1, 2 and 3a which are referred to in the NPPF and presented in Table 4.1.

The 'Flood Map for Planning (Rivers and Sea)' was first developed in 2004 using national generalised modelling (JFLOW) and is now routinely updated and revised using the results from the Environment Agency's programme of catchment studies, entailing topographic surveys and hydrological and/or hydraulic modelling as well as previous flood events.

It should be noted that a separate map is available on the Environment Agency website which is referred to as 'Risk of Flooding from Rivers and Sea'[22]. This map takes into account the presence of flood defences and so describes the actual chance of flooding, rather than the chance if there were no defences present. While flood defences reduce the level of risk they don't completely remove it as they can be overtopped or fail in extreme weather conditions, or if they are in poor condition. As a result the maps may show areas behind defences which still have some risk of flooding. This mapping has been made available by the Environment Agency as the primary method of communicating flood risk to members of the public, however for planning purposes the 'Flood Map for Planning (Rivers and the Sea)' and associated Flood Zones remains the primary source of information.

4.2.4 Hydraulic Modelling Studies

A hydraulic modelling study has been carried out for the Blackwater River[23]. The study was delivered by Peter Brett Associates in 2007 on behalf of the Environment Agency. The downstream extent of the model was the River Blackwater's confluence with the River Loddon. The model extends upstream to the source of the River Blackwater at Rowhill Copse Nature Reserve. Hydrodynamic modelling was carried out along the River Blackwater and Cove Brook as far upstream as Farnborough Airfield. Steady state modelling was also carried on sections of the main tributaries of Cove Brook; Hawley Lake Stream, Marrow Brook and Iveley Brook (referred to as Pyestock Stream in the modelling report).

[21] Environment Agency Flood Map for Planning (Rivers and Sea) http://apps.environment-agency.gov.uk/wiyby/37837.aspx
[22] Environment Agency 'Risk of Flooding from Rivers and Sea' http://watermaps.environment-agency.gov.uk/wiyby/wiyby.aspx?topic=floodmap#x=237038&y=161974&scale=1
[23] Peter Brett Associates (2007) River Blackwater Flood Study

It should be noted that the scope of the modelling study covers flooding associated with main rivers, and therefore ordinary watercourses that form tributaries to the main rivers are not included in the model. Modelling of ordinary watercourses available on the 'Flood Map for Planning (Rivers and Sea)' are likely be the result of the national generalised JFLOW modelling carried out by the Environment Agency and may need to be refined when determining the probability of flooding for an individual site and preparing a site-specific FRA.

4.3 Flood Zone 1

It should be noted that the majority of Rushmoor is located within Flood Zone 1, with only a very small area located in Flood Zone 3b and therefore future development should be steered towards Flood Zone 1, with only Water Compatible and Essential Infrastructure located within Flood Zone 3b.

Notable areas located in Flood Zone 2, 3a and 3b are identified in the following section.

4.4 Flood Zones 2 and 3

Areas where there are properties within Flood Zones 2 or 3 include:

- Southwood Golf Course and adjacent field to the south; this is the location of the Cove Brook Flood Storage Area (FSA), which is designed to store 95,000m^3 of water during flood events. The FSA is located to the west of Cove Brook, and an approximately 900m long earth embankment is present adjacent to the watercourse's eastern bank;
- Along both the Cove Brook, downstream of the FSA, and its tributary Hawley Lake Stream Flood Zone 3 is heavily constrained and therefore very little development is located within Flood Zone 3. However land along sections of Hawley Lake Stream are located within Flood Zone 3, including Sunnybank Road and Pinewood Park;
- Sections of southern Aldershot are located within Flood Zone 3, largely corresponding with Flood Zone 3b. Properties within Flood Zone 3 include Stovold's Way, Boxall's Lane, Sandown Crescent and south of Selbourne Avenue;
- Commercial properties in proximity to Eastern Road in the east of Aldershot;
- Numerous roads and properties within Farnborough are located within Flood Zone 2 associated with Cove Brook, particularly to the east of the watercourse in Westheath and Cherrywood wards. Properties adjacent to Hawley Lake Stream, a tributary of Cove Brook, are also located within Flood Zone 2;
- A number of streets are located within Flood Zone 2 associated with the River Blackwater, namely Hawley Lane and Frimley Business Park in Cherrywood ward, Newton Road and Fleming Close in Empress ward, Woburn Avenue and Chatsworth Road in Knellwood ward, an industrial area in proximity to Hollybush Lane, Brookfield Road, Eastern Road and North Lane in North Town ward and a relatively large area north of Aldershot Park.

4.4.1 Functional Floodplain (Flood Zone 3b)

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

The PPG states that the identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. However, land which would naturally flood during a 5% AEP or greater event, or is designed to flood (such as a flood attenuation scheme) in an extreme (0.1% AEP) flood, should provide a starting point for consideration and discussions to identify the functional floodplain.

The PPG states that *'areas which would naturally flood, but which are prevented from doing so by existing defences and infrastructure or solid buildings, will not normally be defined as functional floodplain'*. There may be opportunities to reinstate areas which can operate as functional floodplain through the use of previously developed land adjacent to watercourses to provide space for flood water to reduce the risk to new and existing development.

During the Level 1 SFRA Update inception meeting it was agreed that the 5% AEP defended outline provided by the River Blackwater Flood Study would be used to define Flood Zone 3b.

The PPG recognises the importance of pragmatic planning solutions that will not unnecessarily 'blight' areas of existing urban development. It may not be practical to refuse all future development within existing urban areas falling within land which would flood during a 5% AEP event, and therefore careful consideration must be given to future sustainability.

A review of the areas across Rushmoor that are at risk of flooding during a 5% AEP event was carried out. The area of the Cove Brook FSA is the most notable area at risk of flooding during such an event. Along the rest of Cove Brook and its main tributaries Flood Zone 3b is largely constrained within areas immediately adjacent to the watercourse, with the exception of small areas along Hawley Lake Stream and an area of greenfield land to the north of Kennels Lane in the west of the Borough.

Small sections along the River Blackwater, particularly in the very south of Aldershot, are at risk of flooding during a 5% AEP event, including sections of developed land.

4.4.2 Climate Change

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

Recommended national precautionary sensitivity ranges for peak rainfall intensity and peak river flow suitable for use in the planning system are derived from the Department for Environment, Food and Rural Affairs FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts, October 2006[24] and presented in Table 4.2. (These values are subject to change in accordance with data from UKCP09).

Table 4.2 Recommended national precautionary sensitivity ranges for peak rainfall intensity, peak river flow, offshore wind speed and wave height

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	+5%	+10%	+20%	+30%
Peak river flow	+10%	+20%		

As part of the River Blackwater hydraulic modelling study, simulations have been run for the 1% annual probability (1 in 100 year event) including the implications of climate change based on these allowances. It should be noted that whilst the modelling of the annual probability events to generate the NPPF Flood Zones (and Flood Map for Planning) do not account for the presence of flood defences, the simulations including an allowance for climate change do tend to include the presence of existing flood defences and therefore take account of the flood defence associated with the Cove Brook FSA.

The flood outline for the 1% AEP event including climate change has been mapped on Figure B4 in Appendix B.

It is clear that climate change will not markedly increase the extent of river flooding within most areas of the study area. However there are a limited number of areas where the extent of flooding is noticeably increased with climate change, including the Cove Brook FSA, as well as areas along the River Blackwater; Tongham Road, Chestnut Avenue and the industrial area around Ivy Road.

It is important to note that these areas, as well as those areas that are currently at risk of flooding, may be susceptible to more frequent, more severe flooding in future years. It is essential therefore that the development management process (influencing the design of future development within the Borough) carefully mitigates against the potential impact that climate change may have upon the risk of flooding to properties.

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

[24] This document has now been superseded by Environment Agency Adapting to Climate Change: Advice for flood and coastal erosion risk management authorities, July 2011, but the allowances are considered suitable for use in the planning system. Further information can be found on the Environment Agency standing advice pages here: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/296964/LIT_8496_5306da.pdf

have upon the Borough over the next 100 years, ensuring that future development is considered in light of the possible increases in flood risk over time. Unless noted, the development management recommendations set out in Section 5 apply to development in areas which are at risk of flooding in the present day, or areas which may be at risk of flooding in the future as a result of the effects of climate change. In relation to surface water management, development in all areas of the Borough must meet requirements for surface water management and SuDS as set out in the NPPF and PPG.

4.5 Flooding from Surface Water

Overland flow and surface water flooding typically arise following periods of intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems. It can run quickly off land and result in localised flooding. The PPG states that an SFRA should identify areas at risk from surface water flooding and drainage issues, taking account of the surface water flood risk published by the Environment Agency as well other available information.

HCC developed a SWMP for Rushmoor in 2011, which provided a detailed analysis of surface water flooding within the Borough. This SFRA has utilised information included within the SWMP to inform the strategic assessment of surface water flood risk in Rushmoor, along with other available datasets such as the uFMfSW which was developed after the SWMP.

4.5.1.1 Environment Agency updated Flood Map for Surface Water

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 probability events: 3.3% AEP (1 in 30 chance of flooding in any one year), 1% AEP and 0.1% AEP. The latest version of the mapping is referred to as the uFMfSW and the extents have been made available to RBC as GIS layers. This dataset is also available on the Environment Agency website, and is referred to as 'Risk of Flooding from Surface Water'.

The uFMfSW provides all relevant stakeholders, such as the Environment Agency, RBC, HCC and the public access to information on surface water flood risk which is consistent across England and Wales[25]. The modelling helps the Environment Agency take a strategic overview of flooding, and assists HCC (as the LLFA) in their duties relating to management of surface water flood risk. For the purposes of this SFRA, the mapping allows an improved understanding of areas within RBC administrative area which may have a surface water flood risk.

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

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

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

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

This dataset provides a picture of surface water flooding across the Borough, as set out in Figure B5, and identifies that incidents are widespread across most parts of the Borough. The following areas are shown to be at particular risk, although the following list is by no means exhaustive;

- Within Aldershot, ponding is shown to occur for all modelled events along the A323 (within Rowhill, Wellington, Manor Park and Aldershot Park wards) from its junction with the A325 in the west to its junction with the A331 in the east. Surface water flooding risk is shown to be highest in areas either side of the A323. Interrogation of the LiDAR for Rushmoor identifies this corridor of land as lying in a broad valley sloping eastwards towards the Blackwater River.

[25] Environment Agency (2013) 'What is the updated Flood Map for Surface Water?'

- To the south of this area, ponding is shown for all modelled events in a narrow corridor to the south of Kings Road, running adjacent to Rowhill Avenue and down to the south-east where the railway embankment appears to prevent the further flow of water.
- To the east of the railway embankment, ponding is shown in proximity of Boxall's Lane and the southern section of Lower Farnham Road in Manor Park ward.
- Surface water is also shown to pond in the east of Aldershot along and in proximity to North Lane (North Town ward) and to the north of Aldershot Park around Tongham Road (Aldershot Park ward).
- To the north-west of Aldershot, where the land use is predominantly greenfield, surface water is concentrated along the paths of ordinary watercourses in addition to ponding in a number of areas throughout Farnborough Airport.
- Within Farnborough, surface water ponding is shown in an area of predominantly commercial properties north of Meudon Avenue (Empress ward).
- A large area of surface water ponding is shown to the north of Farnborough Rugby's grounds and northwards towards the M3 motorway (Westheath and Cherrywood wards). Ponding also occurs on the northern side of the M3 (Farnhill ward).
- In west Farnborough surface water ponding is shown along Whetstone Road and other roads nearby (St John's ward).

The SWMP defined a number of surface water flooding 'hotspots' which were known to have flooded previously. The flooding hotspots show a relatively good correlation with areas indicated to be at risk of surface water flooding by the uFMfSW. The SWMP also highlights areas in southern Farnborough as key flood 'hotspots'; areas around Netley Street/Osbourne Road, Sycamore Road, Farnborough Road and Rectory Road. The description above is a summary of broad areas of surface water ponding. To gain a full understanding of the outputs of the uFMfSW, Figure B5 in Appendix B should be consulted.

4.5.1.2 Source Areas draining towards areas of surface water flood risk

A high level analysis, based on interrogation of the outputs of the uFMfSW and LiDAR for Rushmoor, was carried out to identify broad 'source areas' draining to areas identified as being at risk of surface water flooding. It should be noted that the analysis does not take account of the surface water sewer network which may not entirely follow the gradient of the land, but may have a significant impact on surface water flooding.

Interrogation of the LiDAR covering the south of Aldershot indicates that land as far north as Knolly's Road and Hospital Road and as far south as Heath End in Waverley District may represent source areas for the A323 and the Kings Road/Rowhill Avenue areas of surface water flood risk.

Developed land in Aldershot is predominantly located to the east of Farnborough Road (A325). Rainfall in largely undeveloped areas to the west may drain towards Aldershot, following the broad topography. Therefore the potential impact of any development of greenfield land on areas in Aldershot should be taken account of and, as per the NPPF, runoff would not be allowed to increase post-development. However as the land is already greenfield there would be little potential to reduce runoff rates thereby mitigating flood risk downstream.

Source areas for ponding in proximity to North Lane in the east of Aldershot are likely to lie immediately to the north and west of the area as the topography generally slopes towards the River Blackwater. Ponding is shown along South Atlantic Drive and Ordnance Road, and surface water may flow towards North Lane. However the railway embankment is shown to prevent water flowing eastward. It should be noted that the uFMfSW is unlikely to have taken account of any drainage associated with the rail line. Similarly the Basingstoke Canal is likely to restrict the flow of surface water from areas to the north of the canal.

Surface water may flow from Ash Road and Lower Farnham Road towards land located to the north of Aldershot Park.

Source areas for the ponding shown in proximity to Meudon Avenue in Farnborough are likely to be areas to the east of the A326 including Cedar, Oak and Rectory Road. Land to the east of Avenue Road slopes eastwards towards the River Blackwater and therefore is unlikely to be a source area. Water may flow southwards from land south of the rail line running to and from Farnborough Main railway station as well as northwards from Meudon Avenue. Interrogation of LiDAR indicates that surface water in this general area is likely to flow towards Marrow Brook and subsequently Cove Brook.

In west Farnborough, land south of Minley Road and north of the rail line adjacent to Fleet Road is likely to drain towards the area of Whetstone Road, as land slopes towards the ordinary watercourse located just to the north.

In Farnborough, land to the west of Farnborough Road broadly slopes towards Cove Brook to the west, with surface water likely to flow westward along roads towards Prospect Road. Ponding, though still present, is not as prevalent to the west of Cove Brook as water is likely to be conveyed northward in-channel, where capacity is available.

4.5.2 Climate Change

The uFMfSW does not include a specific scenario to determine the impact of climate change on the risk of surface water flooding. However a range of three annual probability events have been undertaken; 3.3% AEP, 1% AEP and 0.1% AEP and therefore it is considered appropriate to use the 0.1% AEP event as a substitute dataset to provide a worst case scenario and an indication of the implications of climate change.

Appendix B Figure B5 presents the uFMfSW mapping for Rushmoor.

4.5.3 Historic Records of Surface Water Flooding

The Environment Agency provided records of historic flooding recorded in the period 2006-2014. Approximately 100 records of surface water flooding were recorded in July 2007, coinciding with recorded incidents of a fluvial source also recorded by the Environment Agency. Incidents of both external and internal flooding were recorded, and are distributed across Aldershot and Farnborough. Inspection of the recorded surface water flooding incidents indicates a broad correlation with areas identified as being at risk of surface water flooding by the Environment Agency's uFMfSW.

HCC provided records of surface water flooding incidents, with approximately 50 records from 2006 and 10 from 2007. Again, the records show a relatively good correlation with the uFMfSW. However it should be noted that not all recorded flood incidents are located in areas shown to be at risk of surface water flooding in the uFMfSW or vice versa. Flood records for Rushmoor are relatively numerous; however it is likely that additional flood incidents have occurred and have not been reported for various reasons. Such incidents by their very nature are not shown in historic flood records.

RBC provided records of flooding experienced in July 2007, which were identified as having either a fluvial, surface water or sewer source. This provides an illustration of the difficulty in identifying one clear flood source during a particularly large storm event. Records of provision of sandbags by RBC in 2014 indicate that flooding incidents have occurred on a number of previous occasions in Rushmoor.

4.6 Flooding from Groundwater

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.

Figure B7e in Appendix B presents the Environment Agency's dataset: Areas Susceptible to Groundwater Flooding (AStGWF), which 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.

The mapping indicates that areas in proximity to the River Blackwater are shown to be more susceptible to groundwater flooding. However a broad area of the Borough is shown to have some susceptibility to groundwater flooding, though this is predominantly less than 25% of each 1km grid square. The exception to this is the north of the Borough, where a large proportion of Farnborough is not shown to be susceptible to groundwater flooding. However, as discussed below, the Environment Agency has recorded a number of groundwater flooding incidents within this area of Farnborough. This emphasises the broad nature of the AStGWF dataset.

4.6.1 Historic Records of Flooding

The Environment Agency provided records of groundwater flooding recorded between 2000 and 2005. The flood incidents predominantly relate to waterlogging due to poor drainage or a rising water table. None of the recorded incidents are indicated to have caused internal flooding to properties. Incidents are shown to have occurred in areas of underlying London Clay, Bagshot and Sand bedrock. Incidents in areas of London Clay are unlikely to be associated with groundwater flooding, unless caused by a perched water table. Instead, these incidents are more likely to be due to ponding caused by the low permeability of the underlying ground.

The incidents have been recorded in the south-west of Aldershot, within the Rowhill and Manor Park wards. Five incidents have also been recorded within Farnborough in St John's, Cove and Southwood, Westheath and Knellwood wards.

4.6.2 Aquifer Type

Aquifers are underground layers of water-bearing permeable rock or drift deposits from which groundwater can be extracted. The Environment Agency categorises aquifers as being principal aquifers, secondary aquifers and unproductive strata. Their definitions are as follows;

- Principal Aquifers: Highest intergranular and/or fracture permeability which allow water to flow through them providing large levels of water storage. They may support water supplies or river base flow on a strategic scale.
- Secondary Aquifers – types A, B or Undifferentiated:
    - A – Permeable layers which may support water supply and or base flow to rivers on a local scale; and
    - B – Lower permeability which may store and yield limited amounts of groundwater.
    - Undifferentiated – Not possible to attribute to either type A or B due to variable characteristics of the rock type.
- Unproductive strata: are characterised by low permeability with little ability to store or transmit groundwater.

Environment Agency datasets have been used to identify the presence of aquifers within Rushmoor.

The River Terrace Deposits within Rushmoor, located in corridors along the River Blackwater and Cove Brook, are designated as Secondary A aquifers, as are the majority of Head deposits south of the Basingstoke Canal. To the north of the Basingstoke Canal, the majority of the Head deposits are defined as Secondary (undifferentiated) aquifers.

With regards to bedrock geology, almost the entirety of the Borough is designated as Secondary A aquifer. The exception to this is a strip of Swinley Clay running through Aldershot, and the London Clay in the south of Aldershot both of which have no aquifer designation.

4.6.3 Source Protection Zone

The Environment Agency defines Source Protection Zones (SPZ) around all major public and private water supply abstractions in order to safeguard groundwater resources from potentially polluting activities. The Environment Agency records of smaller abstractions have not been reviewed at this stage. The data indicates that almost the entirety of Rushmoor is not located within a SPZ, with the exception of three small areas in the south and south-east of Aldershot identified as being within a SPZ Inner Zone, defined as being highly sensitive to contamination. The areas are associated with abstractions from the River Blackwater.

4.7 Flooding from Sewers

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

1. The rainfall event exceeds the capacity of the sewer system/drainage system:
    - Sewer systems are typically designed and constructed to accommodate rainfall events with a 3.3% 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 TWUL, as the sewerage undertaker for Rushmoor, 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.
2. The system becomes blocked by debris or sediment:
    - Over time there is potential that road gullies and drains become blocked from fallen leaves, build-up of sediment and debris (e.g. litter).
3. The system surcharges due to high water levels in receiving watercourses:
    - Within the study area there is potential for surface water outlets to become submerged due to high river levels. When this happens, water is unable to discharge. Once storage capacity within the sewer system itself is exceeded, the water will overflow into streets and potentially into houses. Where the local area is served by ‘combined’ sewers (i.e. containing both foul and storm water), if rainfall entering the sewer exceeds the capacity of the combined sewer and storm overflows are blocked by high water levels in receiving watercourses, surcharging and surface flooding may again occur but in this instance floodwaters will contain untreated sewage.

4.7.1 Historic Records of Flooding

TWUL has provided an extract from their DG5 Flood Register for the study area. Due to data protection requirements the data has not been provided at individual property level; rather the register comprises the number of properties within 4 digit postcode areas that have experienced flooding either internally or externally within the last 20 years.

TWUL DG5 flood records (Appendix B Figure B6a and B6b) show that internal and external sewer flooding of properties is concentrated in the north, north-east and south of the Borough, as expected due to the concentration of urban development. The south and south-east of Aldershot is shown to have the greatest number of recorded flooded properties, with at least 20 records of internal flooding in the past 20 years in two postcode areas. In the same two areas 31 and 17 incidents of external property flooding were recorded in the past 20 years.

Over 15 internal property flooding events have been recorded within an area surrounding Wellington Avenue in Aldershot. Within the same area 3 incidents of internal property flooding have been recorded.

Fewer incidents of internal flooding have been recorded within Farnborough, with 3 or fewer records in the majority of postcode areas. The exception is an area towards the south of Farnborough stretching approximately from Sycamore Road to the A3011 where 9 properties have experienced internal flooding in the last 20 years. No records of internal flooding exist within the areas of North Camp and Raftborough in Farnborough and Aldershot Camp in Aldershot. Of the two areas, only Raftborough in south-west Farnborough is recorded as experiencing external sewer flooding, with 3 records in the past 20 years.

In the broad areas of South Farnborough and Farnborough Park, approximately between the A3011 and the rail line running to and from Farnborough Main station, 15 and 12 properties respectively have experienced external flooding.

To the north-west and north-east of the rail line bisecting Farnborough, 7 and 4 properties are recorded as experiencing external sewer flooding.

It should be noted that records only appear on the DG5 register where they have been reported to TWUL, and as such they may not include all instances of sewer flooding. Furthermore given that TWUL target these areas for maintenance and improvements, areas that experienced flooding in the past may no longer be at greatest risk of flooding in the future.

4.8 Flooding from Reservoirs, Canals and other Artificial Sources

4.8.1 Reservoirs

4.8.1.1 Environment Agency Risk of Flooding from Reservoirs Mapping

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

The Environment Agency dataset 'Risk of Flooding from Reservoirs' identifies areas that could be flooded if a large reservoir[26], as defined in the Reservoirs Act, were to fail and release the water it holds. The mapping shows that the following reservoirs could result in flooding in Rushmoor:

- Hawley Lake
- Cove Brook FSA
- Mytchett Lake
- Fleet Pond
- Bourley Military No. 2

A relatively extensive area is shown to be at risk of flooding should Cove Brook FSA fail, with a large section of Westheath and south-west Cherrywood wards shown to be at risk. Areas to the east and north of the FSA, within Cove and Southwood wards and Ashbury Drive, as well as Ratcliffe Road to the north of the M3 motorway are also at risk.

The same areas are shown to be at risk as a result of a failure of Hawley Lake, with the areas of Fernhill and St John's wards also at risk.

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

The areas shown to be at risk of flooding as a result of a failure of Mytchett Lake extend from North Camp railway station in the south to the M3 motorway in the north. Flood waters are shown to be constrained by the presence of the railway line running approximately north-south, and therefore flooding within Rushmoor would not be extensive.

Two very small areas on the western boundary of Rushmoor are shown to be at risk of flooding associated with Fleet Pond and Bourley Military No. 2.

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

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

4.8.2 Canals

The Basingstoke Canal is maintained by the Basingstoke Canal Authority (BCA), which is a joint partnership between HCC and Surrey County Council (SCC). The BCA provided a copy of the public version of the Basingstoke Canal Emergency Plan[27] to support this SFRA. The Plan states that the Basingstoke Canal extends from Greywell, approximately 4km east of Basingstoke to the River Wey Navigation, close to Byfleet. The Hampshire section of the canal contains only one lock. The Basingstoke Canal crosses Rushmoor in an approximately east-west direction, with large sections located above the surrounding ground level.

The BCA state that where large rainfall events are predicted by weather forecasts, water can be let out of the canal system, thereby creating capacity to take in large amounts of water during heavy rainfall. In the unlikely event of a breach of the canal, it is possible to isolate sections of canal via a series of stop planks and gates.

The Basingstoke Canal Emergency Plan states that all earth embankments, locks and weirs undergo a safety inspection once every six weeks, or as required. Embankments identified as higher risk are inspected once every week. Overall the canal is monitored daily. Details provided by the BCA show the canal has a hierarchical inspection regime in line with existing national best practice. This includes detailed inspection of the main assets at set intervals. The BCA has an established Asset Management Plan in place. However it should be noted that the BCA has stated that all embankments are over 200 years old and not built to modern engineering standards. Therefore despite the current level of maintenance the residual risk of sudden catastrophic failure of the canal embankments remains.

The BCA has a flood management response in place in the event of an emergency and/or a severe weather warning.

4.8.2.1 Historic Records

Environment Agency historical flooding records compiled as part of the Blackwater Flood Study[28] indicate that the Basingstoke Canal breached in at least two locations in 1968, resulting in flooding in the Willow Park area towards the very east of the Borough and at Puckridge Hill north west of Aldershot. The 2008 SFRA delivered by Halcrow[29] states that the canal was semi-derelict at the time. It should be noted that the canal is currently well maintained and monitored by the BCA. The management of the canal is governed by an Asset Management Plan.

The BCA was contacted for information on any recorded breach or overtopping events within Rushmoor. The BCA states that it does not hold any such records, but is not aware of any breach events in Rushmoor since the BCA's inception in 1990. The last breach event occurred on the West Hart embankment close to Church Crookham approximately 2km west of Rushmoor.

4.9 Effect of Development on Flood Risk Elsewhere

RBC is beginning the preparation of its Local Plan, which will replace the existing Core Strategy, and at the time of writing this Level 1 SFRA Update RBC had not identified potential site allocations for future development within the Borough. It is therefore not possible to provide a specific assessment of the potential impact of development on flood risk.

However, it is noted that the majority of potential site allocations are likely to be brownfield sites and therefore, through appropriate planning policies, opportunities exist to mitigate existing flood risk, particularly that posed by surface water. By

[27] Hampshire County Council (2014) Basingstoke Canal Emergency Response Plan Volume 1
[28] Environment Agency (2002) Blackwater Flood Study)
[29] Halcrow (2008) Rushmoor Borough Council Level 1 Strategic Flood Risk Assessment

setting a policy requiring all development to aim to reduce run-off rates to greenfield rates, the surface water run-off rates and volumes leaving a development site may be reduced from the existing case, providing a level of downstream flood risk mitigation.

As outlined in the Thames CFMP, the preferred policy for the Rushmoor area is to take further actions to keep pace with climate change. As per guidance in the NPPF and PPG, surface water run-off must not be increased from the existing case, taking into account an allowance for climate change. Therefore new development may help to mitigate the impacts of climate change, which are predicted to include an increase in the intensity of future rainfall events.

Development on greenfield sites should be avoided wherever possible. Where such development is necessary, post-development run-off rates must not exceed greenfield rates for the lifetime of the development including an allowance for future climate change, as outlined in the NPPF and PPG.

4.10 Flood Risk Management Measures

Flood risk management can reduce the probability of occurrence through the management of land, river systems and flood defences, and reduce the impact through influencing development in flood risk areas, flood warning and emergency response.

4.10.1 Flood Risk Management Plan

A CFMP is a high-level strategic plan through which the Environment Agency seeks to work with other key decision-makers within a river catchment to identify and agree long-term policies for sustainable flood risk management.

The Thames CFMP covers the Rushmoor area and identifies different policies for different ‘sub-areas’ of the River Thames catchment. These policies are considered using a catchment approach rather than for independent sub-areas. The administrative area of Rushmoor falls within the Upper and Middle Blackwater policy unit and the Thames CFMP sets the following policy option for the policy unit: “*Policy Option 4 - Take further action to sustain the current level of flood risk into the future (responding to the potential increases in risk from urban development, land use change and climate change.”* The CFMP also identifies surface water as being a major source of flooding within the policy unit.

The general approach to be taken is to accept the existing risk but take action to ensure that risk is not increased from the current level, for example due to the potential impacts of climate change. The CFMP outlines key messages for the Upper and Middle Blackwater policy unit:

- Regeneration and re-development can be used to reduce flood risk, for example through surface water run-off management and naturalising the river channel;
- Opportunities to de-culvert sections of watercourse should be looked at;
- Development should be moved out of the floodplain where possible and should not result in loss of floodplain storage;
- Flood proofing should be considered at the planning stage of new developments, as well as for existing properties;
- Surface water runoff should be reduced to greenfield runoff rates wherever possible.

4.10.2 Flood Defences

Flood defences are structures which affect flow in times of flooding and therefore reduce the risk of water from entering property. They generally fall into one of two categories; 'formal' or 'informal'.

A 'formal' flood defence is a structure which has been specifically built to control floodwater. It is maintained by its owner or statutory undertaker so that it remains in the necessary condition to function. In accordance with the FWMA, the Environment Agency has powers to construct and maintain defences to help protect against flooding. HCC has similar powers on ordinary watercourses within Rushmoor.

An 'informal' defence is a structure that has not necessarily been built to control floodwater and is not maintained for this purpose. This includes road and rail embankments and other linear infrastructure (buildings and boundary walls) which may act as water retaining structures or create enclosures to form flood storage areas in addition to their primary function.

A study of informal flood defences has not been made as part of this assessment. Should any changes be planned in the vicinity of road or railway crossings over rivers in the study area it would be necessary to assess the potential impact on flood risk to ensure that flooding is not made worse either upstream or downstream. Smaller scale informal flood defences should be identified as part of site specific FRAs and the residual risk of their failure assessed.

The Environment Agency stated that it owns only one asset within Rushmoor; Cove Brook FSA, which has a volume of approximately 95,000m^3. The scheme entails an associated earth embankment, approximately 900m long, which is located on the eastern bank of Cove Brook. At the north-eastern end of the embankment there are concrete reinforcing embankments approximately 2.5m high and 1m wide, with a concrete flume flow control.

4.10.3 Residual Risk

In producing Flood Zone maps the Environment Agency takes the presence of defences into account by showing the areas that benefit from the defence (ABD). This area can also be deemed an area which is at risk of defence overtopping or failure. It can therefore also be described as a residual risk zone. Residual flood risks can arise due to:

- The failure of flood management infrastructure such as a breach of a raised flood defence, blockage of a surface water conveyance system or culvert, overtopping of an upstream storage area, or failure of a pumped drainage system;
- A severe flood event that exceeds a flood management design standard and results in, for example, overtopping.

There are no areas located with Rushmoor identified as ABDs. The residual risk as a result of failure of the Cove Brook FSA is discussed in the flood risk from reservoirs section of this SFRA (Section 4.8.1). It should be noted that the FSA is designed to store water only during large storm events and does not ordinarily hold significant volumes of water.

There is a residual risk of overtopping or breach of the Basingstoke Canal. The area at risk from these events is discussed in Section 4.8.2. Although the risk of failure is small, the potential for a large volume of water to be released quickly means that the hazard downstream of these structures is high. Where possible, development should therefore be avoided immediately behind raised embankments of the canal where a breach could occur. Where no other development sites are available a detailed breach and overtopping analysis will be necessary to determine the flood hazard and inundation area, and this should be included in the scope of the Level 2 SFRA. Until such an assessment is carried out, it is recommended that a breach assessment be carried out as part of a site-specific FRA to support any planning applications for sites immediately behind raised embankments of the canal.

The Level 1 SFRA produced in 2008 identified a number of potential escape routes, based on a study of the local roads that may be used in the event of a breach of the Basingstoke Canal. The escape routes have been assessed against existing topographical data, and reproduced in Figure 4.1, below.

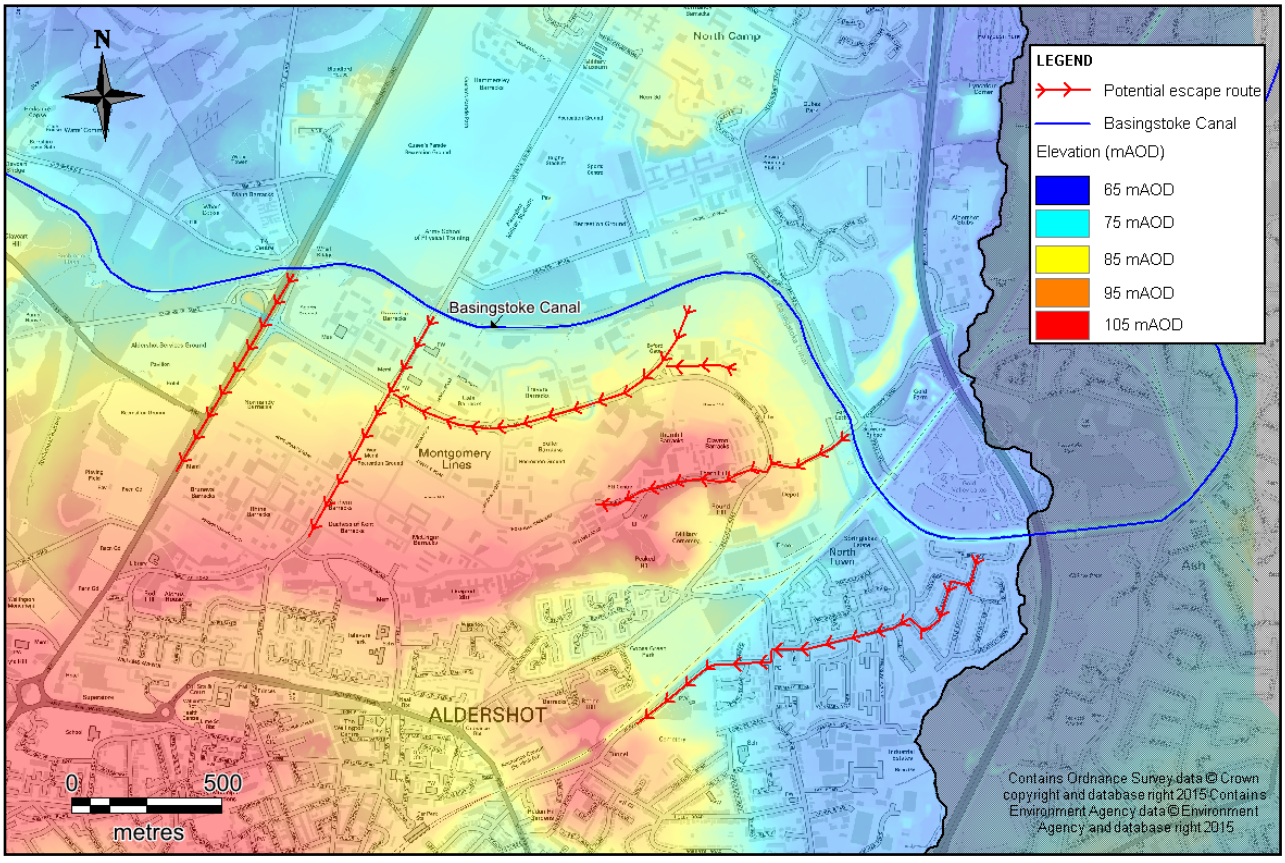

Figure 4.1: Potential escape routes in the event of a breach of the Basingstoke Canal

It must be noted that the escape routes shown in Figure 4.1 are based on a very high-level assessment. It is recommended that the routes should be amended, where necessary, following a more detailed assessment of various potential canal breach scenarios to ensure that the routes remain appropriate and safe.

The Cove Brook FSA and culverted sections of watercourse are mapped in Figure B2 in Appendix B. These should be referenced by those proposing development to identify the possibility of localised residual risks as well as opportunities for de-culverting and restoring the natural channel.

4.10.4 Flood Warning Systems

The Environment Agency provides a free flood warning service for many areas at risk of flooding from rivers and the sea. In some parts of England the Environment Agency may be able to provide warnings when flooding from groundwater is possible. The Environment Agency free flood warning service can provide advance notice of flooding and can provide time to prepare for a potential flood event.

The Environment Agency issue flood warnings to homes and businesses when flooding to properties is expected. Upon receipt of a flood warning, occupants should take immediate action.

The Environment Agency also issue flood alerts when flooding to low lying land and roads is expected. Flood alerts cover larger areas than flood warnings and are issued more frequently. Upon receipt of an alert, occupants should be prepared for flooding and to take action.

Flood warnings and flood alerts are signed up to separately, however when signing up for flood warnings homes and businesses must agree to receive flood alerts.

If a flood alert from groundwater is available this does not mean that a particular property is definitely at risk. It is very difficult to predict the exact location of flooding from groundwater as it is often related to local geology. To help people, the Environment Agency provides flood alerts for large areas that could be affected if groundwater levels were high.

Flood alert and flood warning areas can be viewed on the Environment Agency website (http://apps.environment-agency.gov.uk/wiyby/37835.aspx) and were made available as GIS layers to support this Level 1 SFRA Update. There is one flood alert area and three flood warning areas within the Borough. All stages of warning are disseminated via Floodline Warnings Direct (FWD), which is a free service that provides warnings to registered customers by telephone, mobile, email, SMS text message and fax.

Further information on Flood Warnings in force and Flood Warning Areas can be found from the Environment Agency website, under Flood Warnings and South-East Region.

4.10.5 Flood Response Plan

HCC's Emergency Planning Unit is responsible for the production, maintenance, and development of plans for an integrated response to any major emergency. This involves working closely with the emergency services, other HCC departments, other local authorities including RBC, voluntary agencies and industry to ensure that any response to a major incident is carefully managed to ensure a return to normality as quickly as possible. HCC includes flooding as an emergency situation.

HCC has a Multi-Agency Flood Response Plan which is the main guidance for all key officers in dealing with major flood emergencies. All departments should have emergency procedures in place to guide staff in their tasks where they differ from their normal work practices, such as providing care for evacuees at Emergency Rest Centres. It is recommended that discussion between HCC and RBC is carried out to ensure that HCC's emergency plans tie in with and complement RBC's own Emergency Response Plan[30].

As LLFA HCC provide flood advice on its website (http://www3.hants.gov.uk/flooding.htm). The website directs users to the Environment Agency website to view the flood warnings in place (as described in Section 4.10.4) and to view properties at risk of flooding from main rivers, surface water and reservoirs. HCC's website offers a link to the Environment Agency's website for advice on how to protect homes from flooding, and provides information on what to do in the event of a flood. The website also provides information on who to contact should flooding occur.

RBC also provides flood advice on its website: http://www.rushmoor.gov.uk/article/2861/Flooding-advice and includes a number of links to external websites including those maintained by HCC and the Environment Agency.

[30] Rushmoor Borough Council (2011) Rushmoor Emergency Response Plan

It is recommended that HCC's Flood Response Plan is reviewed and updated in light of the findings of the SFRA to ensure that safe evacuation and access for emergency services is possible during times of flood both for existing developments and those being promoted as possible sites within the Local Plan process. It is further recommended that RBC and HCC work with the Environment Agency to promote the awareness of flood risk to maximise the number of people signed up to the FWD service. Within Rushmoor particular attention should be given to vulnerable people including those with impaired hearing or sight and those with restricted mobility.

With respect to new developments, those proposing the development should take advice from the RBC and HCC's emergency planning officers and for large-scale developments, the emergency services, when producing an evacuation plan as part of a FRA. As a minimum these plans should include information on:

- How flood warning is to be provided:
    - Availability of existing warning systems;
    - Rate of onset of flooding and available warning time; and
    - Method of dissemination of flood warning.
- What will be done to protect the infrastructure and contents:
    - How more easily damaged items could be relocated;
    - The potential time taken to respond to a flood warning;
    - Ensuring safe occupancy and access to and from the development;
    - Occupant awareness of the potential frequency and duration of flood events;
    - Provision of safe (i.e. dry) access to and from the development within Flood Zones 2 and 3 up to the 1% AEP + climate change event;
    - Ability to maintain key services during an event;
    - Vulnerability of occupants and whether rescue by emergency services may be necessary and feasible; and
    - Expected time taken to re-establish normal practices following a flood event.
    - Within areas of surface water flood risk, provision of access in areas where flood waters pose a hazard no greater than "very low" in accordance with the Defra / Environment Agency technical guidance document FD2320/TR2[31]

4.10.5.1 Flood Hazard

Guidance set out in the Defra / Environment Agency technical guidance document FD2320/TR2 categorises the danger to people for different combinations of flood water depth and velocity as shown in Table 4.3.

Table 4.3: Danger to people relative to flood depth and velocity (Taken from Table 13.1 of the Defra/EA FD2320/TR2 report).

Velocity (m/s)	Depth of flooding (m)											
	0.05	0.10	0.20	0.30	0.40	0.50	0.60	0.80	1.00	1.50	2.00	2.50
0.00												
0.10												
0.25												
0.50												
1.00												
1.50												
2.00												
2.50												
3.00												
3.50												
4.00												
4.50												
5.00												

Key:
- Danger for some
- Danger for most
- Danger for all

[31] Defra / Environment Agency (2005) Flood Risk Guidance for New Development Phase 2: Framework and Guidance for Assessing and Managing Flood Risk for New Development – Full Documentation and Tools. R&D Technical Report FD2320/TR2

The technical guidance document states that the velocity and depth scenarios shown in the white boxes in Table 4.3 are considered to represent ‘very low hazard’. FD2320/TR2 also states safe access and egress routes should be within areas of very low hazard, however it is important to note that a hazard is still present.

5 Flood Risk Management Policy Considerations

5.1 Policy Considerations

A key aim of a SFRA is to define flood risk management objectives and identify key policy considerations. It should be noted that it is ultimately the responsibility of the Council to formally formulate these policies and implement them.

It is recommended that the following flood risk objectives are taken into account during the policy making process. Guidance on how these objectives can be met throughout the development control process for individual development sites is included within Section 7.5.

Flood Risk Objective 1: To Seek Flood Risk Reduction through Spatial Planning and Site Design:

- Use the Sequential Test to locate new development in areas of lowest risk, giving highest priority to Flood Zone 1;
- Within Flood Zone 1 highest priority should be given to areas with the lowest level of flood risk from all sources within the Flood Zone;
- Use the Sequential approach within development sites to inform site layout by locating the most vulnerable elements of a development in the lowest risk areas. For example, the use of low-lying ground in waterside areas for recreation, amenity and environmental purposes can provide an effective means of flood risk management as well as providing connected green spaces with consequent social and environmental benefits;
- Avoid development immediately downstream of flood storage reservoirs which will be high hazard areas in the event of failure;
- Avoid development immediately behind raised embankments of the Basingstoke Canal where a breach could occur;
- Seek opportunities for new development to achieve reductions to wider flood risk issues where possible, e.g. larger developments may be able to make provisions for flow balancing within new attenuation SuDS features;
- Identify long-term opportunities to remove development from the floodplain through land swapping;
- Build resilience into a site's design (e.g. flood resistant or resilient design, raised floor levels); and
- Ensure development is 'safe'. Dry pedestrian egress out of the floodplain and emergency vehicular access should be possible. The Environment Agency states that dry pedestrian access/egress should be possible for the 1 in 100 year return period event, and residual risk, i.e. the risks remaining after taking the sequential approach and taking mitigating actions, during the 1 in 1000 year event, should also be 'safe'. In areas of surface water flood risk in Flood Zone 1, access and egress should be provided in areas where flood waters pose a hazard no greater than "very low" in accordance with Defra / Environment Agency document FD2320/TR2. Internal flooding should be avoided through application of the sequential approach to location of development within a site, raising of finished flood levels and/or incorporation of flood resilient/resistant measures.

Flood Risk Objective 2: To Ensure Surface Water Runoff from New Developments remains at Greenfield Rates:

- The NPPF and PPG set out the requirement in future for all major development to include SuDS, enforced through the planning system. Further to this, in line with the existing RBC Core Strategy, all new development, including car parks and other hardstanding will be required to incorporate SuDS.
- All sites require the following:
    - Use of SuDS (where possible use of strategic SuDS should be made)
    - Discharge rates on undeveloped land should be restricted to greenfield rates as a maximum.
    - Brownfield sites should seek to discharge surface water from the redeveloped site at greenfield rates wherever possible. At the least, betterment should be offered (in terms of reduced runoff) for all redeveloped sites.
    - 1 in 100 year attenuation taking into account climate change
- Space should be specifically set aside for SuDS and used to inform the overall layout of development sites.
- Promote environmental stewardship schemes to reduce water and soil runoff from agricultural land.

- Surface water drainage proposals should have a clear plan for the long term maintenance and adoption of the systems, prior to approval of any planning permission.

Flood Risk Objective 3: To Enhance and Restore the River Corridor:

- Those proposing development should look for opportunities to undertake river restoration and enhancement as part of a development to make space for water. Enhancement opportunities should be sought when renewing assets (e.g. de-culverting, the use of bio-engineered river walls, raising bridge soffits to take into account climate change)
- Avoid further culverting and building over culverts. Where practical, all new developments with culverts running through their site should seek to de-culvert rivers for flood risk management and conservation benefit. Any culverting or works affecting the flow of a watercourse requires the prior written consent of either the Environment Agency (for Main Rivers), or HCC (for Ordinary Watercourses) under the terms of the Land Drainage/Water Resources Act 1991 and FWMA. These regulatory bodies seek to avoid culverting, and their Consent for such works will not normally be granted except as a means of access.
- Set development back from rivers, seeking an 8 metre wide undeveloped buffer strip for development by all Main Rivers including those where the Flood Zone does not exist. Under the terms of the Water Resources Act 1991 and the Land Drainage Byelaws the prior written consent of the Environment Agency is required for any proposed works or structures in, under, over or within 8 m from a Main River asset or structure. This is to allow easy maintenance of the watercourse, and includes consent for fencing, planting and temporary structures.
- It is encouraged, where possible, to retain a 5 metre wide undeveloped strip along all ordinary watercourses.
- In consultation with the Environment Agency, a buffer of 8 metres from the Cove Brook FSA should be retained. The Environment Agency should be consulted on any works on or within 8 metres of the Cove Brook FSA embankment.

Flood Risk Objective 4: To Protect and Promote Areas for Future Flood Alleviation Schemes:

- Protect greenfield functional floodplain (our greatest flood risk management asset), where present in Rushmoor, from future development and reinstate areas of functional floodplain which have been developed (e.g. reduce building footprints or relocate to lower flood risk zones).
- Develop appropriate flood risk management policies for the brownfield functional floodplain, focusing on risk reduction.
- Identify sites where developer contributions could be used to fund future flood risk management schemes or can reduce risk for surrounding areas.
- Seek opportunities to make space for water to accommodate climate change.

Flood Risk Objective 5: To Improve Flood Awareness and Emergency Planning:

- Seek to improve the emergency planning process within RBC and HCC using the outputs from the SFRA.
- Encourage all those within existing Flood Zone 3a and 3b (residential and commercial occupiers) to sign up to the Flood Warnings Direct service operated by the Environment Agency.
- Ensure robust emergency (evacuation) plans are implemented for new developments greater than 1 Ha in size.

5.2 Council Specific Policy Issues

Whilst RBC has not yet brought forward potential allocation sites, it is likely that the majority will be on brownfield sites. This presents a number of opportunities with regards to flood risk mitigation and water quality improvements.

As discussed in Flood Risk Objective 2, due to the relatively high level of flood risk from surface water in Rushmoor, SuDS should be incorporated in all new development and redevelopment of brownfield sites, with the aim of achieving greenfield runoff rates. The strategic aim should be to reduce surface water flood risk throughout Rushmoor, where possible.

A strong policy on the implementation of SuDS in new development may also have a beneficial impact on water quality in the River Blackwater and Cove Brook, identified as an issue by the Environment Agency, and all effort should be made to explore the use of SuDS which can provide specific benefits regarding the water quality of run-off.

Opportunities should be taken to carry out remediation of sites, where necessary, to increase the opportunity for infiltration SuDS to be implemented on site. The Environment Agency will require evidence that site investigation and,

where necessary, remediation, has been carried out to confirm that ground contamination is not present on site before infiltration SuDS are permitted.

6 Guidance on the application of the Sequential and Exception Tests

6.1 Sequential Test

The Sequential Test is a simple 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 to 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.

The Sequential Test 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.

6.2 Applying the Sequential Test – Plan-Making

A LPA must demonstrate that it has considered a range of possible sites in conjunction with the Flood Zone and vulnerability information from the SFRA and applied the Sequential Test, and where necessary, the Exception Test, in the site allocation process.

Figure 6.1 illustrates the approach for applying the Sequential Test that RBC should adopt in the allocation of sites as part of the preparation of the Local Plan. The Sequential Test should be undertaken by RBC and accurately documented to ensure decision processes are consistent and transparent.

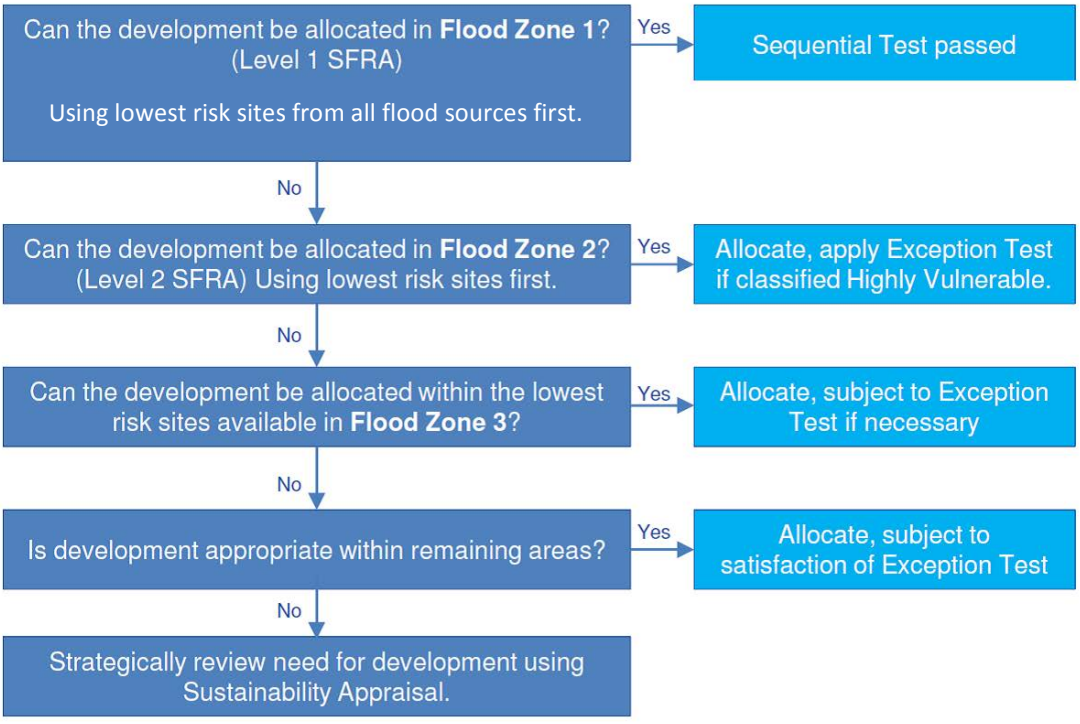

Figure 6.1 Application of Sequential Test for Local Plan preparation

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 4.1 and mapped in Figure B4 in Appendix B (and the Flood Map for Planning (Rivers and Sea) on the Environment Agency website). Flood risk vulnerability classifications, as defined in the PPG, are presented in Table 6.1.

Table 6.1 Flood Risk Vulnerability Classification (PPG, 2014)

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).

Vulnerability Classification	Development Uses
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.

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

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

The recommended steps in undertaking the Sequential Test are detailed below. This is based on the Flood Zone and Flood Risk Vulnerability and is summarised in Table 6.2. Table 6.2 indicates the compatibility of different development types with the Flood Zones.

Table 6.2 Flood Risk Vulnerability and Flood Zone 'Compatibility' (PPG, 2014)

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

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

The information required to address many of these steps is provided in the accompanying GIS layers and maps presented in Appendix B.

1. Assign potential developments with a vulnerability classification (Table 6.1). Where development is mixed, the development should be assigned the highest vulnerability class of the developments proposed.
2. The location and identification of potential development should be recorded.
3. The Flood Zone classification of potential development sites should be determined based on a review of the Flood Map for Planning (Rivers and Sea). Where these span more than one flood zone, all zones should be noted.
4. The design life of the development should be considered with respect to climate change:
    - 100 years – up to 2115 for residential developments; and
    - Design life for commercial / industrial developments will be variable, however a 75 year design life may be assumed for such development, unless demonstrated otherwise.
5. Identify existing flood defences serving the potential development sites. However, it should be noted that for the purposes of the Sequential Test, flood zones ignoring defences should be used.
6. Highly Vulnerable developments to be accommodated within the LPA area should be located in those sites identified as being within Flood Zone 1. If these cannot be located in Flood Zone 1, because the identified sites are unsuitable or there are insufficient sites in Flood Zone 1, sites in Flood Zone 2 can then be considered. Highly Vulnerable developments in Flood Zone 2 will require application of the Exception Test. If sites in Flood Zone 2 are inadequate then the LPA may have to identify additional sites in Flood Zones 1 or 2 to accommodate development or seek opportunities to locate the development outside their administrative area. Within each flood zone Highly Vulnerable development should be directed, where possible, to the areas at lowest risk from all sources of flooding. It should be noted that Highly Vulnerable development is not appropriate in Flood Zones 3a and 3b.
7. Once all Highly Vulnerable developments have been allocated to a development site, the LPA can consider those development types defined as More Vulnerable. In the first instance More Vulnerable development should be located in any unallocated sites in Flood Zone 1. Where these sites are unsuitable or there are insufficient sites remaining, sites in Flood Zone 2 can be considered. If there are insufficient sites in Flood Zone 1 or 2 to accommodate More Vulnerable development, sites in Flood Zone 3a can be considered. More Vulnerable developments in Flood Zone 3a will require application of the Exception Test. As with Highly Vulnerable development, within each flood zone More Vulnerable development should be directed to areas at lowest risk from all sources of flooding. It should be noted that More Vulnerable development is not appropriate in Flood Zone 3b.
8. Once all More Vulnerable developments have been allocated to a development site, the LPA can consider those development types defined as Less Vulnerable. In the first instance Less Vulnerable development should be located in any remaining unallocated sites in Flood Zone 1, continuing sequentially with Flood Zone 2, then Flood Zone 3a. Less Vulnerable development types are not appropriate in Flood Zone 3b – Functional Floodplain.
9. Essential Infrastructure should be preferentially located in the lowest flood risk zones, however this type of development may be located in Flood Zones 3a and 3b, provided the Exception Test is satisfied.
10. Water Compatible development has the least constraints with respect to flood risk and it is considered appropriate to allocate these sites last. The sequential approach should still be followed in the selection of sites; however it is appreciated that Water Compatible development by nature often relies on access and proximity to water bodies.
11. On completion of the Sequential Test, the LPA may have to consider the risks posed to a site within a flood zone in more detail in a Level 2 SFRA. By undertaking the Exception Test, this more detailed study should consider the detailed nature of flood hazard to allow a sequential approach to site allocation within a flood zone. Consideration of flood hazard within a flood zone would include:
    - Flood risk management measures,
    - The rate of flooding,
    - Flood water depth,
    - Flood water velocity.

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

6.2.2 Windfall Sites

Windfall sites are those which have not been specifically identified as available in the Local Plan process. They comprise previously-developed sites that have unexpectedly become available. In cases where development cannot be fully met through the provision of site allocations, LPAs are expected to make a realistic allowance for windfall development, based on past trends and expected future 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.

6.3 Applying the Sequential Test – Planning Applications

As illustrated in Figure 6.2, the flood risk Sequential Test can be considered adequately demonstrated if (1) the Sequential Test has already been carried out for the site for the same development type at the Local Plan level and (2) the development vulnerability is appropriate to the flood zone as set out in Table 6.2.

If the answer to either of these two criteria is 'no', then it is necessary to undertake a Sequential Test for the site. The Environment Agency publication 'Demonstrating the Flood Risk Sequential Test for Planning Applications'[32] sets out the procedure 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 identified for regeneration in Local Plan policies).
- Identify the source of 'reasonably available' alternative sites; usually drawn from evidence base / background documents produced to inform the Local Plan.
- State the method used for comparing flood risk between sites; for example the Environment Agency Flood Map for Planning, the SFRA mapping, site-specific FRAs if appropriate, other mapping of flood sources.
- Apply the Sequential Test; systematically consider each of the available sites, indicate whether the flood risk is higher or lower than the application site, state whether the alternative option being considered is allocated in the Local Plan, identify the capacity of each alternative site, and detail any constraints to the delivery of the alternative site(s).
- Conclude whether there are any reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed.
- Where necessary, as indicated by Table 6.2, apply the Exception Test.
- Apply the Sequential approach to locating development within the site.

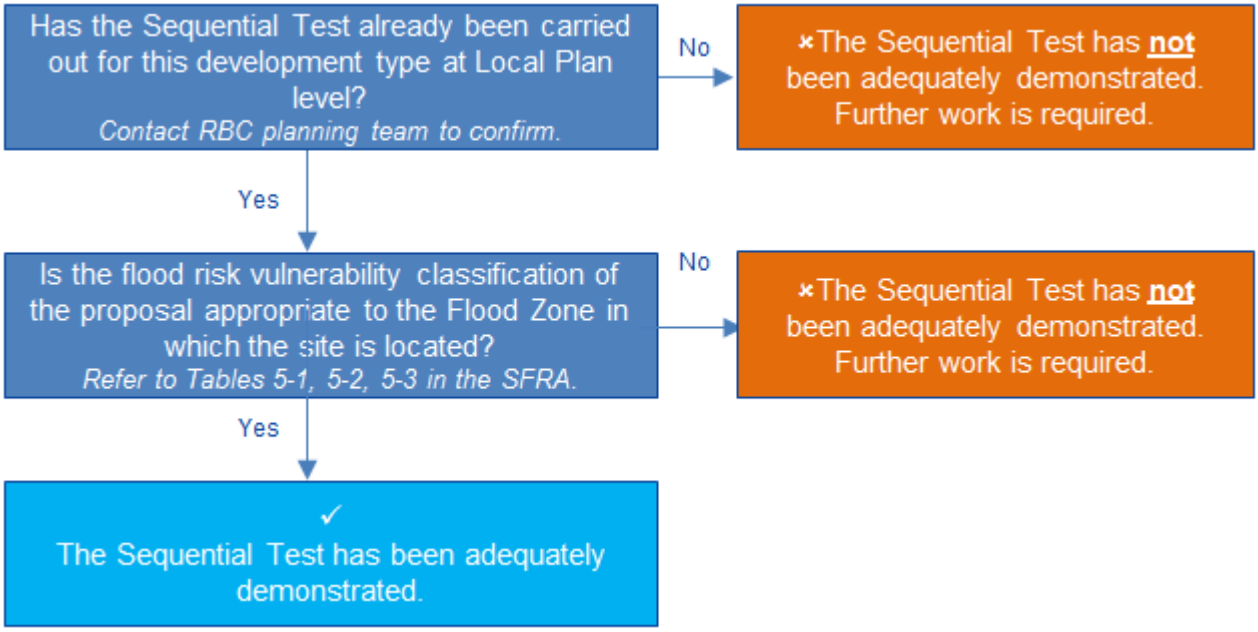

Figure 6.2 Determining when the Sequential Test is required for Planning Applications

It should be noted that it is for LPAs, taking advice from the Environment Agency as appropriate, to consider the extent to which Sequential Test considerations have been satisfied, taking into account the particular circumstances in any given case. The developer should justify with evidence to the LPA what area of search has been used when making the application. Ultimately RBC needs to be satisfied in all cases that the proposed development would be safe and not lead to increased flood risk elsewhere.

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

6.3.1 Sequential Test Exemptions

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 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 with an apartment block); and
    - Do not increase the net footprint of the building(s) unless accompanied by adequate floodplain compensation or suitable under floor voids.
    - Redevelopment, for example replacement dwellings, will be expected to meet current Flood Risk Management best practice standards. Where this is not feasible due to conflicting planning reasons, designs should be as close to best practice as possible. Under no circumstances will a worsening of flood risk compared to the existing case be accepted.

6.4 Exception Test

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

For the Exception Test to be passed:

- *"It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by the SFRA where one has been prepared; and*
- *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."*

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

When determining planning applications, RBC should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where, informed by a site-specific FRA following the Sequential Test, and if required the Exception Test, it can be demonstrated that:

- 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; and
- 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 by emergency planning; and it gives priority to the use of SuDS.

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.

In order to determine part 1) of the Exception Test, applicants should assess their scheme against the RBC Sustainability Appraisal objectives as set out in the RBC Sustainability Appraisal.

6.4.1 Exception Test Exemptions

It is noted that applications for minor development and change of use are exempt from the Exception Test; however site-specific FRAs are still required, as detailed in Section 7.

7 Guidance for preparing Site-Specific FRAs

7.1 Overview

This document provides a strategic assessment of flood risk in Rushmoor and should be consulted by prospective developers within the Borough. However it should be noted that this document has a strategic scope and therefore it is essential that site-specific FRAs are also developed for individual development proposals where required, and that where necessary and appropriate, suitable mitigation measures are incorporated.

A site-specific FRA is a report suitable for submission with a planning application which provides an assessment of flood risk to and from a proposed development, and demonstrates how the proposed development will be made safe, will not increase flood risk elsewhere and, where possible, will reduce flood risk overall in accordance with the NPPF and PPG.

7.2 When is a Flood Risk Assessment required?

The Environment Agency provides flood risk standing advice for applicants and agents on their website: https://www.gov.uk/planning-applications-assessing-flood-risk. This includes information on when a FRA is required and advice on the contents of FRAs for various development types in Flood Zone 1, Flood Zone 2 and Flood Zone 3.

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

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

The Environment Agency Guidance Note for FRAs in Flood Zone 1 (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/311502/LIT_9193.pdf) should be consulted for advice on the approach and content of a FRA.

7.3 Scope of a site-specific FRA

The PPG states that site-specific FRAs should always be proportionate to the degree of flood risk and make optimum use of readily available information, for example the mapping presented within this SFRA.

The PPG outlines that the objectives of a site-specific FRA are to establish the following:

- *"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."*

Table 7.1 is based on the checklist for site specific FRAs provided in the Planning Practice Guidance. Where appropriate, references have been added to determine where the information can be found to support each required item.

Table 7.1: Site-Specific Flood Risk Assessment Checklist (Planning Practice Guidance)

1. Development description and location	
1a. What type of development is proposed (e.g., new development, an extension to existing development, a change of use etc.) and where will it be located?	☐
1b. What is its flood risk vulnerability classification? Refer to Section 6.2 Table 6.1.	☐
1c. Is the proposed development consistent with the Local Plan for the area? RBC is currently carrying out a review of the RBC Core Strategy and Development Policies and is due to start work on its Local Plan in 2015. The existing Core Strategy and Development Policies should be referred to on the RBC website: http://www.rushmoor.gov.uk/corestrategy and seek advice from RBC if necessary	☐
1d. What evidence can be provided that the Sequential Test and where necessary the Exception Test has/have been applied in the selection of this site for this development type? Consult RBC to determine if the site has been included in the Sequential Test once this has been carried out. If not, refer to Section 6.3 for guidance on undertaking the Sequential Test for individual development sites and to determine whether the Exception Test is required.	☐
1e. Will your proposal increase overall the number of occupants and/or users of the building/land, or the nature or times of occupation or use, such that it may affect the degree of flood risk to these people? This is particularly relevant to minor developments (alterations & extensions) & changes of use.	☐
2. Definition of the flood hazard	
2a. What sources of flooding could affect the site? Refer to Section 4	☐
2b. For each identified source under 2a above, can you describe how flooding would occur, with reference to any historic records where these are available? Refer to Section 4	☐
2c. What are the existing surface water drainage arrangements for the site? Undertake a site survey to determine specific details. Where appropriate an asset location survey can be provided by Thames Water http://www.thameswater-propertysearches.co.uk/.	☐
3. Probability	
3a. Which flood zone is the site within? Refer to Section 4	☐
3b. Does the SFRA show the same or a different flood zone compared with the Environment Agency's flood map? Refer to the Flood Map for Planning (Rivers and Sea) on the Environment Agency's website http://maps.environment-agency.gov.uk/wiyby. If different you should seek advice from the local planning authority and, if necessary, the local Environment Agency office: WTenquiries@environment-agency.gov.uk.	☐
3c. What is the probability of the site flooding, taking account of the maps of flood risk from rivers and the sea and from surface water, on the Environment Agency's website, and the SFRA, and of any further flood risk information for the site? Refer to mapping in Appendix B, as well as the Flood Map for Planning (Rivers and Sea) and the Flood Risk from Surface Water mapping on the Environment Agency's website http://maps.environment-agency.gov.uk/wiyby.	☐
3d. If known, what (approximately) are the existing rates and volumes of surface water run-off generated by the site?	☐
4. Climate change	
How is flood risk at the site likely to be affected by climate change? Refer to Section 4.4.2 and 4.5.2 for a description of how climate change will impact fluvial and surface water flooding.	☐

5. Detailed development proposals	
Where appropriate, are you able to demonstrate how land uses most sensitive to flood damage have been placed in areas within the site that are at least risk of flooding (including providing details of the development layout)? Refer to Section 7.5 regarding the use of the sequential approach within development sites.	☐
6. Flood risk management measures	
How will the site/building be protected from flooding, including the potential impacts of climate change, over the development's lifetime? Refer to Section 7.5 for details regarding finished floor levels, basement dwellings, flood resilient design, car parking considerations, and provision of safe access / egress.	☐
7. Off-site impacts	
7a. How will you ensure that your proposed development and the measures to protect your site from flooding will not increase flood risk elsewhere?	☐
7b. How will you prevent run-off from the completed development causing an impact elsewhere? Refer to Section 5.1 regarding Flood Risk Management Objective2. Refer to Section 8 regarding the use of specific types of SuDS throughout the district.	☐
7c. Are there any opportunities offered by the development to reduce flood risk elsewhere? Refer to Section 5.1 regarding Flood Risk Management Objective2. Refer to Section 8 regarding the use of specific types of SuDS throughout the district.	☐
8. Residual risks	
8a. What flood-related risks will remain after you have implemented the measures to protect the site from flooding? In addition, how will implemented measures be maintained?	☐
8b. How, and by whom, will these risks be managed over the lifetime of the development? (E.g., flood warning and evacuation procedures). Refer to Section 7.5 for details regarding flood warning and flood evacuation plans.	☐

7.3.1 Proposed Development in Low Probability Flood Zone 1

FRAs within Flood Zone 1 should primarily take consideration of how the ability of water to soak into the ground may change with development, along with how the proposed layout of development may affect drainage systems. This is to ensure surface water generated by the site is managed in a sustainable manner and does not increase the burden on existing infrastructure and/or flood risk to neighbouring property. The assessment of surface water flood risk should take account of the impact of climate change over the lifetime of the development.

The uFMfSW dataset (Figure B5 in Appendix B) should be used to indicate broad areas with a potential surface water flood risk. Figures B7a-e should be used to provide an indication of areas where there may be a risk of groundwater flooding and where infiltration SuDS may be viable; however more detailed site investigations will also be required to determine local conditions and suitability of drainage techniques. The SFRA provides specific recommendations with respect to the provision of sustainable flood risk mitigation opportunities that will address both the risk to life and the residual risk of flooding to development within particular 'zones' of the area. These recommendations should form the basis for the site-specific FRA.

7.3.2 Proposed Development within Medium Probability Zone 2

For all sites within Medium Probability Flood Zone 2, a scoping FRA should be prepared based upon readily available existing flooding information, sourced from the Environment Agency. If a significant flood risk from other sources (e.g. surface water, groundwater or sewer flooding) is identified then a more detailed FRA should be prepared. It will be necessary to demonstrate that the residual risk of flooding to the property is effectively managed throughout, for example through the provision of raised floor levels and the provision of planned evacuation routes or safe havens. SuDS techniques must be employed to ensure there is no increase in flooding elsewhere.

7.3.3 Proposed Development in Flood Zone 3a High Probability

All FRAs supporting proposed development within High Probability Flood Zone 3a should assess the proposed development against all elements of the Council's flood policy, and include an assessment of the following:

- The vulnerability of the development to flooding from other sources (e.g. surface water drainage, groundwater) as well as from river flooding. This will involve discussion with RBC, the Environment Agency, HCC as LLFA and TWUL to confirm whether a localised risk of flooding exists at the proposed site.
- The vulnerability of the development to flooding over the lifetime of the development (including the potential impacts of climate change), i.e. maximum water levels, flow paths and flood extents within the property and surrounding area.
    - The design life of the proposed development should be considered with respect to climate change as 100 years (up to 2115) for residential developments. Design life for commercial / industrial developments will be variable, however a 75 year design life may be assumed for such development, unless demonstrated otherwise.
    - Applicants should consult the Environment Agency to confirm the availability of modelled flood levels associated with nearby watercourses. Where this information is of suitable quality, modelled flood levels for the relevant annual probability events should be compared with site topographic information to more accurately determine the flood risk to the development site.
- Where the quality and/or quantity of information for any of the flood sources affecting a site is insufficient to enable a robust assessment of the flood risk, further investigation may be required. For example, where hydraulic modelling is not available for ordinary watercourses, the scope of the FRA should be increased to include modelling to ensure details of flooding mechanisms are fully understood and that the proposed development incorporates appropriate mitigation measures;
- The potential of the development to increase flood risk elsewhere through the addition of hard surfaces, the effect of the new development on surface water runoff, and the effect of the new development on depth and speed of flooding to adjacent and surrounding property. This will require a detailed assessment to be carried out by a suitably qualified engineer;
- Opportunities for new developments to deliver reductions to wider flood risk issues where possible, e.g. larger developments may be able to make provisions for flow balancing within new attenuation SuDS features;
- The FRA should consider the vulnerability of those that could occupy and use the development including arrangements for safe access. The FRA should also take account of the vulnerability classification (Table 6.1) and the status of the site in relation to the Sequential and Exception Tests;
- The localised risk of flooding that may occur. This is typically associated with local catchment runoff following intense rainfall;
- A demonstration that residual risks of flooding (after existing and proposed flood management and mitigation measures are taken into account) are acceptable. Measures may include flood defences, flood resistant and resilient design, escape/evacuation, effective flood warning and emergency planning;
- Details of existing site levels, proposed site levels and proposed ground floor levels. All levels should be stated relevant to Ordnance Datum;
- It is essential that developers thoroughly review the existing and future structural integrity of informal defences, if present, upon which the development will rely (i.e. over the lifetime of the development), and ensure that emergency planning measures are in place to minimise risk to life in the unlikely event of a defence failure. This would be particularly important for development that could potentially be affected as a result of a breach of any reservoirs or canals in the study area. SuDS techniques must be employed to ensure no worsening of existing flooding problems elsewhere within the area;
- At all stages, the Local Planning Authority, and where necessary the Environment Agency, IDB and/or the Statutory Water Undertaker should be consulted to ensure the FRA provides the necessary information to fulfil the requirements for Planning Applications.

7.3.4 Proposed Development in proximity to the Basingstoke Canal

Due to the potentially large impact of a failure of the Basingstoke Canal, the potential flood risk posed by embanked sections of the Basingstoke Canal should be considered in the FRA accompanying a planning application for any proposed development in Rushmoor.

7.4 Proposed Development in Flood Zone 3b Functional Floodplain

In line with the NPPF, development will not normally be allowed in the Functional Floodplain unless it is classified as a 'Water Compatible' or 'Essential Infrastructure' use. Table 2 from the NPPF (refer to Section 6 of this report), details the type of developments classified as 'Water Compatible' or 'Essential Infrastructure.'

7.5 Guidance on Flood Risk Management Measures

7.5.1 Sequential approach within development sites

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 e.g. residential developments 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. Whilst traditionally applied to the risk of river flooding, this approach should also be implemented when considering the risk of surface water flooding across a site.

7.5.2 Finished Floor Levels

Where developing in fluvial flood risk areas is unavoidable, the recommended method of mitigating flood risk to people, particularly with More Vulnerable (residential) land uses, is to ensure internal floor levels are raised a freeboard distance above peak flood water levels. Finished floor levels should be set a minimum of 300mm above the 1% AEP (1 in 100 chance of flooding in any one year) plus climate change peak flood level. The peak flood water level should be derived for the immediate vicinity of the site (i.e. relative to the extent of a site along a watercourse as flood levels are likely to vary with increasing distance downstream) as part of a site-specific FRA. In areas of surface water flood risk, finished floor levels should be set at 600mm above the surrounding ground level as a precautionary measure unless evidence of the expected flood depths is provided.

The Environment Agency recommends finished flood levels are set at 300mm above the 1% AEP plus climate change flood level for Less Vulnerable development in Flood Zones 2 and 3. Where this is not possible flood resilient/resistant measures should be incorporated to provide appropriate property-level protection. Requirements for a freeboard above the peak flood level for finished internal floor levels within Less Vulnerable commercial and industrial units vary, depending upon the proposals. For such land uses, finished internal floor levels may not be required to be raised. However, it is strongly recommended that internal access is provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. Such refuges will have to be permanent and accessible to all occupants and users of the site.

With respect to residential accommodation and in accordance with Tables 1, 2, and 3 of the PPG, basement accommodation, single storey accommodation, and multi-storey buildings with ground floor sleeping accommodation should not be permitted, or allocated, in Flood Zone 3. Sleeping accommodation should be restricted to the first floor or above to offer the required ‘safe places’. Internal ground floors below this level could however be occupied by either Less Vulnerable commercial premises, garages or non-sleeping residential rooms (e.g. kitchen, study, lounge) (i.e. applying a sequential approach within a building).

Further consultation with the Environment Agency will therefore be required during the undertaking of any detailed FRA. For both Less and More Vulnerable developments where internal access to higher floors is provided, the associated plans showing this should be included within any site-specific FRA.

Hotels are classed as More Vulnerable land uses, however, where it is not viable to raise finished floor levels, internal access to higher floors must be provided to give safe refuge to all occupants during times of flood. Sleeping accommodation should be set a minimum of 300mm above the 0.1% AEP plus climate change peak flood level.

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 should be approached to discuss options for a reduction in the minimum internal ground floor levels provided flood proofing (resistance) measures are implemented up to an agreed level. There are also circumstances where flood proofing (resilience) measures should be considered first. These are described further below.

7.5.3 Basement Dwellings

Basement dwellings are classified as Highly Vulnerable and as such they are not permitted within Flood Zones 3a and 3b. They must pass the Sequential and Exception Tests should they be proposed for Flood Zone 2. Basement dwellings should therefore be discouraged within areas at risk of fluvial, surface water or groundwater flooding. Where they are constructed, access must be situated 300mm above the design flood level, and waterproof construction techniques should be employed to avoid seepage during flood events. An assessment of groundwater conditions will also be required to inform the structural integrity of the basement construction. Similar problems can also occur where excessive

surface water ponding occurs close to the sides of buildings, leading to significant infiltration. Surface water flow paths should be assessed to ensure that this does not occur, and to inform the strategic location of SuDS and techniques to route flows around the edge of buildings.

FRAs should address the potential impact of large basements on groundwater flooding. Below-ground structures have the potential to impede the flow of groundwater, increasing flood risk up-gradient.

7.5.4 Flood Resistant and Resilient Design

In order to mitigate any potential flood damage, there are a range of flood resilient construction techniques that can be implemented in new developments. The Department for Communities and Local Government (CLG) have published a document 'Improving the Flood Performance of New Buildings, Flood Resilient Construction'[33], the aim of which is to provide guidance to developers and designers on how to improve the resilience of new properties in low or residual flood risk areas, through the use of suitable materials and construction details.

Figure 7.1 provides a summary of different design strategies depending on the depth of floodwater that could be experienced.

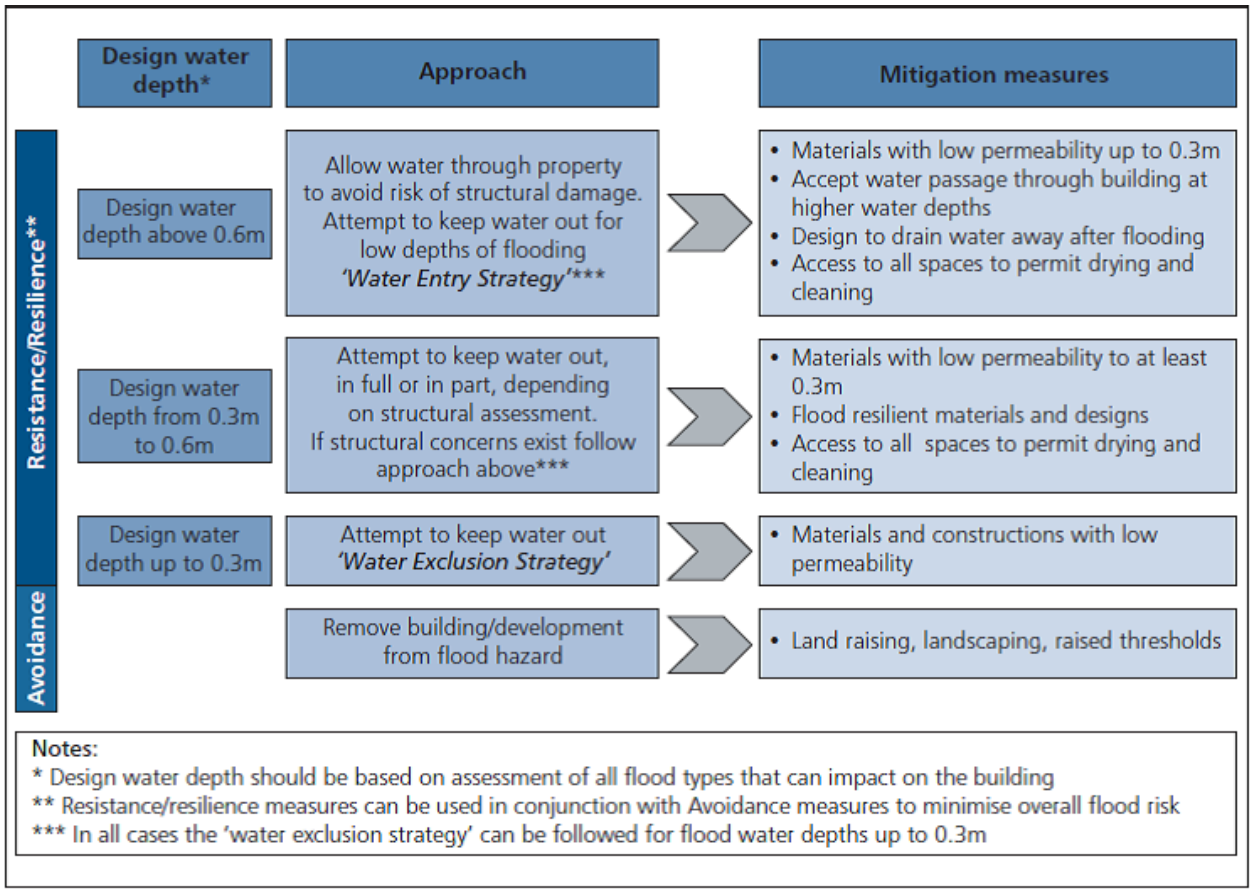

Figure 7.1: Flood Resilient Design Strategies, Improving Flood Performance, CLG 2007

A number of design strategies are detailed including the Water Exclusion Strategy and Water Entry Strategy. 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.

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, i.e. the Water Entry Strategy.

The principle behind the Water Entry Strategy is not only to allow water through the property to avoid the risk of structural damage, but also to implement careful design in order to minimise damage and allow rapid re-occupancy of the building.

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

The NPPF considers these measures to be appropriate for both changes of use and for Less Vulnerable uses where temporary disruption is acceptable and suitable flood warning is received.

Materials will 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 300mm 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.

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' (CLG, 2007).

Where finished floor levels cannot be raised to the recommended height due to ridge height restriction or disabled access, the reasons for this should be clearly stated and appropriate flood resilient/resistant measures should be provided to 300mm above the 1% AEP plus climate change flood level.

7.5.5 Car Parks

Where car parks are specified as areas for the temporary storage of 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. The Environment Agency recommends that in areas where under croft parking is provided, occupants should also sign up to flood alerts. Due to the nature of flood warnings, it is possible that under croft parking areas may have flooded before a flood warning has been issued.

7.5.6 Structures

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.

7.5.7 Safe Access and Egress

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.

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 using public rights of way without the intervention of emergency services or others during design flood conditions, including climate change allowances.

For developments located in areas at flood risk the Environment Agency consider 'safe' access/egress to be in accordance with 'FRA Guidance for new Developments FD2320/TR2'. The requirements for safe access and egress from new developments are 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.

Flooding along the safe access/egress route should have a hazard no greater than very low in accordance with the Defra / Environment Agency guidance document FD2320/TR2 and entirely on publically accessible land. The route should be located entirely outside the 1% AEP plus climate change flood extent.

7.5.8 Floodplain Compensation Storage

Where proposed development results in an increase in building footprint, the developer must ensure that it does not impact upon the ability of the floodplain to store water and that it does not impact upon floodwater flow conveyance.

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.

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 of the site and linked to the planning application. Floodplain compensation must be considered in the context of the 1 in 100 year (1% annual probability) flood level including an allowance for climate change.

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, however, this would be subject to detailed investigations and agreement with the Environment Agency and RBC to demonstrate that the proposals would improve and not worsen the existing flooding situation.

7.5.8.1 Use of Voids for Floodplain Compensation Storage

To support this Level 1 SFRA, the Environment Agency has provided guidance relating to voids for flood storage. Under-floor voids, stilts and under croft parking is considered acceptable mitigation of an increase in building footprint. Such methods may also be utilised in areas of surface water ponding.

Void design should meet the following design requirements, as established by Environment Agency best practice:

- Void openings should be 1 metre wide by the height of the predicted depth of flooding (including an appropriate climate change and freeboard allowance) from ground level to the underside of the flood slab. There should be one opening in every 5-metre length of wall on all sides.
- Voids should be open and maintained for the lifetime of the development.
- Should void openings pose a security risk to property, vertical steel bars may be placed at 100mm intervals.

The Environment Agency states that the use of voids may not be appropriate for flooding depths of 100mm or less.

7.5.9 Flood Routing

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.

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.

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.

7.5.10 Riverside Development

Under Section 109 of the Water Resources Act 1991 and/or Environment Agency Byelaws, any works within 8 metres of any statutory Main River (both open channels and culverted sections) requires Environment Agency consent. This includes any works (including temporary) that affect flow within the channel of any Main River (such as in channel structures or diversion of watercourses) or may impede any drainage work.

In addition, the Environment Agency seek an 8 metre wide undeveloped buffer strip alongside Main Rivers and behind flood defences, and would also ask developers to explore opportunities for river restoration as part of any development. A buffer zone of 5 metres alongside ordinary watercourses is encouraged by the Environment Agency.

The Environment Agency should be consulted on any works on or within 8 metres of the Cove Brook FSA embankment.

As of 6 April 2012 responsibility for the consenting of works by third parties on Ordinary Watercourses under Section 23 of the Land Drainage Act 1991 (as amended by the FWMA) has transferred from the Environment Agency to HCC as the LLFA. HCC now has responsibility for the consenting of works to Ordinary Watercourses and has powers to enforce un-consented and non-compliant works. As with Main Rivers, as outlined above, this includes any permanent or temporary

works that affect flow within the channel of any Ordinary Watercourse. As stated above, responsibility for consenting of third party works on Main Rivers is retained by the Environment Agency.

Consent is refused if the works would result in an increase in flood risk, a prevention of operational access to the watercourse, if they would damage an asset or cause bank instability issues and/ or they pose an unacceptable risk to nature conservation.

7.5.11 Flood Warning and Evacuation Plans

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.

For all development proposed in Flood Zones 2 or 3a, a Flood Warning and Evacuation Plan (FWEP) 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.

It may also be necessary to prepare a FWEP for development in Flood Zone 1 where the area surrounding the site and/or any potential egress routes away from the site may be at risk of flooding during the 1% annual probability (1 in 100) flood event including an allowance for climate change.

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.).

The Environment Agency has a tool on their website to create a Personal Flood Plan[34]. The Plan comprises a checklist of things to do before, during and after a flood and a place to record important contact details.

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

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

8 Sustainable Drainage Systems

8.1 Introduction

The PPG, which accompanies the NPPF, indicates that priority should be given to the use of SuDS in new developments. Appropriate deployment of SuDS within a development can offer benefits in terms of reductions in flood risk, improvements to water quality, quicker replenishment of groundwater and improved visual amenity.

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 with the preferred system contributing significantly to each objective. 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.

These goals can be achieved by utilising a management plan incorporating a chain of techniques, as outlined in the Interim Code of Practice for Sustainable Drainage Systems[35], where each component adds to the performance of the whole system:

Prevention	Good site design and upkeep to prevent runoff and pollution (e.g. limited paved areas, regular pavement sweeping).
Source Control	Runoff control at / near to source (e.g. rainwater harvesting, green roofs, pervious pavements).
Site Control	Water management from a multitude of catchments (e.g. route water from roofs, impermeable paved areas to one infiltration/holding site).
Regional Control	Integrate runoff management systems from a number of sites (e.g. into a detention pond).

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.

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[36] identifies several processes that can be used to manage and control runoff from developed areas. Each option can provide opportunities for storm water control, flood risk management, water conservation and groundwater recharge.

- Infiltration: the soaking of water into the ground. This is the most desirable solution as it mimics the natural hydrological process. The rate of infiltration will vary with soil type and condition, the antecedent conditions and with time. The process can be used to recharge groundwater sources and feed baseflows of local watercourses, but where groundwater sources are vulnerable or there is risk of contamination, infiltration techniques are not suitable. Additionally shallow groundwater and low infiltration rates will prevent the application of infiltration SuDS.
- 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.

[35] National SuDS Working Group (2004) Interim Code of Practice for Sustainable Drainage Systems
[36] CIRIA C697 SuDS Manual. http://www.ciria.org/Resources/Free_publications/the_suds_manual.aspx

- Conveyance: the transfer of surface runoff from one place to another, e.g. through open channels, pipes and trenches.
- Water Harvesting: the direct capture and use of runoff on site, e.g. for domestic use (flushing toilets) or irrigation of urban landscapes. The ability of these systems to perform a flood risk management function will be dependent on their scale, and whether there will be a suitable amount of storage always available in the event of a flood.

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 8.1 has been reproduced from the SuDS Manual, CIRIA C697 and outlines typical SuDS techniques.

Table 8.1 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

For further guidance on SUDS, the following documents and websites are recommended as a starting point:

- The NPPF and associated Planning Policy Guidance technical notes.
- The SuDS Manual – CIRIA C697 (2007) provides the best practice guidance on the planning, design, construction, operation and maintenance of SuDS and facilitates their effective implementation within developments.
- CIRIA C644 – Green Roofs (2007)[37] provides guidance on the design, construction and operation of Green Roofs. The guidance also describes how 'quick wins' for biodiversity can be achieved in the built environment by incorporating nesting and roosting boxes for bird, bats and other animals.
- Interim Code of Practice for Sustainable Drainage Systems[38], National SuDS Working Group, 2004.
- www.susdrain.org/
- Defra / Environment Agency Preliminary Rainfall Runoff Management Rev E[39] provides guidance on surface water drainage strategy for the Environment Agency, LPAs and developers.

8.2 National SuDS Standards

A set of National Standards[40] (NS) have been published which set the requirements for the design, construction, maintenance and operation of SuDS. The NS are intended to be used alongside the NPPF and PPG .

The NS that are of chief concern in relation to the consideration of flood risk to and from development relating to runoff destinations, peak flow control and volume control are presented below:

8.2.1 Peak flow control

SuDS NS2 *'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 must not exceed the peak greenfield runoff rate for the same event'.*

SuDS NS3 *'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'.*

8.2.2 Volume control

SuDS NS4 *'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'.*

SuDS NS5 *'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'.*

SuDS NS6 *'Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with SuDS NS4 or SuDS NS5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk'.*

8.2.3 Flood risk within the development

SuDS NS7 *'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'.*

SuDS NS8 *'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'.*

[37] CIRIA (2007) Building Greener. Guidance on the use of green roofs, green walls and complementary features on buildings (C644)
[38] National SuDS Working Group (2004) Interim Code of Practice for Sustainable Drainage Systems
[39] Defra / Environment Agency (2013) Rainfall runoff management for developments
[40] DEFRA (Sustainable Drainage Systems (March 2015) Non-statutory technical standards for sustainable drainage systems

SuDS NS9 *'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'.*

8.3 Use of Infiltration SuDS in Rushmoor

As part of this SFRA, an assessment of the suitability of using infiltration SuDS techniques across the Borough has been undertaken. The BGS Infiltration SuDS Suitability Map shown on Figures B7c and B7d in Appendix B is largely based on the BGS Infiltration SuDS Suitability dataset. It is understood from the BGS guidance notes that the dataset is derived from the following data:

- Infiltration constraints summary layer;
- Superficial deposits permeability;
- Superficial deposits thickness;
- Bedrock permeability;
- Depth to groundwater level; and
- Geological indicators of flooding

Four categories have been identified by the BGS for suitability for Infiltration SuDS:

1. Highly compatible for Infiltration SuDS: The subsurface is likely to be suitable for free-draining infiltration SuDS;
2. Probably compatible for Infiltration SuDS: The subsurface is probably suitable for infiltration SuDS although the design may be influenced by the ground conditions;
3. Opportunities for bespoke infiltration SuDS: The subsurface is potentially suitable for infiltration SuDS although the design will be influenced by the ground conditions; and
4. Very significant constraints are indicated: There is a very significant potential for one or more geohazards associated with infiltration.

The infiltration SuDS suitability assessment shown on Figure B7c and B7d in Appendix B is based on the map produced by the BGS.

The infiltration SuDS suitability is highly variable throughout the Borough, and in general does not show any clear correlation with the underlying geology. However a corridor along the Blackwater River, typically associated with Alluvium and River Terrace superficial deposits, is indicated to have very significant constraints to infiltration SuDS. The exception to this is intermittent areas along the path of the watercourse which are indicated to present opportunities for bespoke infiltration SuDS. Other notable areas of significant constraints to infiltration SuDS are an area surrounding the Farnborough Industrial Estate in the North Farnborough area and an area lying roughly between North Camp, Aldershot Camp and the A331.

Notable areas indicated to be highly compatible with infiltration SuDS are present throughout the Borough. An area running through Farnborough, from Farnborough Green in the north to North Camp in the south, is shown to be likely to present relatively few constraints. Sections within, and to the north and west of Aldershot are also shown to be highly compatible with infiltration SuDS. The BGS also provide information on the probable depth to groundwater. Areas where groundwater is likely to be over 5m below the ground surface throughout the year closely correspond with areas identified as being highly compatible with infiltration SuDS. Areas where groundwater is likely to be less than 3m below the ground surface during at least part of the year predominantly correspond with areas of significant constraints on infiltration SuDS or opportunities for bespoke infiltration SuDS.

Areas indicated to be probably compatible with infiltration SuDS are scarcer within the Borough, with the most notable area being located in south Aldershot.

Areas identified as presenting opportunities for bespoke infiltration SuDS dominate the north of the Borough, particularly to the north west of Farnborough in the Fox Lane, Rafborough and Southwood areas, as well as Farnborough Airport.

Where superficial deposits are present within Rushmoor, the thickness has been identified by the BGS to be predominantly less than 3m thick and therefore the BGS states that ground permeability may be dependent on both the superficial and bedrock deposits.

It should be noted that this is a high level assessment and only forms an approximate guide to infiltration SuDS suitability; an enhanced site investigation is required in all cases to confirm local conditions. The maximum likely groundwater levels should be assessed, to confirm that soakaways will continue to function even during prolonged wet conditions.

In addition any proposed infiltration SuDS should be located away from areas of historic landfill, known contamination or areas which are at risk of contamination. This is to ensure that the drainage does not re-mobilise latent contamination and exacerbate the risk to groundwater quality and down gradient receptors such as abstractors, springs and rivers. In such circumstances, a preliminary groundwater risk assessment may be required with the planning application.

It should be noted that whilst infiltration SuDS may not be appropriate in all locations, this does not rules out the potential for other SuDS techniques to be used, for example above-ground attenuation methods.

9 Summary and Recommendations

9.1 Site Allocation Process

The outputs from this Level 1 SFRA Update should be used as an evidence base from which to direct new development to areas of low flood risk (Flood Zone 1). Where development cannot be located in Flood Zone 1, the Council should use the flood maps to apply the Sequential Test to their remaining land use allocations.

Where the need to apply the Exception Test is identified, due to there being an insufficient number of suitable sites for development within zones of lower flood risk, the scope of the SFRA may need to be widened to a Level 2 assessment. The need for a Level 2 SFRA cannot be fully determined until the Council has applied the Sequential Test. It is recommended that as soon as the need for the Exception Test is established, a Level 2 SFRA is undertaken by a suitably qualified technical expert or engineer so as to provide timely input to the overall plan making process.

9.2 Council Policy

The Local Plan for Rushmoor and supporting guidance documents should continue to include policies to:

- Protect the functional floodplain from development;
- Direct vulnerable development away from flood affected areas taking account of all flood sources;
- Ensure all new development is ‘safe’. Dry pedestrian access to and from the development must be possible without passing through flood waters where the hazard is greater than “very low” according to Defra / Environment Agency guidance FD2320/TR2, and emergency vehicular access must be possible;
- Promote the use of strategic, integrated and maintainable SUDS in all flood zones for both brownfield and greenfield sites. Space should be set-aside for SUDS; and
- Reduce flood risk from all sources where possible, for example through reduction of surface water runoff rates and volumes, increasing floodplain storage, setting development back from watercourses and de-culverting of watercourses.

9.3 Emergency Planning

It is recommended that the RBC and HCC’s Emergency Response Plans are reviewed and, if necessary, updated in light of the findings of the SFRA to ensure that they are informed by the most up-to-date flood risk information available.

It is further recommended that the Council works with the Environment Agency to promote the awareness of flood risk and encourage communities at risk to sign-up to the Environment Agency Flood Warning Service.

9.4 Future Updates to the SFRA

This SFRA has been updated 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) on a quarterly basis and a rolling programme of detailed flood risk mapping is underway. Future new modelling of watercourses in the area will improve the current knowledge of flood risk within the Borough, and may marginally alter predicted flood extents within parts of the Borough in the future.

New information may influence future development management decisions within these areas. Therefore it is important that the SFRA is adopted as a ‘living’ document and is reviewed regularly in light of emerging policy directives, flood risk datasets and an improving understanding of flood risk within the Borough. Appendix C provides examples of when an update to the Level 1 SFRA may be required.

9.5 Level 2 SFRA

This Level 1 SFRA will allow RBC to assess their proposed site allocations using the Sequential Test. This will act as a 'sieving' process, allocating as many sites as possible to Flood Zone 1. Where it is found that some sites can only be placed in Flood Zones 2 and 3, the Exception Test will need to be applied as described in Section 6, and RBC may wish to consider the preparation of a Level 2 SFRA.

A Level 2 SFRA should be viewed as rather more site specific than a Level 1 SFRA, addressing flood risk to potential development sites which have gone through the Sequential Test and have been located in Flood Zones 2 or 3. The data required for a Level 2 SFRA will therefore depend upon which, if any, of the council's final list of preferred sites remain in Flood Zones 2 and 3 following application of the Sequential Test and hence where the Exception Test needs to be applied.

It is important that a Level 2 SFRA considers the variation of flood risk within a Flood Zone due to flood risk management measures i.e. flood defences. This increased scope involves a more detailed review of flood hazard (flood probability, flood depth, flood velocity, rate of onset of flooding). If development is to be located behind defences, or downstream of flood storage reservoirs, it may be necessary to model constructional failure of the defence (breach) and water levels rising to exceed the level of the defence (overtopping). It is not necessary to carry out such scenarios behind all existing defences, if no new development is to be located behind these structures. In some instances improvements to existing flood defences may be required to manage residual flood risks. Here, the SFRA should include an appraisal of the extent of works to provide or raise the flood defence to appropriate standard.

Level 2 SFRA outputs typically include:

- Maps showing the distribution of flood hazard (as a function of flood depth and velocity) within flood zones;
- Guidance on appropriate policies for the development of sites which satisfy the Exception Test i.e. are safe for occupants / users over their lifetime, do not increase flood risk and where possible reduce flood risk overall;
- Guidance on the preparation of FRAs for sites with varying flood risk across the flood zone.

Appendix A.
Data Register

The following register details the datasets that were used throughout the preparation of the Level 1 SFRA update.

	Dataset	Source	Format	Description
Fluvial	Flood Map for Planning (Rivers and Sea) Flood Zones 2 and 3	Environment Agency Geostore* (*available to the public on the Environment Agency website)	GIS Layer	A quick and easy reference that can be used as an indication of the probability of flooding from Main Rivers. The original Flood Map was broad scale national mapping typically using JFLOW modelling software that is generally thought to have inaccuracies. This is regularly updated with the result of new modelling studies. For those rivers where there is no updated modelling, the Flood Zones from JFLOW modelling may not provide an accurate representation of probability of flooding. Typically watercourses with a catchment area less than 3km^2 are omitted from Environment Agency mapping unless there is a history of flooding affecting a population. Consequently there will be some locations adjacent to watercourses that on first inspection, suggest there is no flood risk.
	Detailed River Network (DRN)	Environment Agency Geostore	GIS Layer	Identification of the river network including Main Rivers and Ordinary Watercourses for which the Environment Agency and HCC have discretionary and regulatory powers.
	Historic Flood Map	Environment Agency Geostore	GIS Layer	A single GIS layer showing the extent of fluvial historic flood events created using best available information at time of publication. However, some of the data is based on circumstantial and subjective evidence. There is not always available metadata, e.g. date of flood event.
	Modelled flood outlines for The River Blackwater	Environment Agency	GIS Layer	Detailed and calibrated hydraulic model outlines. The Environment Agency applies the outcomes from such 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. smaller tributaries). The flood risk from these is based on broad scale JFLOW modelling and therefore the flood risk from these cannot be as accurately assessed.
	Asset Information Management System (AIMS) for the Borough	Environment Agency	GIS Layer	Shows where there are existing defences, structures, heights, type and design standard. Only one such asset exists within Rushmoor.
	Fluvial Flood Records	Environment Agency	MS Excel Database	Historic records of fluvial flooding in the Borough held by the Environment Agency.

	Dataset	Source	Format	Description
	Fluvial Flood Records	RBC	MS Excel Database	Records of flooding associated with Main Rivers within Rushmoor as well as records of sandbags provided to residents.
Surface Water	'Updated Flood Map for Surface Water' dataset	Environment Agency Geostore	GIS Layer	Provides an indication of the broad areas likely to be at risk of surface water flooding, i.e. areas where surface water would be expected to flow or pond. This dataset does not show the susceptibility of individual properties to surface water flooding.
	Surface Water Flood Records	Environment Agency	MS Excel Database	Historic records of surface water flooding in the Borough held by the Environment Agency.
	Surface Water Flood Records	RBC	MS Excel Database / GIS Layer	Historic records of surface water flooding which occurred in July 2007 and records of historic flood addresses.
	Surface Water Flood Records	HCC	MS Excel Database / GIS Layer	Historic records of surface water flooding in the Borough held by HCCs Flood and Water Management and Highways teams.
Groundwater	Groundwater Flood Records	Environment Agency	MS Excel Database	Records of groundwater flooding in the period 2000-2005 held by the Environment Agency.
	GIS layers of the geology across the borough	RBC	GIS Layer	Illustrates bedrock and superficial geology across the Borough.
	GIS layer of Source Protection Zones	Environment Agency Geostore	GIS Layer	Shows the areas where the groundwater is protected by the Environment Agency. The designation may not consider fractures in the strata at a greater radius where pollutants could reach the source protection zone.
	Aquifer Designation Maps for Bedrock and Superficial	Environment Agency website	Website	Shows aquifer designations for bedrock aquifers. The designations identify the potential of the geological strata to provide water that can be abstracted and have been defined through the assessment of the underlying geology.
	GIS layer 'Infiltration SuDS Map'	British Geological Survey	GIS Layer	Dataset produced by the BGS of relevance to professionals who make decisions on SuDS design, construction and approval. The maps will help: (1) make preliminary decisions on the suitability of the subsurface for infiltration SuDS; (2) make preliminary decisions on the type of infiltration SuDS that will likely be appropriate; (3) assess SuDS planning applications to determine whether the necessary factors have been considered; and (4) determine whether infiltration SuDS could be appropriate where a non-infiltrating SuDS technique has been proposed.
	GIS layer 'Areas Susceptible to Groundwater Flooding'	Environment Agency Geostore	GIS Layer	Strategic-scale mapping indicating areas where groundwater emergence may occur.

	Dataset	Source	Format	Description
Sewer	DG5 Register of sewer flooding incidents, by post code area.	Thames Water Utilities Limited	MS Word Doc	Indicates post code areas that may be prone to flooding as have experienced flooding in the last 20 years due to hydraulic incapacity. However, given that TWUL target these areas for maintenance and improvements, areas that experienced flooding in the past may no longer be at greatest risk of flooding.
Artificial	GIS layer of canals	Basingstoke Canal Authority	GIS Layer	GIS layer showing the centre line of the Basingstoke Canal where it passes through Rushmoor.
Other	LiDAR data (DTM, ASCII)	Rushmoor Borough Council	GIS ASCII	Provides a useful basis for understanding local topography and the surface water flood risk in the area. Spatial resolution of 1m, resampled to 5m.
Emergency Planning	Flood Warning Areas	Environment Agency Geostore	GIS Layer	Indicates which areas are covered by the flood warning system.
Planning	OS Mapping of RBC administrative area (1:10K)	Ordnance Survey website	GIS format	Provides background mapping to other GIS layers. Designed for use at 1:10K scales.
	GIS layer of administrative boundary	Ordnance Survey website	GIS format	Defines the administrative area of the Borough for mapping purposes.
	GIS layer of post code boundaries	Ordnance Survey website	GIS format	Delineates post code boundaries for the Borough. Enables mapping of Thames Water Utilities Limited datasets which are provided by post code sector.

Appendix B. Figures

Figure Number	Figure Title
B1	Topography
B2	Surface Waterbodies
B3	Historic Flood Events
B4	Fluvial Flood Zones
B5	Updated Flood Map for Surface Water
B6a	Internal Sewer Flooding
B6b	External Sewer Flooding
B7a	Bedrock Geology
B7b	Superficial Geology
B7c	SuDS drainage potential – infiltration constraints summary
B7d	SuDS drainage potential – drainage summary
B7e	Areas Susceptible to Groundwater Flooding

Appendix C.
SFRA Update Checklist

Checklist on factors to trigger an update to the Level 1 SFRA

1. A significant flood event occurs, following which relevant information should be detailed within an addendum to the Level 1 SFRA. The following information should be included:
    - The mapped extent of the flooding;
    - The date on which the event occurred;
    - The source of the flooding;
    - If known, the return period of the flood event – the likelihood of an event of the same magnitude occurring in any given year;
    - Any amendments to Flood Zone 2 and 3 carried out by the Environment Agency as a result of the flooding.

2. The NPPF or PPG are amended, with subsequent impacts on the approach to flood risk, for example:
    - An amendment is made to the application of the Sequential or Exception Test;
    - An amendment is made to the definition of fluvial flood zones;
    - Land use vulnerability definitions, presented in the PPG, are amended;
    - The approach to management of SuDS is amended.

3. The Environment Agency releases updates or amendments to its detailed modelling of the River Blackwater, or amends its standing advice. An update would be required if:
    - Updates to the River Blackwater model alters the 1 in 20 year plus climate change (defended), 1 in 100 year (undefended), 1 in 100 year plus climate change (defended) or 1 in 1000 year (undefended) outline. If this is the case Flood Zone 3b, Flood Zone 3, Flood Zone 3 with climate change and Flood Zone 2 should be re-mapped within the Level 1 SFRA;
    - If any other flood risk data is updated, such that the SFRA does not provide the most relevant and up-to-date information;
    - Environment Agency standing advice is altered so that it is no longer in-line with Flood Risk Management Policy Considerations, or other guidance within this Level 1 SFRA. Should this be the case, it is recommended that the Environment Agency is consulted.

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