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# Reigate & Banstead Borough Council Level 2 Strategic Flood Risk Assessment

Final Report

October 2017

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# JBA Project Manager

Alistair Clark  
 8a Castle Street  
 Wallingford  
 Oxfordshire  
 OX10 8DL

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## Contract

This report describes work commissioned by Reigate and Banstead Borough Council in February 2017. Alistair Clark and Richard Pardoe of JBA Consulting carried out this work.

Prepared by ..... Richard Pardoe MEng  
 Assistant Analyst

Reviewed by ..... Alistair Clark BSc MSc  
 Senior Analyst

## Purpose

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## Acknowledgements

JBA Consulting would like to thank Rosanna Sterry of Reigate and Banstead Borough Council, and Nick Philpott at the Environment Agency for their assistance in preparing this report.

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# Contents

1	Introduction .....	1
1.1	Introduction .....	1
1.2	SFRA Objectives .....	1
1.3	How to use the Level 2 SFRA .....	1
1.4	Consultation .....	1
2	How did we identify sites for the Level 2 assessment? .....	2
3	What detailed modelling data has been used? .....	3
3.1	Environment Agency detailed hydraulic models.....	3
4	How have we assessed climate change?.....	4
4.1	Government guidance on climate change.....	4
4.2	Climate change modelling.....	4
5	Level 2 Site flood risk summaries.....	5
6	Implications for development and requirements for the Exception Test .....	6
6.1	Sites within Flood Zone 2 and 3 and the Exception Test .....	6
6.2	Sites at risk from flooding from ordinary watercourses.....	6
6.3	Sites at risk of significant surface water flooding.....	7
6.4	Opportunities for flood betterment.....	7
7	Future use of SFRA data .....	8
Appendices .....		I
A	Site summary sheets .....	I
B	Site maps .....	I

## List of Tables

Table 4-1: Climate Change Allowances ..... 4

## Abbreviations / Glossary

Term	Definition
AEP	Annual Exceedance Probability
AStGWF	Areas Susceptible to Groundwater Flooding
Brownfield	Previously developed parcel of land
CC	Climate change - Long term variations in global temperature and weather patterns caused by natural and human actions.
CS	Core Strategy for Reigate and Banstead Borough Council (adopted 2014) - part of the Local Plan for the area. This sets out development principles and targets.
CFMP	Catchment Flood Management Plan- A high-level planning strategy through which the Environment Agency works with their key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk.
CIRIA	Construction Industry Research and Information Association
Defra	Department for Environment, Food and Rural Affairs
Designated Feature	A form of legal protection or status reserved for certain key structures or features that are privately owned and maintained, but which make a contribution to the flood or coastal erosion risk management of people and property at a particular location.
DG5 Register	A water-company held register of properties which have reported sewer flooding due to hydraulic overload, or properties which are 'at risk' of sewer flooding more frequently than once in 20 years.
DMP	Currently in preparation and following on from the CS the DMP will provide more detailed policy requirements and site allocations.
EA	Environment Agency
EU	European Union
FEH	Flood Estimation Handbook
Flood defence	Infrastructure used to protect an area against floods as floodwalls and embankments; they are designed to a specific standard of protection (design standard).
Flood Risk Area	An area determined as having a significant risk of flooding in accordance with guidance published by Defra and WAG (Welsh Assembly Government).
Flood Risk Regulations	Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management.
Floods and Water Management Act (FWMA)	Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods, the aim of which is to clarify the legislative framework for managing surface water flood risk in England.
Fluvial Flooding	Flooding resulting from water levels exceeding the bank level of a main river
FRA	Flood Risk Assessment - A site-specific assessment of all forms of flood risk to the site and the impact of development of the site to flood risk in the area.

Term	Definition
FRMP	Flood Risk Management Plan
FZ	Flood Zones
GI	Green Infrastructure – a network of natural environmental components and green spaces that intersperse and connect the urban centres, suburbs and urban fringe
Greenfield	Undeveloped parcel of land
Ha	Hectare
HELAA	Housing and Economic Land Availability Assessment - a technical study which is used to assist in the monitoring of whether there is an adequate supply of deliverable land for Housing and Employment related uses etc. It provides information on site characteristics and constraints to inform the planning policy process through the Local Plan preparation by identifying land that is potentially suitable, available and achievable for housing and economic development uses to meet identified needs over the plan period. It incorporates the SHLAA mentioned in the NPPF (see below). Identification in the HELAA does not in itself confirm that development is acceptable.
Indicative Flood Risk Area	Nationally identified flood risk areas, based on the definition of 'significant' flood risk described by Defra and WAG.
IDB	Internal Drainage Board
JBA	Jeremy Benn Associates
LFMRS	Local Flood Risk Management Strategy
LLFA	Lead Local Flood Authority - Local Authority responsible for taking the lead on local flood risk management
LPA	Local Planning Authority
mAOD	metres Above Ordnance Datum
Main River	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers
NPPF	National Planning Policy Framework (2012)
OFWAT	Water Services Regulation Authority
Ordinary Watercourse	All watercourses that are not designated Main River. Local Authorities or, where they exist, IDBs have similar permissive powers as the Environment Agency in relation to flood defence work. However, the riparian owner has the responsibility of maintenance.
OS NGR	Ordnance Survey National Grid Reference
PFRA	Preliminary Flood Risk Assessment
Pluvial flooding	Flooding as a result of high intensity rainfall when water is ponding or flowing over the ground surface (surface runoff) before it enters the underground drainage network or watercourse, or cannot enter it because the network is full to capacity.
PPG	National Planning Practice Guidance published by Central Government (Gov.uk) as a web resource and updated on an occasional basis
PPS25	Planning and Policy Statement 25: Development and Flood Risk – superseded by the NPPF and PPG
RoFSW	Risk of Flooding from Surface Water mapping, which replaces the uFMfSW
Resilience Measures	Measures designed to reduce the impact of water that enters property and businesses; could include measures such as raising electrical appliances.

Term	Definition
Resistance Measures	Measures designed to keep flood water out of properties and businesses; could include flood guards for example.
Return Period	An estimate of the interval of time between events of a certain intensity or size, in this instance it refers to flood events. It is a statistical measurement denoting the average recurrence interval over an extended period of time.
RFCC	Regional Flood and Coastal Committee
Risk	In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring, and the consequence of the flood.
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
SFRA	Strategic Flood Risk Assessment
SHLAA	Strategic Housing Land Availability Assessment - The Strategic Housing Land Availability Assessment (SHLAA) is a technical piece of evidence to support local plan preparation (such as the CS and DMP)s and Sites & Policies Development Plan Documents (DPDs). Its purpose is to demonstrate that there is a supply of housing land in the borough which is available, suitable and achievable.
SoP	Standard of Protection - Defences are provided to reduce the risk of flooding from a river and within the flood and defence field standards are usually described in terms of a flood event return period. For example, a flood embankment could be described as providing a 1 in 100-year standard of protection.
Stakeholder	A person or organisation affected by the problem or solution, or interested in the problem or solution. They can be individuals or organisations, includes the public and communities.
SuDS	Sustainable Drainage Systems - Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques
Surface water flooding	Flooding as a result of surface water runoff because of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or watercourse, or cannot enter it because the network is full to capacity, thus causing what is known as pluvial flooding.
SWMP	Surface Water Management Plan - The SWMP plan should outline the preferred surface water management strategy and identify the actions, timescales and responsibilities of each partner. It is the principal output from the SWMP study.
uFMfSW	Updated Flood Map for Surface Water
WFD	Water Framework Directive



# 1 Introduction

## 1.1 Introduction

Reigate & Banstead Borough Council (the Council) is currently preparing a Development Management Plan (DMP), which will form part of the Local Plan for the Borough together with the adopted Core Strategy (CS). The documents will cover topics including housing, the economy, community facilities and infrastructure, as well as design, climate change and environmental protection. The adopted CS sets out a vision and framework for development in the Borough from 2012 to 2027. The emerging DMP will, when adopted, set out in more detail how these development principles and targets will be implemented and delivered.

This Level 2 Strategic Flood Risk Assessment (SFRA) follows the Level 1 SFRA<sup>1</sup>, produced as a joint study with Mole Valley District Council and Tandridge District Council in line with the approach set out in the National Planning Policy Framework (2012). Together these form part of the evidence base for the Local Plan and is relevant to the DMP being prepared by the Council. It will also provide input to assist with the consideration of individual proposals for planning decision but note that more detailed investigations may be required in relevant circumstances.

This approach is consistent with the National Planning Policy Framework (2012) and in particular Section 10: Meeting the challenge of climate change, flooding and coastal change.

The SFRA Levels One and Two are prepared in accordance with best practice as set out in the National Planning Practice Guidance "Local planning authorities: strategic flood risk assessment" (last updated 28 February 2017)

The County Council (Sustainable Drainage Systems Approving Body) and the Environment Agency have statutory responsibilities related to flooding and have been consulted on this Study

## 1.2 SFRA Objectives

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

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

The Level 1 SFRA identified that Level 2 SFRA assessments were required at a number of sites in the Borough of Reigate and Banstead. Level 2 assessments should be undertaken at all sites which have been identified as 'at risk' and which may be carried forward in the Development Management Plan. The aim of the Level 2 assessments is to determine whether or not the Exception Test as set out in Planning Guidance could be passed, i.e. development could be achieved safely, for sites that have been found to be at flood risk by the Level 1 assessment.

## 1.3 How to use the Level 2 SFRA

The Level 2 report gives a short non-technical summary of how the Level 2 sites were selected, the detailed flood risk data that was used to carry out individual site-level assessments for each of the Level 2 sites, and how climate change was assessed. Further technical detail is given in the Appendices.

The main output of the Level 2 Assessment is the individual site summary sheets (Appendix A), which offer high level flood risk assessments and conclusions for each site.

## 1.4 Consultation

This document has been prepared with the guidance and input of the Environment Agency and Surrey County Council.

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<sup>1</sup> RBBC TO INSERT LINK TO LEVEL 1 ONCE ONLINE

## 2 How did we identify sites for the Level 2 assessment?

The Level 1 SFRA carried out a screening of 52 sites, against available flood risk information including:

- Flood Map for Planning (Rivers and Sea) – Flood Zone 2 and 3
- Risk of Flooding from Surface Water (RoFSW)
- Flood Risk from Reservoirs mapping
- JBA Groundwater flood map
- Historic Flood Map

The sites for screening were identified from a range of sources including the Strategic Housing Land Availability Assessments (SHLAA); Housing and Economic Land Availability Assessment (HELAA) (2017), sites owned by the council or other public organisations, sites suggested as part of the Regulation 18 DMP consultation and land or buildings that are empty or derelict or land which is underutilised in its current form.

The detailed assessment of fluvial flood risk to the 52 identified sites found that 37 of these were entirely located within Flood Zone 1 and therefore considered to be at a low risk of fluvial flooding. Of the sites at considered at higher risk, 15 contain areas of Flood Zone 2 and 11 were identified as containing areas of Flood Zone 2 and Flood Zone 3a.

The assessment of surface water risk identified that 28 sites contained greater than 1% of the 100-year RoFSW extent and seven of these sites had an area of greater than 20% at risk. 22 had a total site area of greater than 20% at risk from the 1 in 1000-year surface water flood map.

6 sites were identified as within the Environment Agency's historic flood outline.

Following the Regulation 18 Consultation and further work on the Development Management Plan the sites to be assessed have been refined further by the Council. 19 sites were taken forward for Level 2 assessment. The primary flood source for the sites (and reason they have been assessed at Level 2) are as follows:

- 13 sites are partly located within the current Flood Zones (3b, 3a and 2), and
- 6 sites are located entirely in Flood Zone 1, but either contain an ordinary watercourse, or have greater than 20% of their area within the RoFSW 1 in 1000 year (0.1%) risk area.

## 3 What detailed modelling data has been used?

### 3.1 Environment Agency detailed hydraulic models

The Environment Agency flood risk mapping programme has produced large detailed hydraulic models within Reigate and Banstead Borough. These cover the River Mole, Burstow Stream, and Redhill Brook and Salfords Stream. Their outputs are incorporated into the existing Flood Zones, but they can also provide additional information on flood probability, rates of onset, depths, velocities and hazards.

The models for the Upper and Middle Mole used in the Level 1 SFRA were originally developed in 2006 and 2007 respectively, and both are in the process of being updated as part of the Environment Agency's flood risk mapping programme at the time of writing. They were developed in accordance with best practice at the time, and their results can still provide valuable information as long as the limitations are understood:

- Flood data used will not have taken into account more recent flood events (e.g. winter 2013/ 2014)
- Techniques used to estimate extreme flood flows may have been updated since the models were originally developed.
- Ground level (LiDAR) and river survey data may be out of date, particularly where new development has taken place.
- Flood alleviation work has been undertaken in the upper catchment that may impact on the flow regimes downstream.

It should be noted that the outputs from the River Mole models have not been used in the Level 2 SFRA as none of the proposed sites are shown to be at risk from the watercourses included in the models.

The scope of the SFRA does not allow for re-survey and re-modelling of these extensive river catchments. However, they were obtained and re-run for climate change scenarios.

Each of the hydraulic models available within the Borough of Reigate and Banstead was reviewed by a senior hydrologist and hydraulic modeller to assess its suitability and limitations for use within a Strategic Flood Risk Assessment.

## 4 How have we assessed climate change?

### 4.1 Government guidance on climate change

Updated government guidance on assessing the impact of climate change on flooding in line with the UKCP09 Climate Change Projections was released in February 2016, and updated in 2017. The guidance provides a range of climate change allowances which are dependent on location (by river basin) and timescale of development (epoch). It also provides several bands (termed 'central', 'higher central' and 'upper end') to test depending on the vulnerability of the development and the Flood Zone within which it is located.

For the purposes of strategic planning, the key epoch considered is 2070-2115 as this reflects the lifetime of development; and the key vulnerability is 'more vulnerable' as this represents a conservative classification incorporating all vulnerabilities. The key allowances to consider for Flood Zone 3a are therefore the Higher Central and Upper End (35% and 70% in Thames river basin) as shown in Table 4-1.

Table 4-1: Climate Change Allowances<sup>2</sup>

River basin district	Allowance category	Total potential change anticipated for the 2080s (2070 to 2115)
Thames	Upper end	70%
	Higher central	35%
	Central	25%

### 4.2 Climate change modelling

In order to assess the impact of these climate change scenarios on the 1 in 100-year flood risk (Flood Zone 3a) at development sites, in accordance with the NPPF, we used the following hierarchy of modelling information as agreed with the Council and the Environment Agency:

- Re-run of existing detailed models with the Higher Central and Upper End climate change flows scenarios.
- Flood Zone 2 as a proxy.

Applying additional flows into hydraulic models above what they were originally optimised for has a tendency to cause instability, and adding 65% or 70% onto the 1 in 100-year flow often leads to model failure. We were able to run both climate change events for the Burstow Stream, and Redhill Brook and Salfords Stream models. The existing River Mole models have not been used in this assessment as none of the proposed sites are shown to be at risk from the watercourses included in the models.

The source of climate change information is noted on the summary sheets under 'Available model data and limitations'.

<sup>2</sup> Flood risk assessments: Climate change allowances, Environment Agency (2017), Accessed online at: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances> on: 24-07-17

## 5 Level 2 Site flood risk summaries

The flood risk summary sheets in Appendix A give flood risk information for each Level 2 site in order to determine whether the Exception Test will be required and/or development will be viable. These include:

- Basic site information (area, type of site, % of site in each Flood Zone)
- Description of sources and mechanisms of flooding
- Flood Zone (1% and 0.1% annual probability events) and functional floodplain extent maps, flood hazard map, flood depth map, flood velocity map, climate change impact maps
- Information on rate of onset and duration of flooding
- Risk of Flooding from Surface Water (RoFSW) map
- Assessment of flood defences.
- A high-level assessment of how sites might be affected during events where there is failure of flood risk management measures (breach or failure), or they are overwhelmed by events that exceed their envisaged design capacity (overtopping).
- An assessment of flood warning coverage
- An assessment of emergency planning procedures and how safe access and egress will be managed
- An assessment of the effect of land use and structures on flood risk both within the potential location plan site and for other development nearby.
- Recommendations on the requirements for drainage control and impact mitigation, including an assessment of likely SuDS suitability and flood betterment opportunities.
- Site-specific development control advice (including for example sequential site design, access and egress, requirements for SuDS, recommendations for drainage control and impact mitigation)
- Information on the requirements for the Exception Test, flood risk assessments and site design.

These summary sheets form the main output of the Level 2 SFRA.

## 6 Implications for development and requirements for the Exception Test

### 6.1 Sites within Flood Zone 2 and 3 and the Exception Test

Guidance is clear that the Sequential Test must be applied first and only if passed should the site consideration extend to Level 2. Only once the Sequential Test is passed should the Exception Test be applied.

Of the sites considered in the Level 2 assessment, there are 13 sites where part of the site falls outside the current Flood Zone 1. For seven of the sites examined, including three for which the proportion of the site outside Flood Zone 1 is less than 1%, it is expected that it will be entirely possible to preserve Flood Zones 2 and 3 (subject to a detailed flood risk assessment) as public green space or other open land category, with built development restricted to Flood Zone 1.

Additionally, innovative designs for buildings within high risk flood areas have been promoted successfully in the UK and elsewhere. See Long term initiatives for flood risk environments (Life) Project - Building Research Establishment

For these seven sites, the Exception Test will only be required if built development is proposed in Flood Zone 2 or 3.

Flood risk assessments must carry out detailed assessments where appropriate to define the Flood Zones and model the effect of climate change. Climate change assessments should be undertaken using the relevant allowances (February 2017) for the type of development and level of risk and in discussion with the EA. The requirements for flood risk assessments are set out in the Level 1 SFRA. Further detail is given on the relevant summary sheets.

The remaining six sites were found to have significant proportions of the site at fluvial flood risk, meaning that built development may need to be located within Flood Zone 2 and/or 3, if the Council wishes to take these sites forward:

Site Code	Site Name
NWH1	Land at Meath Green Lane, Horley
REI1	Library & Pool House, Bancroft Road, Reigate
RTC4	Colebrook, Noke Drive, Redhill
RED8	Land at Reading Arch Road/Brighton Road, Redhill
Trentham	Trentham and Treetops
Woodlea Stables	Woodlea Stables Peek Brook Lane

In this case they will need the Exception Test depending on the vulnerability of the development:

- If More Vulnerable and Essential Infrastructure is located in FZ3a.
- If Highly Vulnerable development is located in FZ2.
- If Essential Infrastructure is located in Flood Zone 3b

Development will not be permitted in the following scenarios:

- Highly Vulnerable infrastructure within FZ3a and FZ3b.
- More Vulnerable and Less Vulnerable Infrastructure within FZ3b.

The site and building design will need to ensure that the development is safe and resilient to the modelled flood risk, and any residual risk in defended areas. A flood mitigation and adaptation approach is likely to be required. Development should be designed using a sequential approach, with built development / higher vulnerabilities located towards areas of lower risk and hazard. The functional Flood Zone 3b and areas of higher hazard should be preserved as public open space. Further detail is given on the relevant summary sheets.

### 6.2 Sites at risk from flooding from ordinary watercourses

There are two sites which fall entirely in Flood Zone 1, but which contain an ordinary watercourse.

These sites must still pass the Sequential Test, taking account of the non-fluvial source of flooding, but will not require the Exception Test. In this case, the area at risk is likely to be limited and as long as it is taken into account in the site design, it should not affect the viability of development. Flood risk assessments must carry out detailed modelling where appropriate to define the Flood Zones and model the effect of climate change. The requirements for flood risk assessments are set out in the Level 1 SFRA. Further detail is given on the relevant summary sheets.

Liaison with Surrey County Council (LLFA) is advised for sites within Flood Zone 1 that contain an ordinary watercourse.

### 6.3 Sites at risk of significant surface water flooding

All developments over 1ha must carry out a flood risk assessment to assess surface water drainage and other sources of flooding. There are 12 sites where greater than 20% of the site area is within the RoFSW 1 in 1000-year risk area.

These sites will still need to pass the Sequential Test, taking account of the non-fluvial source of flooding, but will not require the Exception Test.

Flood risk assessments should consider carrying out surface water modelling to define the level of surface water risk, and the risk areas / flow paths, including the effects of climate change. Drainage designs should 'design for exceedance' and accommodate existing surface water flow routes. Building design (threshold levels etc.) should ensure that development is safe from flooding. The requirements for surface water strategies and flood risk assessment are set out in the Level 1 SFRA. Further detail is given on the relevant summary sheets.

Liaison with the Surrey County Council (LLFA) is advised for sites within Flood Zone 1 that contain significant surface water flood risk.

### 6.4 Opportunities for flood betterment

Many of these developments offer real opportunities to provide flood betterment alongside sustainable development. Such opportunities should be discussed with the LLFA and Environment Agency as appropriate at an early planning stage. These include:

- All developments should take the opportunity to implement exemplar SuDS design, delivering multiple benefits for the development (water quality, biodiversity, amenity, green infrastructure).
- Opportunities for developer contributions to flood mitigation options under consideration by organisations such as Surrey County Council or Environment Agency.
- Improvements or daylighting of culverts and removal of other structures which may restrict flow, have the potential to reduce flood risk, provide amenity space and improve habitats.
- Opportunities for mitigation of surface water flow routes to improve flood risk on adjoining land – particularly to public buildings such as hospitals and schools.

Opportunities have been highlighted on the relevant site summary sheets.

## 7 Future use of SFRA data

The Level 2 SFRA has examined each of the sites deemed to be at flood risk in more detail. The aim of the Level 2 assessments is to determine whether or not the Exception Test could be passed, i.e. development could be achieved safely, for sites that have been found to be at flood risk by the Level 1 assessment. The limitations of the available detailed modelling have been highlighted, and detailed flood risk assessments will be required on all of these sites to ensure that they are designed safely.

It is important to recognise that the SFRA has been developed using the best available information at the time of preparation. This relates both to the current risk of flooding from rivers, and the potential impacts of future climate change. In particular the Environment Agency's detailed river models for the River Mole are in the process of being updated as part of their ongoing flood risk mapping programme.

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



## Appendices

- A Site summary sheets
- B Site maps

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**Registered Office**

South Barn  
Broughton Hall  
SKIPTON  
North Yorkshire  
BD23 3AE  
United Kingdom

t:+44(0)1756 799919  
e:info@jbaconsulting.com

**Jeremy Benn Associates Ltd**  
Registered in England  
3246693



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