

# 1 Introduction

- 1.1 Faber Maunsell was appointed by Hastings Borough Council on 27th April 2007 to undertake a Strategic Flood Risk Assessment of Hastings Borough. This study will inform the preparation of the Local Development Framework and assist the Local Planning Authority in the allocation of sites for future development and general decision-making.
- 1.2 The scope of the study was described in a Brief issued by the Borough Council and dated March 2007. Maps showing the location of Hastings Borough within East Sussex and the main urban areas within the Borough are shown as Figures 1 and 2 respectively.

Figure 1: Location of Hastings Borough within East Sussex



Figure 2: Overview of Hastings Borough



- 1.3 The agreed methodology, designed to comply with the recently published Planning Policy Statement 25 (PPS25) and its Guide Companion, divided the study into two phases. The first phase of the study was to consist of the collection and evaluation of all available data and information relevant to the strategic assessment of flood risk within the Council. The second phase involved the preparation of a strategic flood risk assessment (SFRA) for the whole of Hastings Borough.
- 1.4 The second phase of the SFRA consisted of two levels. Level 1 involved an assessment of the flood risk throughout the Borough and level 2 focused on particular sites of interest to Hasting Borough Council.
- 1.5 The SFRA has been carried out in close collaboration with officers of the Council and key stakeholders such as the Environment Agency, Southern Water, etc. The results of this assessment are described in this Report and should allow the Local Authority to undertake the Sequential and Exception Test required as part of the planning process.
- 1.6 A series of recommendations have also been made to ensure the SFRA is regularly and efficiently updated so it can be confidently used by the Council in the future.

## 2 User Guide

2.1 The purpose of this study is to allow the application of the Sequential and Exception Test by the Local Planning Authority and by doing so introduce the concept of flood risk at the early stages of the planning process.

2.2 In order to ensure an adequate understanding of the elements involved in this process, a summary of the essential concepts is presented below.

### **The Sequential Test**

2.3 The Sequential Test is applied by Local Planning Authorities to establish land suitable for development (residential, commercial, industrial, etc) to be included in their Local Development Documents and to demonstrate that there are no alternative locations in areas with a lower probability of flooding that would be suitable for the type of development or land use proposed.

2.4 Any new development should be directed to Flood Zone 1 (low risk) wherever possible, and then sequentially to Flood Zones 2 and 3, and to the areas of least flood risk within Flood Zones 2 and 3, as identified by the Strategic Flood Risk Assessments (SFRA) (see Table D.1 and Table D.2 of PPS25, included as Appendix I).

2.5 The Local Planning Authority must demonstrate that an array of potential development sites has been considered in conjunction with the Flood Zone information from the Strategic Flood Risk Assessment and that they have applied the Sequential Test, and where necessary, the Exception Test, in the site allocation process. In cases where development cannot be fully met through the provision of site allocations, Local Planning Authorities are allowed to make a realistic allowance for windfall development if robust evidence has been provided, based on windfall delivery rates and expected future trends.

2.6 The Sequential Test should also be used by Local Planning Authorities to resolve planning applications where Local Development Documents policies have not applied the Sequential Test when allocating sites. In these cases it is the responsibility of the developer to collect the relevant evidence for their site to allow the Local Planning Authority's planning officer to carry out the Sequential Test.

2.7 A schematic showing the train of thought when applying the Sequential Test as well as the maps to be referred to during this process is provided in Figure 3. A step by step guide to the application of the Sequential Test is provided below.

- 1) Identify the site. (location, size, existing and proposed use)
- 2) Is the potential allocation site in an area at low risk of flooding? To answer this question it is necessary to refer to the following maps:
  - 002 Flood Zones: Establish the location of the site within the various Flood Zones. In this map flood zones 2 and 3 (EA) refer to tidal flooding without taking into consideration flood defences whereas the other flood zone identified refer to fluvial flooding. No formal river defences exist in the area. If a site is located outside the flood zone areas shown in the Map, it can be assumed that is located within flood zone 1 (low risk).
  - 004 Flooding History: Establish if the site has been affected by flooding from any source in the past or if it is located in an area with recognised flooding problems.
  - 005 Potential Flood Risk: Determine if the site has the potential to be affected by factors such as existing infrastructure or local conditions. Additionally, establish if the site is within a buffer zone.
  - 006 Groundwater Risk: Establish if the site is likely to be affected by springs or is located in a dry bed and therefore prone to occasional flooding.

When carrying out the sequential test, the hierarchy in terms of determining the level of flood risk is as follows:

- Flood Zones – most important factor
- Flooding History
- Groundwater Risk
- Potential Flood Risk

It is important to emphasise the importance of applying common sense when establishing the level of flood risk at any particular location as each site is different.

- 3) Is flood risk at the site likely to be affected by climate change? This question can be answered by referring to the following maps:
  - 011 Climate Change Outline: Establish if the site is likely to be affected by extreme flooding
- 4) Is there an alternative site not sensitive to climate change? To answer this question it is necessary to refer to the Local Plan and be aware of the existence of potential sites outside the Climate Change Outline shown in Map 11.
- 5) Is there an alternative potential location in an area at low risk of flooding? To answer this question it is necessary to refer to the Local Plan and be aware of the existence of potential sites within Flood Zone 1 as shown in Map 2.
- 6) Is this alternative site less suitable taking into account other planning issues? This should be assessed by a planner with good local knowledge and referring to the Local Plan and the following map:
  - 008 Special Considerations: Shows the areas with international, national and local designations that are likely to be subject to special planning conditions.
- 7) Is the potential allocation site in an area of medium risk of flooding? To answer this question it is necessary to refer to the following maps:
  - 002 Flood Zones: Establish the location of the site within the various Flood Zones. In this map flood zones 2 and 3 (EA) refer to tidal flooding without taking into consideration flood defences whereas the other flood zone identified refer to fluvial flooding. No formal river defences exist in the area. For a site to be located in an area of medium risk of flooding, it must lie within flood zone 2. It must be noted that when a site falls within more than one flood zone, the higher risk zone in terms of flooding should be assumed for the site. The hierarchy in terms of flood zones is as follows:
    - Zone 3b (functional floodplain) – higher flood risk area
    - Zone 3a (high probability)
    - Zone 2 (medium risk)
    - Zone 1 (low risk) – lower flood risk area
  - 004 Flooding History: Establish if the site has been affected by flooding from any source in the past or if it is located in an area with recognised flooding problems.
  - 005 Potential Flood Risk: Determine if the site has the potential to be affected by factors such as existing infrastructure or local conditions. Additionally, establish if the site is within a buffer zone.
  - 006 Groundwater Risk: Establish if the site is likely to be affected by springs or is located in a dry bed and therefore prone to occasional flooding.

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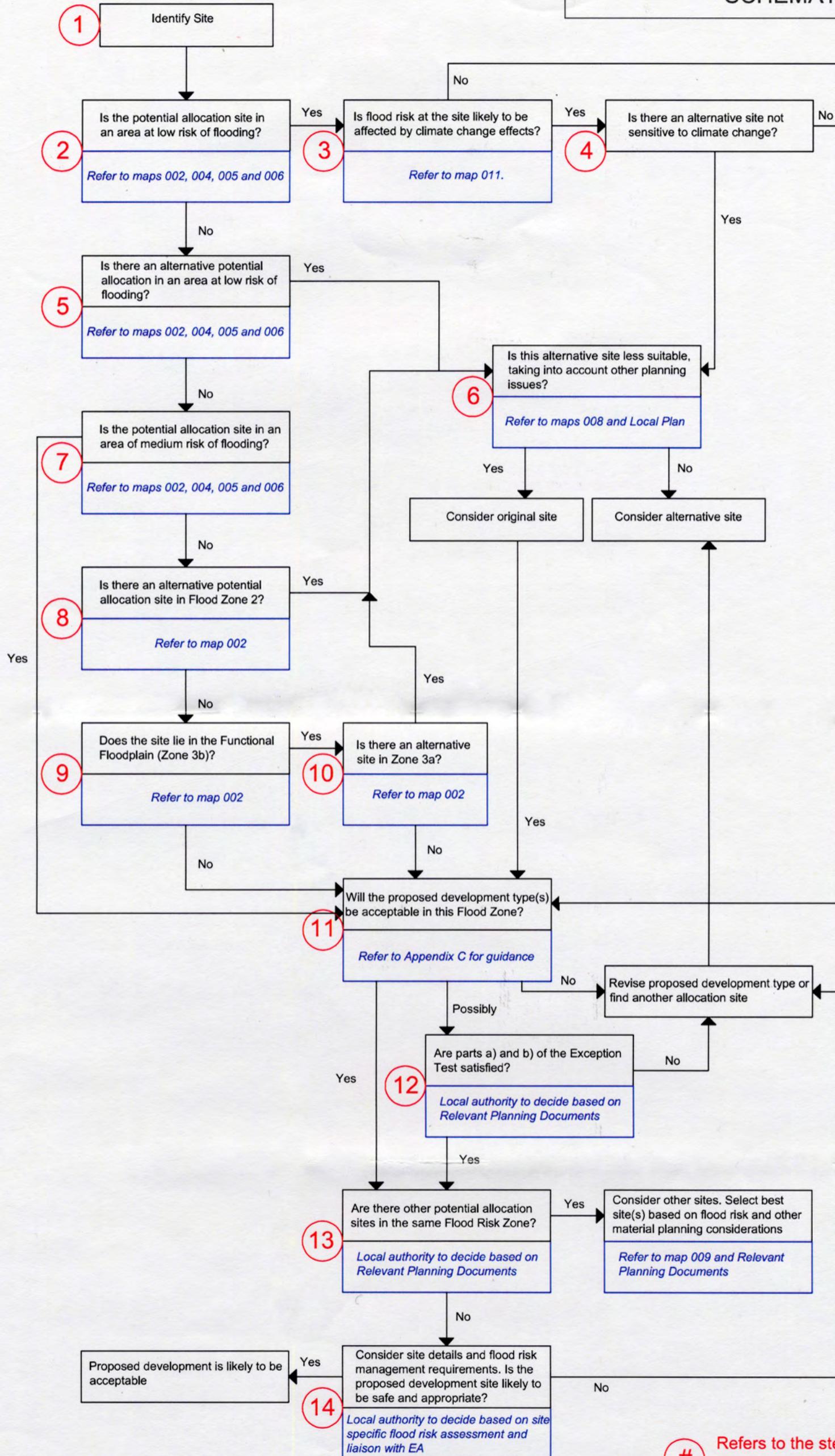
It is important to emphasise the importance of applying common sense when establishing the level of flood risk at any particular location as each site is different.

- 8) Is there an alternative potential allocation site in Flood Zone 2? To answer this question it is necessary to refer to the Local Plan and be aware of the existence of potential sites within Flood Zone 2 as shown in Map 2.
- 9) Does the site lie in the functional floodplain, Zone 3b? To answer this question is necessary to refer to the following maps:
  - 002 Flood Zones: Establish the location of the site within the various Flood Zones. In this map flood zones 2 and 3 (EA) refer to tidal flooding without taking into consideration flood defences whereas the other flood zone identified refer to fluvial flooding. No formal river defences exist in the area. When a site falls in Flood Zone 3 (EA), it must be assumed that this correspond to the functional floodplain, Flood Zone 3b unless additional information is put forward to prove otherwise. It must be noted that when a site falls within more than one flood zone, the higher risk zone in terms of flooding should be assumed for the site. The hierarchy in terms of flood zones is as follows:
    - Zone 3b (functional floodplain) – higher flood risk area
    - Zone 3a (high probability)
    - Zone 2 (medium risk)
    - Zone 1 (low risk) – lower flood risk area
- 10) Is there an alternative site in Zone 3a? To answer this question it is necessary to refer to the Local Plan and be aware of the existence of potential sites within Flood Zone 3a as shown in Map 2.
- 11) Will the proposed development type(s) be acceptable in this Flood Zone? To answer this question is necessary to refer to Flood Risk Vulnerability section in Appendix C for guidance.
- 12) Are parts a) and b) of the Exception Test satisfied? To answer this question it is necessary to apply planning judgement and refer to relevant planning documents.
- 13) Are there other potential allocation sites in the same Flood Risk Zone? To answer this question it is necessary to refer to the relevant planning documents.
- 14) Is the proposed development site likely to be safe and appropriate? This should be decided based on the site specific flood risk assessment and other planning considerations. Liaison with the EA will be necessary to determine if the FRA addresses all flood risk issues and delivers a safe and compatible development.

Figure 3: Application of the Sequential Test

(SEE OVERLEAF)

# APPLICATION OF SEQUENTIAL TEST SCHEMATIC



# Refers to the step by step guide to the application of the Sequential Test, as described in Chapter 2 of the Report.

2.8 The checklist used by the Environment Agency to facilitate the demonstration of the application of the Sequential Test to planning applications is provided as Table 1.

Table 1: EA Checklist for the demonstration of the application of the Sequential Test to planning applications

Question	Answer Yes/No	Sequential Test – passed or failed?
1. Is this application consistent in scale, development type and location, with a site allocation that has already been sequentially tested and included in the Local Development Document (LDD)?	If yes, state which allocation and the location in the development plan. <b>If the answer is 'No' go to Question 2.</b>	If the answer is Yes the Sequential Test has been passed – FINISH HERE
2. Does the application site fall within an area identified for 'windfall' development that has been agreed as part of the LDD in association with a Strategic Flood Risk Assessment (SFRA)?	If yes, state the location in the LDD. <b>If the answer is 'No' or there are no such areas identified in the LDD, go to Question 3.</b>	If the answer is Yes the Sequential Test has been passed – FINISH HERE
3. Does the LDD or background documents contain reasonably available, alternative site allocations that are situated in a lower flood risk zone?	If yes, state which allocation(s) and the location in the development plan. <b>If the answer is 'No' go to Question 4</b>	If the answer is Yes the Sequential Test has been failed – FINISH HERE
4. Does the development plan or background documents contain reasonably available, alternative site allocations that are within the same Flood Zone and subject to a lower probability of flooding from all sources as detailed by the SFRA?	If yes, state which allocation(s) and the location in the development plan.	<b>If the answer is No to Questions 3 and 4 the Sequential Test has been passed.</b> <b>If the answer is Yes to Question 4, the Sequential Test has been failed – FINISH HERE</b>

(Source Guide Companion to PPS25)

### The Exception Test

2.9 Application of the Sequential Test should ensure that more vulnerable property types, such as residential housing will not be allocated to areas at high risk of flooding. In exceptional situations, there may be well-founded reasons for a development type which is not entirely compatible with the level of flood risk at a particular site to nevertheless be considered. In these circumstances, it will be necessary for the Local Planning Authority or developer to demonstrate that the site qualifies for development in the manner proposed by passing all elements of the Exception Test.

2.10 The Exception Test should only be applied following application of the Sequential Test. There are three rigorous conditions, all of which must be fulfilled before the Exception Test can be passed. These conditions are as follows:

- a) it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared. If the Local Development Document (LDD has reached the 'submission' stage (see Figure 4.1 of PPS12: Local Development Frameworks) the benefits of the development should contribute to the Core Strategy's Sustainability Appraisal (SA));
- b) the development must be on developable (as defined in PPS3: Housing) previously-developed land or, if it is not on previously-developed land, that there are no reasonable alternative sites on developable previously-developed land; and

- c) a site-specific Flood Risk Assessment must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall”.

- 2.11 When considering part a) of the test, if a planning application fails to score favourably against the aims and objectives of the Sustainability Appraisal, the Local Planning Authority should consider whether the use of planning conditions and/or Section 106 Agreements of the Town and Country Planning Act, 1990, could make it do so. Where this is not possible the Exception Test has not been satisfied and planning permission should be refused.
- 2.12 In the absence of a Sustainability Appraisal, the developer/Local Planning Authority will have to provide a sound justification explaining in detail how the planning application provides wider sustainability benefits to the community that outweigh flood risk. Local Planning Authorities may consider the use of a sustainability checklist for this purpose.
- 2.13 Assistance on the consideration of part b) of the test can be found within Planning Policy Statement 3: Housing.
- 2.14 With regard to part c) it is the responsibility of the developer to propose a comprehensive flood risk management strategy for the site in question, covering:
- the design of any flood defence infrastructure;
  - access;
  - operation and maintenance;
  - resident awareness;
  - flood warning; and
  - evacuation procedures and funding arrangements.
- 2.15 The breach analysis work carried out in Bulverhythe and West Marina should assist the Council when undertaking the exception test in those areas, as it provides a good indication of the sectors at low, medium and high risk of flooding and the danger posed by a potential breach.
- Presentation of Results**
- 2.16 A GIS mapping system that allows layer superimposition was adopted to present the results. This system enables the analysis of all the factors influencing flood risk and facilitates the application of the Sequential and Exception tests.
- 2.17 The various maps produced as part of this study have been formatted so information is not overlooked or missed due to the superimposition of layers or resolution. When opening individual tables to create new maps, special attention is required to ensure all layers are fully visible and nothing is ignored.
- 2.18 The software package used for this purpose was MapInfo which is also used by the Environment Agency. This program is however compatible with most GIS standard packages which can also be used to access the data.
- 2.19 A more detailed explanation of the GIS layers used can be found in the GIS Layers and Maps section of this report.
- Optimising the Use of the SFRA**
- 2.20 To ensure this document is used to its full potential, the following table has been prepared.

Table 2: SFRA and the Planning Process

Task	Stage within Planning Process	Refer to	Mapping	To be carried out by
Application of the Sequential Test	Initial	Schematic shown as Figure 3 of this report and process described in Section 2.7	Maps reference shown in schematic (Figure 3)	Local Planning Authority
Application of Exception Test	If necessary and only after Sequential Test has been applied	The Exception Test section in Chapter 2 of this report	Refer to all maps (as necessary)	Local Planning Authority or Developer
Site Specific Flood Risk Assessments (FRA)	As early as possible	Appendix C for requirements based on Flood Zones	Refer to: Map 002 for identification of flood zone Map 004 for flooding history Map 005 for potential flood risk Map 006 for groundwater risk Map 008 for special considerations Map 009 for residual flood risk Map 010 for areas inadequate for infiltration techniques FD2320 Maps (if necessary)	Competent drainage and flood risk professionals appointed by the Developer
Sustainable Drainage Systems (SUDS)	To accompany FRAs	Appendix C for background information	Refer to: Map 010 for areas inadequate for infiltration techniques Map 005 for potential flood risk	Competent drainage and flood risk professionals appointed by the Developer

## 3 Area Overview

- 3.1 Hastings Borough is located within East Sussex on the south east coast of England. The Borough has an area of 3,076ha, the majority of which is used for residential purposes.
- 3.2 The main settlements within the Borough include Hastings town centre, the Old Town, Ore Village, St Helens and St Leonards.
- 3.3 Hastings Borough has been identified as a key area in the development of the Sussex coastal towns (South East England Regional Assembly, 2004).
- 3.4 The vast majority of flooding problems in the Borough cannot be attributed to a single source but are largely as a result of a combination of factors such as surge, tide locking, surface water runoff, groundwater, high river flows, deficiencies/problems with the sewer network, and overland flow.
- 3.5 The two sources likely to have the greatest impacts in terms of extent and severity of flooding are the sea and the watercourses. The impact of flooding from these sources on their own outweighs that from any other flood risk source within the Borough.
- 3.6 Recent flood alleviation works undertaken by the Environment Agency in the Bulverhythe area of Hastings have significantly reduced the risk of tidal flooding in the area. However, other parts of the Hastings coastline are still affected by tidal flooding and/or overtopping.
- 3.7 The Combe Haven and associated streams also have the potential to cause extensive flooding to locations within the Borough. However, this is less frequent and mostly confined to unoccupied areas (floodplains), as shown in Map 002. As a consequence of the relatively minor effect on people and property, no formal river defences have been built within Hastings Borough.
- 3.8 The Environment Agency has identified a fluvial and a tidal warning area in the Borough. These areas are located within the Combe Haven Catchment and generally cover West Marina and Bulverhythe, to the western end of the Borough. Please refer to map 007 for an indication of the extent of flood warning areas in the Borough
- 3.9 The impact of flooding from others sources such as groundwater, sewers, surface water runoff is limited in its extent even though its local impact, in terms of the depth and velocity of flooding, may be comparable with that from rivers and the sea.
- 3.10 There are a significant number of springs in the area. The areas where springs are frequent as recognised by the EA are shown in map 006. This map also shows locations of dry beds as identified by the Council.
- 3.11 There are seven recognised reservoirs within the Borough. Four of these are in active operation. These are shown in map 005.
- 3.12 No canals exist within the Borough boundaries or its immediate vicinity.
- 3.13 There are areas where significant flooding is the result of a combination of various factors. This is the case at Bulverhythe where groundwater, surface water runoff and tide locking combine to produce flooding.
- 3.14 The risk of fluvial and tidal flooding is increasing as a result of global warming and climate change. PPS25 makes allowances for the likely effects of climate change. These allowances have been taken into consideration throughout this Study.
- 3.15 The only area to have a formal flood plan within the Borough is Bulverhythe. This document sets out the procedure to be followed during times of flooding and divides the Bulverhythe area into 3 distinctive flood sectors as shown in map 007.

## 4 Data Collection

4.1 A Schedule of the data and information considered to be required for the strategic flood risk assessment was prepared at the beginning of the study. The various items of data were grouped into categories and the anticipated source of the information identified.

4.2 As the study progressed, the Schedule was amended to reflect the findings of the data collection process. The final version of the Schedule is given in Table 3 below.

Table 3: Schedule of Data and Information for the preparation of the SFRA

### Section 1 – Sources of Flooding

	Supplied by	Reliable / Complete	Comments
1 Plan (1/25,000 or larger) showing all Main Rivers and COWs in the Borough.	EA/HBC	Yes	
2 Details of all COWs in the Borough, including details of culverted sections.	HBC	Partial	Details not provided for all culverts
3 Summary of all channel long & X-section data available for Main Rivers within the Borough.	FM	Yes	
4 Summary of all channel long & X-section data available for non-Main River watercourses within the Borough.	HBC	No	Not available
5a Flooding Records & Maps - all available data for the whole Borough, including minor events.	HBC	Partial	Missing period 1986/93
5b Flooding records - all available data for Cuckmere & Sussex Havens Catchment.	EA	Yes	Obtained from CFMP
5c Flooding records - all available data for surface water and combined sewers within the Borough.	SW/HBC	Partial	Only last 10 years provided
6 Report & Plans for Flood Alleviation Schemes, including details of design flood flows, flood levels and defence levels.	EA	Yes	Bulverhythe FAS only
7 Maps showing areas protected by the various Flood Alleviation Schemes and the standard of protection provided.	EA	Yes	Bulverhythe FAS only
8 Description of all computer-based hydraulic modelling carried out in the Combe Haven catchment (Main Rivers and tributaries), specifying lengths of channels modelled, including details of any earlier modelling.	FM/EA	Yes	Fluvial: Faber Maunsell Tidal: Capita Symonds
9a Summary of all stream flow gauging stations in the Combe Haven catchment (i.e. OS grid ref, gauge type, period of record, etc).	EA	N/A	
Continued over....			

Continued....	Supplied by	Reliable / Complete	Comments
9b Summary of all water level recorder stations ditto	EA	Yes	Only brief details provided
10 Plan showing principal surface water sewers in Hastings Borough.	HBC	Yes	
11 Details of Flood Warning Schemes (including emergency response) in operation in the Borough.	HBC	Yes	Bulverhythe Flood Plan only
12 Details of flooding from Canals and location of storm overflow weirs.	HBC	N/A	
13 Details of existing flood storage lagoons and runoff retention ponds in the Borough.	HBC/SW	Partial	Details not provided for all

### Section 2 – Topography

	Supplied by	Reliable / Complete	Comments
1 OS Base Maps in electronic format on CD (coverage of the whole Borough)	HBC	Yes	
2 Selected LIDAR data	EA	Partial	Not all Borough covered
3 OS level data from major development plans	HBC	Partial	Not all sites covered
4 OS level data and floodplain obstruction details from major highway schemes	ESCC	No	No OS level data available

### Section 3 – Land Use Planning

	Supplied by	Reliable / Complete	Comments
1 Local Plan and/or Local Development Framework (if available).	HBC	Yes	Local Plan (2004)
2 Hastings Borough Council Urban Housing Capacity Assessment.	HBC	Partial	Only Map provided
3 Hastings Borough Council Key Issues Consultation Report Summary of Responses.	HBC	Yes	From website
4a Details of Major Development Areas (Existing & Proposed) in the Local Planning Authority area.	HBC	Partial	Some info provided
4b County Structure Plan.	ESCC	Yes	From website
4c Regional or Sub-Regional Strategy Studies.	RA	Yes	From website
5 Details of significant environmental sites in the Borough (NNRs, SSSIs, SIAs etc).	HBC	Yes	
Continued over....			

Continued....	Supplied by	Reliable / Complete	Comments
6 Catchment Flood Management Plans (CFMPs) and Local Environmental Action Plans (LEAPs) or most recent equivalent.	EA	Yes	No LEAPs available for Hastings Borough
7 Shoreline Management Plans (SMPs)	HBC	Yes	From website
8 Land Use Maps	HBC	Yes	
9 Local Drainage Studies	HBC	N/A	

KEY: HBC: Hastings Borough Council  
 SW: Southern Water  
 ESCC: East Sussex County Council  
 FM: Faber Maunsell Limited

EA: - Environment Agency  
 BW: - British Waterways  
 RA: -Regional Assembly  
 ES: Emergency Services

#### 4.3

The appropriate authority (as listed in the "supplied by" column in Table 3) was contacted either by the Council or directly by Faber Maunsell with a request for the information outlined under the relevant item of data or information required. The initial request was usually followed by further correspondence or an exchange of telephone calls, faxes or e-mails. The completeness of the data ultimately obtained under each item is summarised and commented on in the third and fourth columns of Table 3. All the data and information received from the various sources was then collated and evaluated prior to incorporation into this study.

## 5 GIS Layers and Maps

- 5.1 A series of maps have been produced to accompany this study and facilitate the application of the Sequential and Exception Tests. A GIS based mapping system using the software package 'MapInfo' was implemented for this effect.
- 5.2 MapInfo uses a series of tables and allows superimposition of their contents to facilitate assessment of the information. This principle has been used to create the various maps necessary for this study as described in Table 5.
- 5.3 The tables containing information relevant to the study were provided by the various key stakeholders. A review of the information provided for mapping purposes is carried out below.

Table 4: GIS Tables Used for Mapping

Table Name	Supplied by	Reliable / Complete	Comments
Areas Benefiting from Defences	EA	Partial	Combe Haven Catchment only. Slightly misaligned
Coastal Flood Warning Area	EA	Partial	Slightly Misaligned
Flood Defences 200yr SoP	EA	Yes	Bulverhythe FAS are only formal flood defences in the Borough (EA)
Flood Zone 2 (EA)	EA	Partial	Hollington Stream misaligned
Flood Zone 3 (EA)	EA	Partial	Hollington Stream misaligned
Fluvial Flood Warning Areas	EA	Partial	Slightly Misaligned
Major Aquifer High Soil Class	EA	Yes	
Major Aquifer Intermediate Soil Class	EA	Yes	
Major Aquifer Low Soil Class	EA	Yes	
Minor Aquifer High Soil Class	EA	Yes	
Minor Aquifer Intermediate Soil Class	EA	Yes	
Minor Aquifer Low Soil Class	EA	Yes	
Reservoirs in Operation	EA	Partial	
Springs	EA	Yes	Confirmed by HBC but likely to be incomplete
Water Management Structures	EA	Yes	All recognised for the Borough included (EA)
Flooding Incidents under Storm Conditions (Emergency Services)	ES/HBC	Partial	Only last ten years provided
Climate Change Outline Tidal 200yr_2115	FM	Yes	From extreme water level estimation carried out by FM following EA data and PPS25 guidelines
Climate Change Outline 1000yr+20%	FM	Yes	Based on Hydraulic modelling carried out by FM 1 in 1000yr+20%
D_Max Legend	FM	Yes	Maximum Depth Legend (refer to Appendix A)

Table Name	Supplied by	Reliable / Complete	Comments
Dur_Legend	FM	Yes	Maximum Duration Legend (refer to Appendix A)
Escarpment Identification	FM	Yes	Only the most significant identified
FD2320 Legend	FM	Yes	Flood Risk Assessment Guidance for New Developments (refer to Appendix A)
Model 2004	FM	Yes	Model for Bexhill to Hastings Link Road
Model 2007	FM	Yes	Additional modelling for SFRA
Onset Legend	FM	Yes	Rate of Onset Legend (refer to Appendix A)
SFRA_brch3_2115_20_64_fd2320	FM	Yes	Breach analysis results to FD2320 20yr RP in 2115
SFRA_brch3_2115_200_66_fd2320	FM	Yes	As previous for 200yr RP
SFRA_brch3_2115_1000_68_fd2320	FM	Yes	As previous for 1000yr RP
SFRA_brch3_2115_20_64_V/d/dur/ons	FM	Yes	Breach analysis results
SFRA_brch3_2115_20_64_d	FM	Yes	Breach analysis Depth results 20yr RP in 2115
SFRA_brch3_2115_20_64_dur	FM	Yes	Breach analysis Duration results 20yr RP in 2115
SFRA_brch3_2115_20_64_ons	FM	Yes	Breach analysis Onset results 20yr RP in 2115
SFRA_brch3_2115_200_66_V/d/dur/ons	FM	Yes	As above for 200yr RP
SFRA_brch3_2115_1000_68_V/d/dur/ons	FM	Yes	As above for 1000yr RP
V_Max Legend	FM	Yes	Maximum Velocity Legend (refer to Appendix A)
Zone 2_Medium Risk	FM	Yes	Based on Hydraulic modelling carried out by FM
Zone 3a_High Probability	FM	Yes	Based on Hydraulic modelling carried out by FM
Zone 3b_Functional Floodplain	FM	Yes	Based on Hydraulic modelling carried out by FM 1in 20 year RP
Poor infiltration soil CLAY	FM/EA	Yes	Based on Geology Map
Ancient Monuments	HBC	Yes	Part of Local Plan
Area of Outstanding Natural Beauty	HBC	Yes	Part of Local Plan
Areas with Overtopping Problems	HBC	Yes	
Areas with potential fluvial flooding	HBC	Yes	Locations identified by HBC
Borough Boundary	HBC	Yes	
Broad Development Options	HBC	Yes	
Broomgrove Redevelopment Area	HBC	Yes	Part of Local Plan
Buffer Zone 5m	HBC	Yes	

Table Name	Supplied by	Reliable / Complete	Comments
Buffer Zone 8m	HBC	Yes	
Buffer Zone 10m	HBC	Yes	
Bulverhythe Flood Sectors	HBC	Yes	
Caravan Sites	HBC	Yes	Part of Local Plan
Conservation Areas	HBC	Yes	Part of Local Plan
Culverts	HBC	Partial	Only partial details available
Dry Valleys	HBC	Yes	
Employment Development	HBC	Yes	Part of Local Plan
Existing Ponds	HBC	Partial	Only partial details available
Flooding History	HBC	Partial	Issues already resolved not included
Flooding in Town Centre	HBC	Yes	Recent incidents
Housing Sites	HBC	Yes	Part of Local Plan
Industrial Development	HBC	Yes	Part of Local Plan
Landfill Sites	HBC	Yes	
Local Nature Reserves	HBC	Yes	Part of Local Plan
Main Rivers	HBC	Yes	
Open Space Areas	HBC	Yes	Part of Local Plan
Ordinary Watercourses	HBC	Yes	
Ordnance Survey Background	HBC	Yes	
Ordnance Survey Text	HBC	Yes	
Outside Built Up Area	HBC	Yes	Part of Local Plan
Parks and Gardens	HBC	Yes	Part of Local Plan
Playing Fields	HBC	Yes	Part of Local Plan
Potentially Contaminated Land	HBC	Yes	
Principal Roads	HBC	Yes	Part of Local Plan
Proposed Sites	HBC	Yes	Bulverhythe and West Marina Sites
Pumping Stations	HBC	Partial	
Railway	HBC	Yes	Part of Local Plan
Reservoirs not Operating	HBC	Yes	Some capacity details included
Retail Areas	HBC	Yes	Part of Local Plan
Schools	HBC	Yes	Part of Local Plan
Secondary Roads	HBC	Yes	Part of Local Plan
Site of Nature Conservation Importance	HBC	Yes	Part of Local Plan
Site of Specific Scientific Interest	HBC	Yes	Part of Local Plan
Southern Water Infrastructure	HBC	Partial	No information provided by SW
Sewer Manhole	HBC	Yes	
Sewer Network	HBC	Yes	
Urban Areas	HBC	Yes	Part of Local Plan
Various Development	HBC	Yes	Part of Local Plan
Flood incidents SW	SW	Partial	Only last decade included

## 5.4

The above tables were used to create a series of maps to assist the application of the Sequential and Exception Tests. A brief description of the maps produced and the various tables shown on each map is included below.

Table 5: Summary of Maps Created

Map Reference	Map Title	Tables Used
001	River Network	Borough Boundary* Main Rivers* Ordinary Watercourses* Culverts* Ordnance Survey Text* Ordnance Survey Background*
002	Flood Zones	All base tables plus Flood Zone 2 (EA) Flood Zone 3 (EA) Zone 2 Medium Risk Zone 3a High Probability Zone 3b Functional Floodplain
003	Water Management Infrastructure	All base tables plus Flood Defences 200yr SoP Water Management Structures
004	Flooding History	All base tables plus Areas with Overtopping Problems Flooding History Flooding in Town Centre Flooding Incidents SW Flooding Incidents under Storm Conditions (Emergency Services)
005	Potential Flood Risk	All base tables plus Pumping Stations Areas with potential of fluvial flooding Sewer Network Sewer Manholes Southern Water Infrastructure Reservoirs in Operation Reservoirs not Operating Existing Ponds Escarpment Identification Buffer Zone 5m Buffer Zone 8m Buffer Zone 10m
006	Groundwater Risk	All base tables plus Springs Dry Valleys Minor Aquifer Low Soil Class Minor Aquifer Intermediate Soil Class Minor Aquifer High Soil Class Major Aquifer Low Soil Class Major Aquifer Intermediate Soil Class Major Aquifer High Soil Class
007	Existing Emergency Plans	All base tables plus Coastal Flood Warning Area Fluvial Flood Warning Area Bulverhythe Flood Sectors
008	Special Considerations	All base tables plus Ancient Monuments Areas of Outstanding Natural Beauty Conservation Areas Caravan Sites Sites of Nature Conservation Importance Local Nature Reserve Site of Special Scientific Interest Parks & Gardens

Map Reference	Map Title	Tables Used
009	Residual Flood Risk	All base tables plus Areas Benefiting from Defences Flood Zone 2 (EA) Flood Zone 3 (EA)
010	Areas Unsuitable for Drainage Infiltration	All base tables plus Landfill Site Potentially Contaminated Land Poor infiltration soil CLAY
011	Climate Change Outline	All base tables plus Climate Change Outline 1000yr+20% Climate Change Outline Tidal 200yr_2115
012	Extent of Hydraulic Modelling	All base tables plus Model 2004 Model 2007
Breach2_2115_20yr_FD2320	FD2320_Safe Access and Exit Analysis	All base tables plus SFRA_brch3_2115_20_64_fd2320 FD2320 Legend
Breach2_2115_200yr_FD2320	FD2320_Safe Access and Exit Analysis	All base tables plus SFRA_brch3_2115_200_66_fd2320 FD2320 Legend
Breach2_2115_1000yr_FD2320	FD2320_Safe Access and Exit Analysis	All base tables plus SFRA_brch3_2115_1000_68_fd2320 FD2320 Legend
Breach2_2115_20yr_MDepth	Maximum Depth of Flooding	All base tables plus SFRA_brch3_2115_20_64_d_Max D_Max_Legend
Breach2_2115_200yr_MDepth	Maximum Depth of Flooding	All base tables plus SFRA_brch3_2115_200_66_d_Max D_Max_Legend
Breach2_2115_1000yr_MDepth	Maximum Depth of Flooding	All base tables plus SFRA_brch3_2115_1000_68_d_Max D_Max_Legend
Breach2_2115_20yr_MDuration	Duration of Flooding	All base tables plus SFRA_brch3_2115_20_64_dur_Max Dur_Legend
Breach2_2115_200yr_MDurat	Duration of Flooding	All base tables plus SFRA_brch3_2115_200_66_dur_Max Dur_Legend
Breach2_2115_1000yr_MDurat	Duration of Flooding	All base tables plus SFRA_brch3_2115_1000_68_dur_Max Dur_Legend
Breach2_2115_20yr_ROnset	Onset of Flooding	All base tables plus SFRA_brch3_2115_20_64_onset Onset_Legend
Breach2_2115_200yr_ROnset	Onset of Flooding	All base tables plus SFRA_brch3_2115_200_66_onset Onset_Legend
Breach2_2115_1000yr_ROnset	Onset of Flooding	All base tables plus SFRA_brch3_2115_1000_68_onset Onset_Legend
Breach2_2115_20yr_MVelocity	Maximum Flood Velocities	All base tables plus SFRA_brch3_2115_20_64_V_Max V_Max_Legend
Breach2_2115_200yr_MVeloc	Maximum Flood Velocities	All base tables plus SFRA_brch3_2115_200_66_V_Max V_Max_Legend
Breach2_2115_1000yr_MVeloc	Maximum Flood Velocities	All base tables plus SFRA_brch3_2115_1000_68_V_Max V_Max_Legend

Map Reference	Map Title	Tables Used
Broad Development Options_FH	Broad Development Options – Flood History	All base tables plus Areas with Overtopping Problems Flooding History Flooding Incidents SW Flooding Incidents under Storm Conditions (Emergency Services) Broad Development Options
Broad Development Options_FR	Broad Development Options – Fluvial Risk	All base tables plus Zone 2 Medium Risk Zone 3a High Probability Zone 3b Functional Floodplain Climate Change Outline 1000yr+20% Broad Development Options Buffer Zone 5m Buffer Zone 8m Buffer Zone 10m
Broad Development Options_TR	Broad Development Options – Tidal Risk	All base tables plus Flood Zone 2 (EA) Flood Zone 3 (EA) Climate Change Outline Tidal 200yr_2115 Areas Benefiting from Defences Broad Development Options
Proposed Sites_FH	Proposed Sites – Flood History	All base tables plus Areas with Overtopping Problems Flooding History Flooding Incidents SW Flooding Incidents under Storm Conditions (Emergency Services) Proposed Sites
Proposed Sites_FR	Proposed Sites – Fluvial Risk	All base tables plus Zone 2 Medium Risk Zone 3a High Probability Zone 3b Functional Floodplain Climate Change Outline 1000yr+20% Proposed Sites
Proposed Sites_TR	Proposed Sites – Tidal Risk	All base tables plus Flood Zone 2 (EA) Flood Zone 3 (EA) Climate Change Outline Tidal 200yr_2115 Areas Benefiting from Defences Proposed Sites

Note: \* = base table

# Glossary

**Annual exceedence probability**

The estimated probability of a flood of given magnitude occurring or being exceeded in any year. Expressed as, for example, 1 in 100 year return period or 1 per cent.

**Attenuation**

Reduction of peak flow and increased duration of a flow event.

**Catchment Flood Management Plans (CFMP)**

A strategic planning tool through which the Environment Agency will seek to work with other key decision-makers within a river catchment to identify and agree policies for sustainable flood risk management.

**Escarpment**

The long continuous steep face of a ridge or mountain.

**Floodplain**

Area of land that borders a watercourse, an estuary or the sea, over which water flows in time of flood, or would flow but for the presence of flood defences where they exist.

**Flood Action Group**

Local community groups who aim to ensure that all authorities work closely together to manage flood risk and to deliver an action plan to minimise flood risk within their area.

**Flood Defence**

Flood defence infrastructure, such as flood walls and embankments, intended to protect an area against flooding to a specified standard of protection (SoP).

**Flood Map**

A map produced by the Environment Agency providing an indication of the likelihood of flooding within all areas of England and Wales, assuming there are no flood defences.

**Flood Risk Assessment**

A study to assess the risk to an area or site from flooding, now and in the future, and to assess the impact that any changes or development on the site or area will have on flood risk to the site and elsewhere. It may also identify, particularly at more local levels, how to manage those changes to ensure that flood risk is not increased. PPS25 differentiates between regional, sub-regional/strategic and site specific flood risk assessments.

**Flood Risk Management Measure**

Any measure which reduces flood risk such as flood defences.

**Flood Risk Management Strategy**

A long-term approach setting out the objectives and options for managing flood risk taking into account a broad range of technical, social, environmental and economic issues.

**Flood Zone**

A geographic area within which the flood risk is in a particular range as defined within PPS25.

**Greenfield land**

Land that has not been previously developed.

**Local Development Framework**

A non-statutory term used to describe a folder of documents which includes all the Local Planning Authority's Local Development Documents (LDDs). The Local Development

Framework will also comprise the Statement of Community Involvement, the Local Development Scheme and the Annual Monitoring Report.

**Local Development Documents (LDDs)**

All development plan documents which will form part of the statutory development plan, as well as supplementary planning documents which do not form part of the statutory development plan.

**Main River**

A watercourse designated on a statutory map of Main Rivers, maintained by Defra, on which the Environment Agency has permissive powers to construct and maintain flood defences.

**Ordinary watercourse**

All rivers, streams, ditches, drains, cuts, dykes, sluices, sewers (other than public sewer) and passages through which water flows which do not form part of a Main River. Local authorities and, where relevant, Internal Drainage Boards have similar permissive powers on ordinary watercourses, as the Environment Agency has on Main Rivers.

**Planning Policy Statement (PPS)**

A statement of policy issued by central Government to replace Planning Policy Guidance notes. Advice on practical implementation is not included in Planning Policy Statements. Rights to carry out certain limited forms of development without the need to make an application for planning permission, as granted under the terms of the Town and Country Planning (General Permitted Development) Order 1995.

**Previously-developed land (often referred to as brownfield land)**

Land which is or was occupied by a permanent structure, including the curtilage of the developed land and any associated fixed surface infrastructure (PPS3 Annex B)

**Regional Spatial Strategy (RSS)**

A broad development strategy for a region for a 15 to 20 year period prepared by the Regional Planning Body.

**Reservoir (large raised)**

A reservoir that holds at least 25,000 cubic metres of water above natural ground level, as defined by the Reservoirs Act, 1975.

**Residual risk**

The risk which remains after all risk avoidance, reduction and mitigation measures have been implemented.

**Resilience**

Constructing the building in such a way that although flood water may enter the building, its impact is minimised, structural integrity is maintained, and repair, drying & cleaning are facilitated.

**Resistance**

Constructing a building in such a way to prevent flood water entering the building or damaging its fabric. This has the same meaning as flood proof.

**Return Period**

The long-term average period between events of a given magnitude which have the same annual exceedence probability of occurring.

**Run-off**

The flow of water from an area caused by rainfall.

**Shoreline Management Plan (SMP)**

A plan providing a large-scale assessment of the risk to people and to the developed, historic and natural environment associated with coastal processes. It presents a policy framework to manage these risks in a sustainable manner.

**Standard of Protection**

The design event or standard to which a building, asset or area is protected against flooding, generally expressed as an annual exceedence probability.

**Sustainable Drainage Systems (SUDS)**

A sequence of management practices and control structures, often referred to as SUDS, designed to drain water in a more sustainable manner than some conventional techniques. Typically these are used to attenuate run-off from development sites.

**Sustainability Appraisal**

An integral part of the plan-making process which seeks to appraise the economic, social and environmental effects of a plan in order to inform decision-making that aligns with sustainable development principles.

**Vulnerability Classes**

PPS25 provides a vulnerability classification to assess which uses of land maybe appropriate in each flood risk zone. These have been included in this report.

**Washland**

An area of the floodplain that is allowed to flood or is deliberately flooded by a river or stream for flood management purposes.

**Windfall sites**

Sites which become available for development unexpectedly and are therefore not included as allocated land in a planning authority's development plan.

**OTHER TERMS USED IN MAPPING****Areas Benefiting from Defences**

The area that is protected by a defence or defence system against flooding from a 1% (1 in 100) annual probability fluvial event and 0.5% (1 in 200) annual probability tidal event, assuming all defences remain intact and function perfectly. This area does not have to contain any assets of high economic value to be included.

**Breach<sub>2</sub>\_YEAR\_RP**

Analysis of possible breach of flood defences in the year specified (YEAR) and under the return period specified (RP).

**Dry River Bed**

Paths followed by groundwater flows when the groundwater table is high.

**Flood Defence with SoP of #yr RP**

Indicates level of flood defence with a Standard of Protection described in terms of flood Return Period as identified in the National Flood and Coastal Defence Database.

**Flood Risk Sectors**

Areas recognised as at risk of flooding during significant events. These areas have their own emergency plans in times of flooding.

**Flood Warning**

If a flood warning is issued in an area, it means flooding is expected and will cause disruption.

**Flood Zone 2**

Land which has between a one in 100 and one in 1000 annual probability (chance) of river flooding (1% -0.1%); or between a one in 200 and 1 in 1000 annual probability (chance) of sea flooding (0.5%-0.1%)

**Flood Zone 3**

Land which has a greater than one in 100 annual probability (chance) of river flooding (>1%); or greater than one in 200 annual probability (chance) of sea flooding (>0.5%)

**Functional Floodplain**

Land where water has to flow or be stored in times of flood. Specifically, this land would flood with an annual probability of 1 in 20 (5 %) or greater in any year.

**High Soil Class**

Indicates soils with High Leaching Potential (H) and includes the following sub-classification:

H1 – Soils which readily transmit liquid discharges because they are either shallow or susceptible to rapid flow directly to rock, gravel or groundwater.

H2 – Deep, permeable, coarse textured soils which readily transmit a wide range of pollutants because of rapid drainage and low attenuation potential.

H3 – Coarse textured or moderately shallow soils which readily transmit non-adsorbed pollutants and liquid discharges. Some ability to attenuate due to clay or organic matter contents.

**Intermediate Soil Class**

Indicates soils with Intermediate Leaching Potential (I) and includes the following sub-classification:

I1 – Soils which can possibly transmit a wide range of pollutants.

I2 – Soils which can possibly transmit non or weakly adsorbed pollutants and liquid discharges but are unlikely to transmit adsorbed pollutants.

**Low Soil Class**

Indicates soils with Low Leaching Potential (L). These are soils in which pollutants are unlikely to penetrate the soil layer because either water movement is largely horizontal or they have ability to attenuate diffuse pollutants. Generally have high clay content.

**Major Aquifer**

Highly Permeable formations with known or probable presence of significant fracturing. Highly productive and able to support large abstractions for public supply and other uses.

**Minor Aquifer**

Fractured or potentially fractured rocks which do not have a high primary permeability. Seldom produce large quantities of water for abstraction, but important for local supplies and supplying base flow to rivers.

**Model 2004**

Shows the extent of the MIKE11 model produced by Bullen Consultants (now incorporated into Faber Maunsell) in 2004 for the Bexhill to Hastings Link Road project.

**Model 2007**

Shows the extent of the MIKE11 models produced by Faber Maunsell in 2007 to complete the SFRA.

**SW Flood Events**

Location for which Southern Water has a recorded history of flooding (last decade).

**Water Management Structures**

Shows structures identified in the National Flood and Coastal Defence Database.

# References

## **Environment Agency (EA) Publications**

- Cuckmere and Sussex Haven Catchment Flood Management Plan - November 2006
- SO 617 Sussex Tidal Flood Outlines – Project Report, August 2005
- Enmainment of Critical Ordinary Watercourses, 2007
- Fluvial and Coastal Flood Warning Areas, 2007
- NFCDD (Defences and Structures tables) and Springs table, 2007
- Bulverhythe structures and flood defences – (to complement NFCDD), 2007
- Areas benefiting from flood defences – outlines and identification criteria, 2007
- Geological map for Hastings, 2007
- List of Reservoirs – East Sussex, 2007
- Extreme Sea Level Analyses, JBA, 2007
- LIDAR Data necessary for Breach Analysis, 2007

## **Hastings Borough Council (HBC) Publications**

- Pamphlet showing proposals for Land at West Marina and the former West St Leonards Primary School
- Hastings Local Plan 2004
- Urban Capacity Study Map, 2007
- Local Development Framework Core Strategy Issues and Options Consultation Overview, December 2006
- Creating Accessible Electronic Documents Guidelines, 2007
- Hastings Seafront Strategy Documents, 2007
- Hastings Environmental Sites Information, 2007
- Housing Potential Study Map & Hard Copy of Geological Map for Hastings, 2007
- Details of Level Recording Sites in Hastings, 2007
- Bulverhythe Flood Plan 2007
- Bulverhythe Topographic survey drawings, 2007
- Hastings flooding in the town centre outlines, 2007
- Hastings Areas requiring further studies, 2007
- Hastings overtopping and EA – landfill sites outlines, 2007
- HBC Logo, 2007
- Bulverhythe Flood sectors outlines, 2007
- Hastings ponds and dry valleys outlines, 2007

## **Other Publications / Data made available**

- South Foreland to Beachy Head Shoreline Management Plan - Draft, South East Coastal Group, January 2005
- Hastings and Bexhill Seafront Strategy Document - Various, May 2005

- Flooding Records covering last 10 years from Southern Water
- Details of Bulverhythe Flood Alleviation Scheme – Various.
- List of Flooding Incidents, East Sussex Fire and Rescue
- Topographic survey data, BW Surveying
- Extreme Sea Level Analyses, JBA

#### **Digital Information / Mapping**

- Aerial View of the Borough 2No.CDs, Hastings Borough Council
- Hastings Borough OS Master Map and other data CD, Hastings Borough Council
- Hastings Borough LIDAR Data CD, Environment Agency
- GIS Data (EA data, Environmental data and Local Plan data) CD, Hastings Borough Council
- Combe Haven Tidal Gate Photographs
- CD with data including FWA, LIDAR (superseded), Rivers, JBA Report, SAR. Environment Agency
- Hastings Local Plan; Water Retention, Pumping Stations, Major Sewers, Major Rivers Outlines, Watercourses Outlines and Culverts Outlines, culverts\_4 & reservoirs outlines with some details, Hastings HA- Historic landfill, Hastings potential flood areas and combined sewers outlines, Hastings surface water sewers outlines, 2007
- Groundwater Vulnerability Map, EA
- Geological Map for Hastings (JPG only) CD, Hastings Borough Council.
- Bulverhythe Scheme & Capita Symonds modelling CD, EA
- Capita Symonds missing Tuflow data, EA
- DVD - HBC SFRA – Digital Height Data, Hastings Borough Council

#### **Information from Websites**

- The South East Plan Core Document, [www.southeast-ra.gov.uk/southeastplan/plan/](http://www.southeast-ra.gov.uk/southeastplan/plan/)
- Environmental Action Plan for East Sussex, [www.eastsussex.gov.uk/](http://www.eastsussex.gov.uk/)
- Cuckmere and Sussex Haven Catchment Flood Management Plan SUMMARY, [www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)
- East Sussex County Council Structure Plan, [www.eastsussex.gov.uk](http://www.eastsussex.gov.uk)
- South Foreland to Beachy Head Shoreline Management Plan, [www.eastsussex.gov.uk](http://www.eastsussex.gov.uk)
- Core Strategy Consultation Summary, [www.hastings.gov.uk](http://www.hastings.gov.uk)
- South East Coastal Group Report, [www.se-coastalgroup.org.uk](http://www.se-coastalgroup.org.uk)