Horsham District Council

Strategic Flood Risk Assessment

Final Report

June 2007

Prepared for:

Horsham District Council

Revision Schedule

Horsham District Council Strategic Flood Risk Assessment – Final Report
June 2007

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Abbreviations

ACRONYM	DEFINITION
AONB	Area of Outstanding Natural Beauty
CFMP	Catchment Flood Management Plan
DEM	Digital Elevation Model
DPD	Development Plan Documents
EA	Environment Agency
EP	English Partnerships
FRA	Flood Risk Assessment
GIS	Geographical Information Systems
HDC	Horsham District Council
IDB	Internal Drainage Board
LDDs	Local Development Documents
LDF	Local Development Framework
LDS	Local Development Scheme
LiDAR	Light Detection and Ranging
LPA	Local Planning Authority
ODPM	Office of the Deputy Prime Minister
PCPA	Planning and Compulsory Purchase Act 2004
PPG25	Planning Policy Guidance Note 25: Development and Flood Risk
PPS25	Planning Policy Statement 25: Development and Flood Risk
RFRA	Regional Flood Risk Assessment
RPG	Regional Planning Guidance
RSS	Regional Spatial Strategy
SAR	Synthetic Aperture Radar
SA	Sustainability Assessment
SFRA	Strategic Flood Risk Assessment
SPG	Supplementary Planning Guidance
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems

Glossary

TERM	DEFINITION
Aquifer	A source of groundwater comprising water-bearing rock, sand or gravel capable of yielding significant quantities of water.
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.
Climate Change	Both natural and human actions causing long term variations in global temperature and weather patterns.
Culvert	A channel or pipe that carries water below the level of the ground.
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 plain	Area adjacent to river, coast or estuary that is naturally susceptible to flooding.
Flood storage	A temporary area that stores excess runoff or river flow often ponds or reservoirs.
Fluvial flooding	Flooding by a river or a watercourse.
Groundwater	Water that is in the ground, this is usually referring to water in the saturated zone below the water table.
Indicative flood plain map	A map that delineates the areas that have been predicted to be at risk of being flooded during an event of specified probability.
Internal Drainage Board	Independent bodies with responsibility of ordinary watercourses within a specified District.
Inundation	Flooding.
Local Development Framework (LDF)	The core of the updated planning system (introduced by the Planning and Compulsory Purchase Act 2004). The LDF comprises the Local Development Documents, including the Development Plan Documents that expand on policies and provide greater detail. The development plan includes a core strategy, site allocations and a proposals map.
Local Planning Authority	Body that is responsible for controlling planning and development through the planning system.
Mitigation measure	An element of development design which may be used to manage flood risk or avoid an increase in flood risk elsewhere.
Risk	The probability or likelihood of an event occurring.
Sequential Test	A risk based approach in to assessing flood risk, which gives priority in ascending order of flood risk, i.e. lowest risk first.
Sewer flooding	Flooding caused by a blockage or overflowing in a sewer or urban drainage system.
Stakeholder	A person or organisation that has an interest in, or affected by the decisions made within a site.
Sustainability Appraisal	A process used to identify if policies, strategies or plans promote sustainable development and further used for improving policies. It is a requirement for Regional Spatial Strategies under the *Planning and Compulsory Purchase Act 2004.*

TERM	DEFINITION
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.
Sustainable development	Development that meets the needs of the present without compromising the ability of future generations meeting their own needs.
1 in 100 year event	Event that on average will occur once every 100 years. Also expressed as an event, which has a 1% probability of occurring in any one year.
1 in 100 year design standard	Flood defence that is designed for an event, which has an annual probability of 1%. In events more severe than this the defence would be expected to fail or to allow flooding.

1 Introduction

The Planning and Compulsory Purchase Act 2004 (PCPA) (HMSO, 2004) requires Local Planning Authorities to produce Local Development Frameworks (LDFs) to replace the system of Local, Structure and Unitary Development Plans. Local Development Frameworks are a portfolio of documents (Local Development Documents (LDDs)) that collectively deliver the spatial planning strategy for the authority area. The PCPA 2004 requires LDDs to undergo a Sustainability Appraisal (SA) which assists Planning Authorities in ensuring their policies fulfil the principles of sustainability. Strategic Flood Risk Assessments (SFRAs) are one of the documents to be used as the evidence base for planning decisions; they are also a component of the SA process and should be used in the review of LDDs or in their production.

The release of Planning Policy Guidance Note 25: Development and Flood Risk in July 2001 (PPG25)(DTLR, 2001) introduced the responsibility that Local Authorities have to ensure that flood risk is understood and managed effectively using a risk-based approach as an integral part of the planning process.

PPG25 was superseded by Planning Policy Statement 25: Development and Flood Risk (PPS25) in December 2006. PPS25 re-emphasises the active role Local Authorities should have in ensuring flood risk is considered in strategic land use planning. PPS25 encourages Local Planning Authorities to undertake SFRAs and to use their findings to inform land use planning. In February 2007, a "Living Draft" of the Practice Guidance for PPS25 was released for consultation. Although this is a consultation document, the approach to SFRAs that it suggests should be considered.

To assist Local Authorities in their strategic land use planning, SFRAs should present sufficient information to enable Local Authorities to apply the Sequential Test to their proposed development sites. The SFRA should have regard to river catchment wide flood issues and also involve a:

> *"Process which allows the Local Planning Authority to determine the variations in flood risk across and from their area as the basis for preparing appropriate policies for flood risk management for these areas".*

In addition, where development sites cannot be located in accordance with the Sequential Test as set out in PPS25 (i.e. to steer development to low risk sites):

> *"The scope of the SFRA should be increased to provide the information necessary for the application of the Exception Test."*

In addition to being a tool for use in strategic land use planning, an SFRA should also be accessible and provide guidance to aid in the general planning process of a local authority.

1.1 The Horsham District Council SFRA

Horsham District has been recognised as operating at a pivotal point of a diamond of large urban communities between Crawley/Gatwick, Portsmouth and Brighton. Whilst the District has an important and cherished rural and agricultural heritage, it is important to recognise and maintain a balanced and sustainable momentum for economic growth and prosperity. In order to seek to achieve a sustainable future for the District whilst meeting their housing requirements, Horsham District Council (HDC) have started their LDF process and have adopted a Core Strategy that sets out a vision for the District to 2018 and identifies areas suitable for growth and development.

These strategic development locations are primarily focused to the West of Horsham and to the West of Crawley (see SFRA objectives below).

The spatial planning of any proposed development must be considered with regard to the current and future risk of flooding from a number of sources, including fluvial, tidal, surface water (storm water) management and groundwater. It is therefore vitally important that flood risk is considered at a strategic scale to inform land allocations and future developments proposed by the emerging Local Development Frameworks.

In accordance with the recently released Practice Guide Companion to PPS25, Strategic Flood Risk Assessments may be completed in two consecutive stages. The Level 1 SFRA should present sufficient information to enable the Local Planning Authority to apply the Sequential Test to potential development sites and to assist in identifying if application of the Exception Test will be necessary. In addition, the Level 1 SFRA provides background information and a preliminary review of available data, sufficient to scope the type of assessment necessary should a Level 2 SFRA be required. Level 1 SFRAs should be used by the Local Planning Authority, together with other evidential documents and the draft sustainability appraisal, to undertake the Sequential Test. This will help to identify where sites can be located in Flood Zone 1 and may require further investigation through a Level 2 SFRA. This report presents the information generated during Level 1 of the SFRA.

1.2 The SFRA Objectives

The objectives of the Horsham District Council SFRA as set out in the brief dated December 2006 are: -

1. Undertake an SFRA in line with the policies and guidance presented in PPS25 for the administrative areas of HDC falling within the Rivers Adur and Arun Catchments. Part of the administrative areas for HDC fall under the River Mole Catchment to the west of Crawley. This area will be covered under a separate SFRA;
2. Identify the extent of all PPS25 Flood Zones to provide sufficient information to allow the Sequential Test to be carried out. As part of the Level 2 SFRA, particular attention will be given to areas within Flood Zone 3 and areas where new development is likely to be concentrated;
3. To identify flood defences including their condition and standard of protection;
4. To identify significant historical flooding within the Arun and Adur catchments and to engage stakeholders in the discussion of flooding issues;
5. Ensure that the Authority meets its obligations under emerging planning guidance: PPS25 as well as the Water Framework Directive and DEFRA's 'Making Space for Water';
6. Recommendations of suitable mitigation measures including Sustainable Drainage Systems (SuDS).
7. Provide an evidence-based report to inform the Horsham Local Development Framework and other Development Planning Documents about managing potential flood risk.

1.3 The SFRA Structure

Since this study was commissioned, the Department of Communities and Local Government has released the Practice Guide Companion to accompany PPS25. The Practice Guide Companion to PPS25 recommends that SFRA's are completed in two consecutive stages; this follows the iterative approach encouraged by PPS25 and provides Local Planning Authorities with tools throughout the LDF and SFRA process sufficient to inform and update decisions regarding development sites. The two stages are: -

- Level 1 SFRA – Enables application of the Sequential Test
- Level 2 SFRA – Increases scope of SFRA for sites where exception test is required

The results of the Level 1 SFRA will enable HDC to review the current preliminary site allocations and to inform the scope of the Sustainability Appraisal. Following consultation with HDC, the findings of the Level 1 assessment will also enable the scope of the Level 2 SFRA to be defined.

Level 1 SFRA

The objective of the Level 1 SFRA is to collate and review available information on flood risk for the study area. Information has been sought from a variety of stakeholders including the Environment Agency, Horsham District Council, West Sussex County Council, the Highways Agency, Southern Water and Thames Water. In addition to the review of data and consultation with local stakeholders, Level 1 also reviews the available data to meet the requirements of a Level 2 SFRA where required. Where necessary the report also identifies works beyond the critical scope that may benefit the assessment.

The information presented in a Level 1 SFRA should not be considered as an exhaustive list of all available flood related data for the study area. The Level 1 SFRA report is a presentation of flood sources and risk based on data collected following consultation with and input from the partner Local Authorities and agencies within the timeframe available. If required, a level 2 SFRA will enable the contacts and relationships with key stakeholders developed in Level 1 to continue to assist in providing data and information for the SFRA.

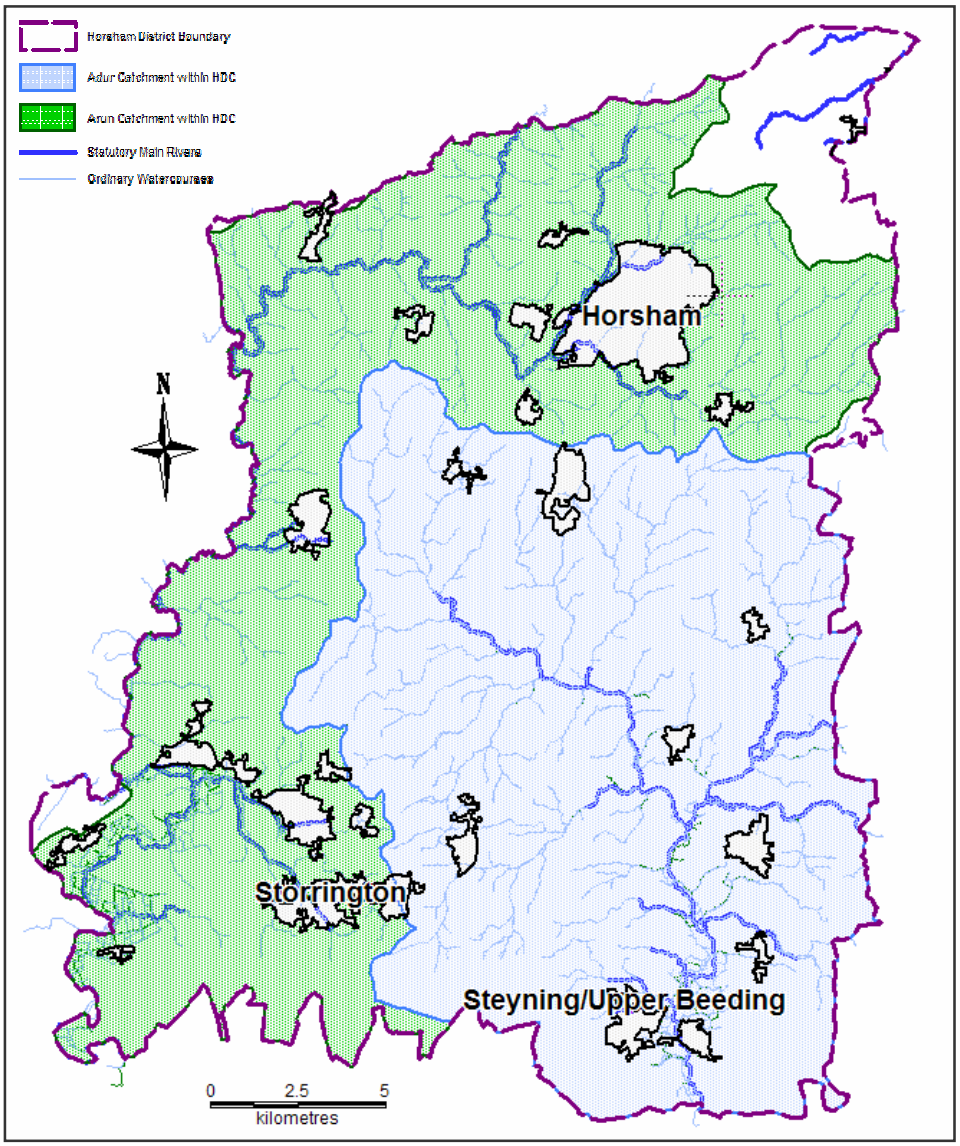
Level 2 SFRA

The Level 2 SFRA will provide sufficient information to facilitate the application of the Exception Test where required. This will be based on information collected for the Level 1 SFRA and additional works where necessary.

2 Study Area

The study area is defined by the administrative boundaries of Horsham District Council and the Arun and Adur River catchments (Figure 2-1). This results in a total study area of 529km².

Figure 2-1: Horsham District Council SFRA Hydrological Map



2.1 Hydrology and Flood Sources

The main river catchments within the study area are: -

- The River Arun and tributaries;
- The River Adur and tributaries;

The River Arun & Tributaries

The catchment of the River Arun covers the north and eastern sections of the study area (Figure 2-1). Its source is located at St Leonard's Forest near Horsham, approximately 120m AOD and, like much of the River Adur in Horsham District, it has a flashy nature and responds quickly to heavy rainfall events due to the underlying impermeable Weald Clay and steep topography.

The Upper Arun collects water from the High and Low Weald, which mainly comprises of low permeability Weald Clay, and transfers it downstream to the confluence with the River Rother at Pulborough, which is also the tidal limit. The Upper and Eastern Arun is the reach of the river that covers the majority of the study area. There are few or no flood defences within this reach of the Arun and no major urban areas are at risk, however, a number of properties in rural areas and in parts of Horsham have been flooded in the past.

The Lower Arun extends from the confluence with the Rother at Pulborough downstream as far as Littlehampton and is influenced by the tide throughout its length. Flood defences exist on both banks of the river along the whole of this section, which currently prevent flooding during events with a return period less than about 3% per year (that is about 1 in 30 years on average). The embankments are overtopped during more severe events, leading to widespread inundation of the floodplain. At Pulborough, floodplain flows are complicated by the presence of road and rail crossings on embankments with culverts/bridge openings as well as abrupt bends in both the rivers and the flanking defences. Overall, there is little risk of property flooding in this middle part of the catchment, although there can be local problems where drains are blocked or pumps fail in parts of Pulborough where the surface water is pumped into the river (the IDB is now operated by the Environment Agency). There is, however; considerable disruption to transport and extensive flooding of agricultural land during severe events[1].

The River Adur & Tributaries

The River Adur and its tributaries are situated in the High Weald, Low Weald and South Downs natural conservation areas (as defined by Natural England and previously the Countryside Agency). The catchment is largely rural with a few urban centres such as Horsham and the urbanised coastal strip of Brighton and Hove, Shoreham and Worthing.

The entire catchment of the River Adur is in excess of 600km^2 and extends from the south coast at Littlehampton in the west, Brighton and Hove in the east, northwards to Horsham and Haywards Heath. The upper and western branch of the Adur catchment spans most of Horsham District and is underlain by the Weald Clay. As a result, the watercourses respond rapidly to rainfall causing the water to run-off the impermeable surface. There is however, little history of flooding in this sub catchment of the Adur and consequently there is a low risk to people and property in this area.

[1] Arun and Western Streams CFMP – draft plan, Environment Agency, August 2006

This differs from the lower, more permeable chalk areas, which respond more slowly and can be a source of groundwater flooding from the chalk aquifers. Flooding occurs from a number of sources such as rivers overtopping their defences (fluvial flooding), urban surface water run-off and inadequate local drainage, run-off from fields and groundwater flooding as well as a mixture of tidal and fluvial flooding[2].

2.2 Hydrogeology

The geology of the study area is varied. The High Weald, covering most of the study area, consists of sandstones and mudstones overlain by the relatively impermeable Weald Clay. The High Weald then drops down to the Low Weald to the south where the geology is comprised predominantly of chalk and softer sandstones and mudstones. This geological group tends to underlie the southern edge of the study area with parts being classified as a Groundwater Emergence Zone[3].

The chalk areas to the south of the study area are classified as Major Aquifers by the Environment Agency and provide an important resource for local population centres. However, due to the nature of the chalk and high permeability of the overlying soils, this area may also be prone to groundwater flooding.

2.3 Tidal Influences

Tidal flooding affects both the River Arun and River Adur within the southern areas of the study area. On the River Arun, the tidal limit is at Pallingham Locks, where defences currently provide a standard of protection of 3% (1 in 30 years). The River Adur has its normal tidal limit near Partridge Green. Again, defences in the area are thought to have a standard of protection of around 3% (1 in 30 years).

2.4 Sewers

The majority of sewers are built to the guidelines within “sewers for adoption” (WRC, 2006). These sewers have a design standard of the 1 in 30 year flood event and therefore it is likely that the majority of sewer systems will surcharge during rainstorm events with a return period greater than 30 years (e.g. 100 years). Southern Water has provided point locations of sewer flooding incidents that have occurred in the last 10 years.

2.5 Groundwater

There are no records of groundwater flooding within the study area. However, the chalk areas to the south of the study area are classified as major aquifers with a high permeability. Many of the streams overlying this area are predominantly fed by groundwater and are dry for parts of the year. The high values of Base Flow Index (BFI) on these streams, coupled with the fact that they overly major aquifers leads to a potential for groundwater flooding in the area.

[2] River Adur Catchment Flood Management Plan – Scoping Report , Environment Agency, (March 2006)
[3] Strategy for Flood and Coastal Erosion Risk Management: Groundwater Flooding Scoping Study (LDS 23), DEFRA – Making Space for Water, 2004.

2.6 Pluvial

There are no recorded incidents of pluvial, or overland, flooding in the District. However, on steeper slopes that consist of the Weald Clay to the north of the District, there could be potential for direct surface runoff to occur during periods of prolonged rainfall.

2.7 Administrative Areas

Environment Agency

The study area falls entirely in the Environment Agency's Southern Region. The Environment Agency's Southern Region has discretionary powers under the Water Resources Act (1991) for all Main Rivers and their associated flood defences within the study area.

The Environment Agency also administers the Internal Drainage Boards (IDB) to the south of the Horsham District Council boundary along the River Arun and the River Adur.

Drainage

Southern Water and Thames Water are responsible for storm water and foul water management across the study area. In addition, private individuals may be responsible for drainage systems that operate prior to discharge either into a watercourse or into a public sewer.

2.8 Specific Local Information

The Horsham District Council administrative area is predominantly rural, with few major urban centres. Consequently, a relatively low level of flood risk exists when compared to some surrounding Districts. Environment Agency data, including Historical Flood Maps, CFMPs and flood event databases indicate that major flooding on the Arun and Adur has occurred in the past as a result of tidal and fluvial causes. Flooding from lesser sources is also important with stakeholder responses from Parish Councils, Southern Water and The Highways Agency indicating sporadic flooding hotspots across the District.

Table 2-1: Selected Historical Flooding from the Arun & Western Streams and the Adur Catchment Flood Management Plans

Event Date	Catchment	Details
1911	Adur	Heavy rains in November caused flooding of the Adur valley from Ashurst, Partridge Green, Henfield, and Steyning to Bramber. Lower floors of properties were inundated.
1925	Adur	Widespread flooding of Adur valley.
Feb-66	Adur	Roads and fields flooded at Cuckfield and Bolney.
Sep-68	Arun	Flood damage at Chiddingfold (15 properties), Horsham (up to 50 properties) and Pulborough (5 properties). A29 and several minor roads blocked.
11- 14 Nov-1974	Adur	Widespread flooding across catchment - Ashurst, Bramber, Coombes, Shipley, Twineham, Upper Beeding, West Grinstead, Lancing, Steyning. Properties flooded in Lancing. A281 closed at Henfield.
22-23 Nov-1974	Adur	Flooding in Burgess Hill, Ashurst, Clayton, Cuckfield, Ditchling, East Preston, Ferring, Findon, Fulking, Shipley and Henfield. Surface water flooding at Steyning High Street, river flooding at Steyning affected some properties. Road flooding at Burgess Hill. Shopping area in Findon covered in an inch of silt. Shoreham airport access disrupted. Kimp Barn Lane flooded cutting off access to properties and the sewage treatment works.
1977	Adur	Properties flooded in Ashington.
1979	Adur	Flooding in Henfield, Burgess Hill and Ashington.
Oct-80	Adur	Steyning - the High Street was closed.
1981	Arun/Adur	A significant event occurred in Billingshurst after heavy rains that caused flooding in the High Street and Rosehill area due to inadequate highway drainage and blockages of surface water flow to sewers. The same event affected Southwater Street in Pulborough and Southwater.
Dec-1993	Arun	Heavy rainfall throughout the autumn caused the River Larent to overtop. Flooding at Storrington damaged 15 properties. Storrington flood relief scheme implemented as a result.
1994	Adur	Heavy runoff from the downs caused property flooding in Sompting and North Lancing.
Autumn 2000	Adur	Flooding in Sayers Common and Steyning. Severe flooding in Bramber following overtopping of defences on the main river.
Autumn 2000	Arun	Flooding from main river/surface water and/or groundwater at Pulborough (5 properties) and Bury (3 properties). Flooding from groundwater and/or surface water at Chiddingfold (12 properties) and Midhurst (3 properties).

3 Level 1 SFRA – Methodology

3.1 Objective

As outlined in Section 1.2 the objective of the Level 1 SFRA is to collect, collate and review the information available relating to flooding in the study area. This information is then presented in a format to enable the Local Planning Authorities to apply the Sequential Test to their growth areas and where necessary to apply the Exception Test. Gaps in the data/information have also been identified in order to ascertain additional requirements needed to meet the objectives of a Level 2 SFRA, where required.

3.2 Tasks

The sequence of tasks undertaken in the preparation of the Level 1 SFRA was, in order: -

- Inception meeting with the Horsham District Council on 9th January, 2006;
- Established the local stakeholders;
- Contacted stakeholders requesting data/information;
- Collated and reviewed data and populated data register;
- Presentation of available relevant information on flood sources and flood risk
- Reviewed received data against the SFRA objectives; and
- Identified gaps in data.

All tasks were completed between January 2007 and May 2007.

3.3 Stakeholders

The stakeholders that were contacted to provide the data/information for the SFRA were: -

- West Sussex County Council;
- Horsham District Council;
- Parish Councils,
- Thames Water;
- Southern Water;
- Environment Agency; and,
- Highways Agency.

The principal contacts and their associated details for these stakeholders are presented in Appendix C.

3.4 Data / Information Collected

Information/data was requested from the stakeholders. The data was integrated with Scott Wilson's GIS system where possible to facilitate a review. The information/data requested from the stakeholders identified was based on the following categories: -

- Terrain Information e.g. LiDAR, SAR, river cross-sections;

- Hydrology e.g. the main and ordinary watercourses;
- Hydrogeology e.g. groundwater emergence zones and vulnerability maps;
- Flood Defence e.g. flood banks, sluices;
- Reservoirs Act (1975) Water Bodies within the District;
- Environment Agency Modelled Flood Levels;
- Flood Risk Assessments e.g. on previous development sites;
- Environment Agency Flood Zone Maps;
- Local Authority Information e.g. Local Development Schemes and allocation sites; and,
- Sewer flooding problems.

All received data was registered on receipt and its accuracy and relevance reviewed to assess a confidence levels for contribution to the SFRA (Table 3-1). Details of all the data collected at the time of production are presented in Appendix D.

Table 3-1: Method for qualitative confidence ranking of data received

		RELEVANCE		
		1 - VERY RELEVANT	2 - PARTLY RELEVANT	3 - NOT RELEVEANT
ACCURACY	1 - EXCELLENT	**VERY GOOD**	GOOD	GOOD
	2 - GOOD	GOOD	GOOD	FAIR
	3 - FAIR	GOOD	FAIR	FAIR
	4 - POOR	FAIR	FAIR	POOR
	5 - VERY POOR	FAIR	POOR	**VERY POOR**

3.5 GIS Layers

Using the data collected a series of GIS layers were collated to visually assist HDC in their site allocation decisions and Development Control activities. Using GIS, the data was analysed and interrogated to produce flood risk statistics to the District as a whole and individual settlements (See Appendix A and Appendix B).

Broadly, the layers can be classified into planning policy, informative and flood risk categories.

Table ***3-2*** summarises the main GIS layers used in the SFRA. Appendix D includes a more detailed table highlighting the GIS layers that have been used and their limitations.

GIS Data Gaps & Assumptions

Some data, that is necessary to satisfactorily complete an SFRA, is either not available at all, or is not available in GIS format. In order to present complete and continuous flood zones for Horsham District, it has been necessary to make certain assumptions, in agreement with Horsham District Council and the Environment Agency, so that data gaps could be filled.

Table 3-2: GIS Layers used in SFRA

Planning Policy	Informative	Flood Risk
HDC Boundary	Tidal limits	Flood Zone Maps (Fluvial and Tidal)
Urban Areas	Main River Network & Catchments	Historical Flooding Maps
Potential Allocation Sites	Ordinary Watercourse Network	Storm water Flooding areas
Alternative Allocation Sites	Major Water Bodies under the Reservoirs Act (1975)	Flood Defences
Parish Council Questionnaires		Flood Warning Areas
		Groundwater Emergence Zones
		Groundwater Vulnerability maps
		River Network – BFI classified

Flood Risk GIS Layers

In order to present the most up-to-date and relevant flooding information available, the flood zone maps (for both fluvial and tidal) have been created using a variety of existing sources of data. Where detailed hydraulic modelling has been undertaken and flood outlines mapped, these have been used in preference to broad-scale modelled flood outlines. This results in a single map for each flood zone generated using a combination of data. For each fluvial or tidal reach, meta-data has been provided detailing the source of the data used to create the flood zone and the relative confidence in the data. For example, the flood outlines (both fluvial and tidal for FZ3a, FZ3b and FZ3 + Climate Change) for the Lower Arun have been derived from EA commissioned two-dimensional hydraulic modelling. These outlines have been used in preference to the EA broad-scale modelled outlines.

Tidal & Fluvial Flooding

In addition to combining the flood outlines for detailed and broad-scale modelling results, the tidal and fluvial flood outlines have been combined. Therefore, the event 1 in 200 year (0.5% annual exceedence probability (AEP)) tidal outline has been merged with the 1 in 100 year (1% AEP) fluvial outline for Flood Zone 3a. This results in a single map for each flood zone, making the task of allocating development more streamlined for HDC.

Functional Floodplain

One of the requirements of PPS25 is that the Functional Floodplain, Flood Zone 3b, should be identified and mapped to highlight those areas where only water-compatible development and land use is recommended. PPS25 defines Flood Zone 3b as the flood with an annual probability of 1 in 20 (5% AEP) or greater. For the rivers Adur and Arun, the 5% flood outline has not been delineated or modelled. However, the 1 in 25 year (4% AEP) flood event has been extensively modelled and mapped for both watercourses. The council and the EA agreed that adopting the 1 in 25 year outline was an acceptable, and more conservative, approach to representing

functional floodplain. Where the 1 in 25 year flood outline is not available, it was agreed, that the whole of Flood Zone 3 should be assumed to be functional until such time that more detailed information is available, such as an EA Strategic Flood Risk Mapping (SFRM) study or a site specific FRA.

The Effects of Climate Change

To ensure sustainable development now and in the future, PPS25 requires that the effects of climate change should be taken into account in an SFRA and that flood outlines delineating climate change should be presented. Where possible, modelled outlines for Flood Zone 3 including the effects of climate change have been presented. For tidal reaches, this includes the effects of sea level rise over and above the 1 in 200 year flood event using net sea levels rises recommended in PPS25. For fluvial reaches, climate change has been added to the 1 in 100 year flood event using a net increase of 20% over and above peak flows. In areas where climate change has not been modelled or mapped, an increase in the depth and extents of the existing flood zones is likely. In order to take into this into account, it has been agreed with HDC and the EA that Flood Zone 2 should be used as a surrogate for Flood Zone 3 plus climate change until such time that more detailed information is available, such as an EA Strategic Flood Risk Mapping (SFRM) study or a site specific FRA.

Historical Flood Mapping

A historical flood outline layer was created using data from the EA, HDC and the Parish Councils that delineates approximate areas that have flooded in past. Much of the information used to create the outlines is estimated following a flood and some inaccuracies may exist. However the layer serves a useful purpose to highlight to HDC that there are areas – potentially outside the Flood Zone maps – that have experienced flooding in the past.

Storm Water Flooding

Incidents of storm water flooding due to a lack of hydraulic capacity at key local sites have bee provided by Southern Water and also Parish Councils. The locations of flooding spots have been presented in a point GIS layer. This layer will help to highlight to HDC that there are certain areas where the drainage network can be overwhelmed during periods of high intensity rainfall and therefore new development in these areas must take this into account.

Flood Defences

EA maintained flood defences have been shown as a separate GIS layer. The information has been derived directly from NFCDD system and, as a result, layers also contain metadata detailing the general condition and a description of the defence. This will assist HDC in determining sites that potentially lie in defended areas.

Flood Warning Layers

Areas benefiting from an EA flood warning have been shown as a separate GIS layer. Emergency Planning Officers can use the flood warning layers in conjunction with the flood zone maps and flood defence information to assist in developing emergency plans for areas at risk of flooding within the District.

Groundwater Vulnerability Mapping & BFI Classified CEH Stream Network

The EA's groundwater vulnerability maps have been presented in a thematic map to highlight areas that overlie aquifers with a high vulnerability. Major Aquifers with a high vulnerability tend to have a more permeable surface geology. When combined with a thematically mapped stream network classified by BFI, it is possible to determine streams that are predominantly groundwater fed and broad areas that could potentially be at risk of groundwater flooding.

Groundwater Emergence Zones

A groundwater emergence zone layer has been presented from the DEFRA Groundwater Flooding Scoping Study[4]. This highlights a large area in the South Downs to the south of the district that is at risk of groundwater flooding.

Reservoir Act (1975) Water Bodies

A layer displaying major water bodies falling under the regulation of the Reservoir Act has been provided by the EA (Exeter). This can assist HDC in assessing sites immediately downstream of major water bodies. HDC may wish to undertake more detailed analysis of particular water bodies to determine any potential flood risk.

Planning Policy GIS Layers

Political and Urban Areas Boundaries

In addition to the flood zone and flood source GIS layers, a series of Planning and Policy GIS layers were provided by HDC. These include political and built up urban area boundaries derived from settlement sustainability studies and ensures that the SFRA is using the same information used in the rest of the HDC LDF process.

Potential Allocation Sites and Alternative Development Sites

HDC also provided GIS layers of potential allocation sites as well as alternative development sites. When overlain with flood risk GIS layers, it is possible to determine which sites are located in areas at risk of flooding and to what extent.

[4] Strategy for Flood and Coastal Erosion Risk Management: Groundwater Flooding Scoping Study (LDS 23), DEFRA – Making Space for Water, 2004.

4 Level 1 SFRA – Flood Risk Review

A suitable Level 1 SFRA will collate and review existing information on flood sources and flood risk to assist the Local Planning Authority in its obligation to consider flood risk in strategic land allocations and developing future policies. The Level 1 SFRA will achieve this by providing sufficient information to enable Local Planning Authorities to apply the Sequential Test (as set out in PPS25) to assist them in determining the suitability of sites for development. In accordance with PPS25 and its Companion Guide, where there are no reasonably available sites in Flood Zone 1 it may be necessary to locate development in Flood Zone 2, potentially through the successful application of the Exception Test. Only where there are no reasonably available sites in Flood Zones 1 and 2 should development be located in Flood Zone 3 and where necessary, successful application of the Exception Test will require information to be provided in a Level 2 SFRA.

4.1 Broad Scale Assessment

Broad-scale information received from stakeholders that is of use to the Local Planning Authorities in applying the Sequential Test at a District Level is presented in Appendix A and in an accompanying GIS workspace and summarised in Table 4-1. The broad-scale assessment has been based on the GIS layers highlighted in Section 3.5. Using GIS, the various layers were queried against one another to determine total areas of intersection for each flood zone.

Table 4-1: Horsham District-Level Broad-Scale Assessment

Question	Area (km^2)	% of Area	
Total Area of Horsham administrative Area	529	100%	
Area of Horsham in Zone 3b (Functional Floodplain)	31.35	5.93%	of total area
Area of Horsham in Zone 3a (High Flood Risk)	6.34	1.20%	of total area
Area of Horsham in Zone 2 (Moderate Flood Risk)	0.97	0.18%	of total area
Area of Zone 3 that is defended	0.00	0.00%	of Zone 3
Total Developed Area	33.46	6.33%	of total area
Existing Development in Flood Zone 3b	0.27	0.81%	of dev. area
Existing Development in Flood Zone 3a	0.16	0.48%	of dev. area
Existing Development in Flood Zone 2	0.35	1.04%	of dev. area
Potential New Development Required	3.65	0.69%	of total area
Potential New Development in Zones 3b	0.09	2.46%	of pot. dev.
Potential New Development in Zones 3a	0.02	0.49%	of pot. dev.
Potential New Development in Zones 2	0.06	1.61%	of pot. dev.
Drainage Problem Areas	Minimal Drainage Flooding – records show points rather than areas.		
Extent of Groundwater Emergence Zone	21.34	4.03%	of total area

4.2 Focussed Settlement Assessments

The Horsham District Council Core Strategy (Policy CP5) defines a Sustainable Settlement Hierarchy that identifies two levels of settlement with potential for future development.

- Category 1 Settlements represent towns and villages with a good range of services and facilities as well as some access to public transport – capable of sustaining some expansion, infilling and redevelopment.
- Category 2 Settlements represent villages with a more limited level of services which should accommodate only small-scale development or minor extensions that address specific local needs.

Table 4-2: Horsham District Council Category 1 Settlements

Category 1 Settlements	
Billingshurst	Pulborough
Broadbridge Heath	Southwater
Henfield	Steyning, Bramber and Upper Beeding
Horsham	Storrington/Sullington

Table 4-3: Horsham District Council Category 2 Settlements

Category 2 Settlements	
Amberley	Partridge Green
Ashington	Rudgwick & Bucks Green
Barns Green	Rusper
Christ's Hospital	Slinfold
Codmore Hill	Small Dole
Coldwatham	Thakeham (The Street & High Bar Lane)
Cowfold	Warnham
Faygate	Washington
Lower Beeding	West Chiltington Common & Village
Mannings Heath	

Following the Sustainable Settlement Categories, a more focussed, local-level assessment has been carried out for each of the Category 1 and Category 2 settlements within the District and is presented in Appendix B. This consists of the same information used in the District-level assessment, but at a smaller scale, allowing planners to assess flood risk information at a higher resolution. In addition, these assessments provide a table with information on development aspiration for housing and employment uses from the Horsham District Council Core Strategy and other policies that influence development. They also provide a summary of reported incidents within the area, highlighting flooding sources and problem areas.

There are two maps included in the local-level assessment that do not cover settlements but potential employment areas – The Shoreham Cement Works and the Centre of Excellence at Brinsbury. These sites have been identified in the Core Strategy and, in order to allow the planning team at HDC to make an informed decision as to their level of flood risk, it was necessary to include the sites even though they fall outside of the Sustainable Settlement Hierarchy.

The information presented at the Level 1 SFRA has predominately been provided by the Environment Agency from their high level hydraulic modelling programmes. HDC, West Sussex County Council, the Highways Agency, Thames Water and Southern Water made additional contributions.

4.3 Summary

In line with PPS25, the Sequential Test should be applied at all stages of planning. The aim of this is to direct new development towards areas that have a low probability of flooding. The information provided in Table 4-1 and Appendix A and Appendix B indicate the geographical extent of Flood Zone 2 and Flood Zone 3 for the administrative area of Horsham District Council (within the Arun and Adur River Catchments).

Horsham District Council has a total administrative area of 529 km². Using the flood zone maps, it is apparent that 5.93% (31.35 km²) of the total administrative area is located within Flood Zone 3b (Functional Floodplain) whilst 1.20% (6.34 km^2) is located in Flood Zone 3a (High Risk) and 0.18% (0.97 km^2) is located in Flood Zone 2. Of the total area, approximately 6.33% (33.46 km²) is already developed with 0.81% (0.27 km^2) falling under FZ3b, 0.48% (0.16 km^2) falling under FZ3a and 1.04% (0.35 km^2) falling under FZ2.

The broad-scale and settlement-level assessments clearly show that, whilst flood risk exists in areas of the District, it does not pose a widespread and significant issue for the allocation of development sites. Where potential development sites are at risk from flooding, the planning authority must determine their suitability based on the Sequential Test and vulnerability classifications presented in Tables D1 and D2 of PPS25. Wherever possible the LPA should seek to direct development to low probability Flood Zones (Flood Zone 1). Where this is not possible, development should preferably be located in Flood Zone 2 and where this is not possible, sites in Flood Zone 3 can be considered, however, any development sites that are either wholly or partly situated in Flood Zone 2 or 3 will require, where necessary, the application of the exception test. Those areas requiring application of the exception test will require further assessment in a Level 2 SFRA. Information on the application of the Sequential Test, guidance on strategies for managing flood risk, guidance on the potential use of Sustainable Drainage Systems (SuDS) and guidance on site specific Flood Risk Assessments (FRAs) are provided in Section 5 and Section 7.

It should be noted that Horsham District Council have identified two areas of development within their adopted Core Strategy: CP7 – West of Horsham and CP6 – West and North West of Crawley. These areas are now adopted under the Core Strategy and therefore form part of the planning policy for the District. As areas of these sites fall within Flood Zones 2 and 3, it will be necessary to consider them in the Sequential Test. CP6 covers the catchment of the Upper Mole and is not covered by this SFRA.

A table of all potential development sites and their corresponding flood risk can be found in Appendix B. This table should be used by HDC to identify those sites at risk of flooding in Flood Zones 2 and 3.

5 Sequential Test

5.1 Background

The sequential approach is a simple decision-making tool designed to ensure that sites at little or no risk of flooding are developed in preference to areas at higher risk. It 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-incompatible) 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.

The Sequential Test refers to the application of the sequential approach by Local Planning Authorities (LPA). This allows the determination of site allocations based on flood risk and vulnerability (see Table 5-1 and Table 5-2, provided below). Development should be directed to Flood Zone 1 wherever possible, and then sequentially to Flood Zones 2 and 3, and to the areas of least flood risk within Flood Zone 2 and then Flood Zone 3, as identified within this Strategic Flood Risk Assessment. A flow diagram for application of the Sequential Test from the Practice Guide Companion to PPS25 is also provided.

Table 5-1: Flood Zones as defined in Table D1, Annex D of PPS25 (full description provided in Appendix D of PPS25).

FLOOD ZONE	DEFINITION		PROBABILITY OF FLOODING
	FLUVIAL	TIDAL	
Flood Zone 1	< 1 in 1000 year (< 0.1%)	< 1 in 1000 year (< 0.1%)	Low Probability
Flood Zone 2	Between 1 in 1000 year (< 0.1%) and 1 in 100 year (1%)	Between 1 in 1000 year (< 0.1%) and 1 in 200 year (0.5%)	Medium Probability
Flood Zone 3a	> 1 in 100 year (> 1%)	> 1 in 200 year (> 0.5%)	High Probability
Flood Zone 3b	Either > 1 in 20 (5%) or as agreed by between the EA and LPA	Either > 1 in 20 (5%) or as agreed by between the EA and LPA	Functional Floodplain

The application of the sequential approach aims to manage the risk from flooding by avoidance. This will help avoid the promotion of sites that are inappropriate on flood risk grounds. The application of the Exception Test through a Level 2 SFRA will ensure that new developments in flood risk areas will only occur where flood risk is clearly outweighed by other sustainability drivers.

A LPA must demonstrate that it has considered a range of possible sites in conjunction with the Flood Zone information from the SFRA and applied the Sequential Test, and where necessary, the Exception Test (see Appendix D of PPS25), in the site allocation process. 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.

Table 5-2: Flood Risk Vulnerability Classification (from PPS25, Appendix D, Table D2)

Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes), which has to cross the area at risk, and strategic utility infrastructure, including electricity generating power stations and grid and primary substations.
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.
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	• 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 plants. • Sewage treatment plants (if adequate pollution control measures are in place).
Water-compatible Development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel workings. • 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.

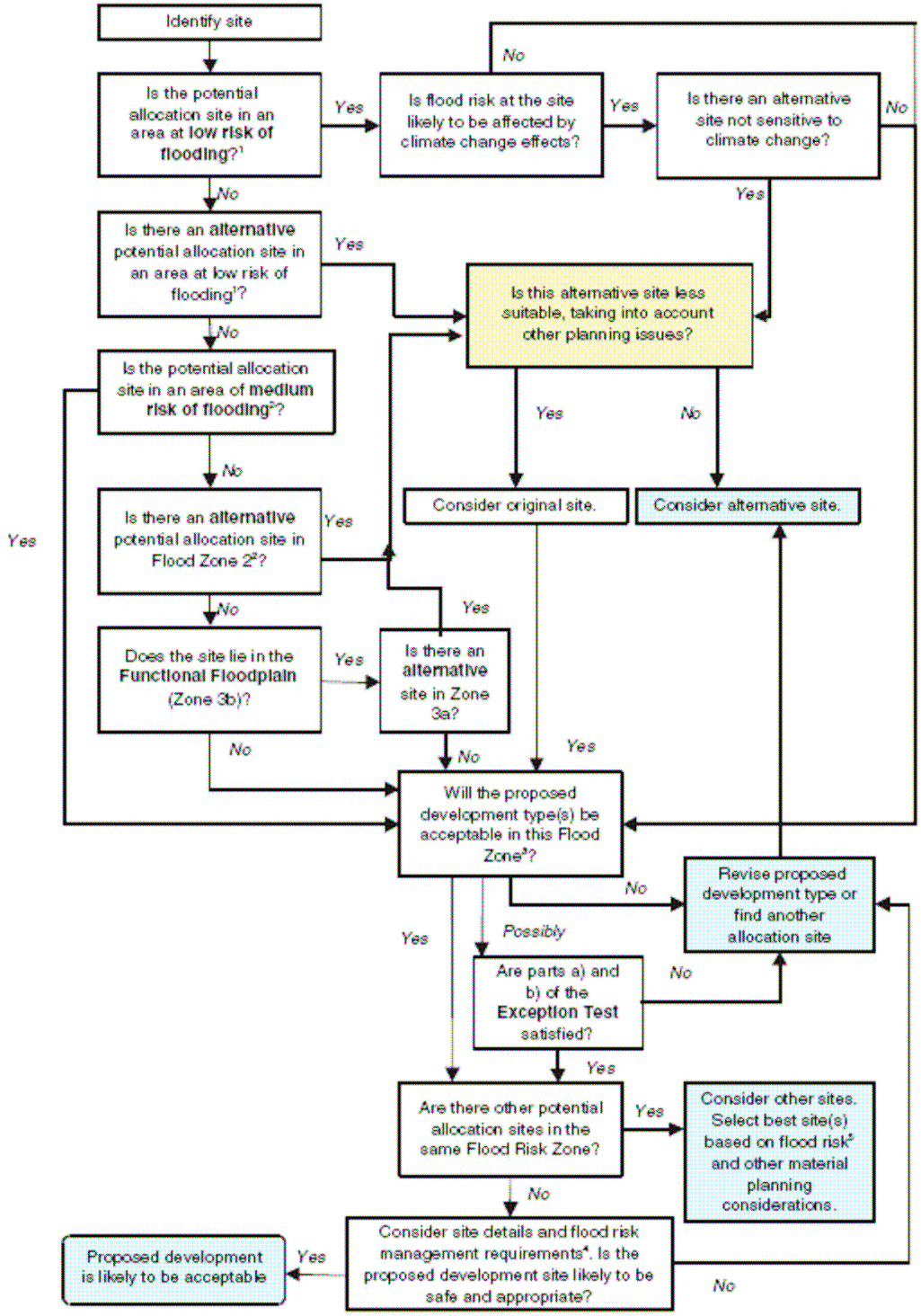


Figure 5-1: Flow diagram illustrating the application of the Sequential Test (from PPS25 Practice Guidance – April 2007)

PPS25 acknowledges that some areas will (also) be at risk of flooding from flood sources other than fluvial or tidal systems. All sources of flooding must be considered when looking to locate new development. The other sources of flooding requiring consideration when situating new development allocations include:

- Surface Water;
- Groundwater;
- Sewers; and
- Artificial Sources.

These sources (as sources of flooding) are typically less understood than tidal and fluvial sources. Data primarily exists as point source data or through interpretation of local conditions. In addition, there is no guidance on suitable return periods to associate with floods arising from these sources. For example modern storm water drainage systems are constructed to a 1 in 30 year standard. Any storm event in excess of the 30 year return period storm would be expected to cause flooding. If a location is recorded as having experienced repeated flooding from the same source this should be acknowledged within the Sequential Test.

5.2 Using the SFRA to Apply the Sequential Test

The Sequential Test should be undertaken by the LPA and accurately documented to ensure decision processes are consistent and transparent. The Sequential Test should be carried out on potential development sites, seeking to balance the flood probability and development vulnerability of sites throughout the Local Planning Authority area.

A table of all potential development sites and their corresponding flood risk, as defined in the Level 1 SFRA, can be found in Appendix B. This table should be used by HDC to identify those sites at risk of flooding in Flood Zones 2 and 3.

Table 5-3: Flood Risk Vulnerability and Flood Zone 'Compatibility' from PPS25, Appendix D, Table D.3
(✓ - Development is appropriate, × - Development should not be permitted)

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

The recommended steps required in undertaking the Sequential Test are detailed below. This is based on the Flood Zone and Flood Risk Vulnerability and is summarised in Table 5-3.

Recommended stages for LPA application of the Sequential Test

The information required to address many of these steps is provided in the accompanying Level 1 GIS layers and maps presented in Appendix B.

1. Assign potential developments with a vulnerability classification (Table 5-2). Where development is mixed, this should be moved to the higher classification.
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 Environment Agency Flood Zones for fluvial and tidal sources. 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:
    - 60- years – up to 2072 for commercial / industrial developments; and
    - 100 years – up to 2112 for residential developments
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. 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.
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.
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 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 fulfilled.
10. Water compatible development has the least constraints with respect to flood risk and it is considered appropriate to allocate these sites last.

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 Assessment. 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 and or,
    - 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. This should be discussed with the Environment Agency to establish the appropriate time for the assessment to be undertaken, (i.e. Exception Test through a Level 2 SFRA or assess through a site specific flood risk assessment).

The table presented in Appendix E is designed to assist HDC in determining the flood risk classification for each site and in completing the Sequential Test. This will aid the determination of the most suitable type of development for each site based on development vulnerability and flood risk. Certain sites have been identified as lying within Flood Zones 2 and 3 and, if the sites cannot be relocated, it will be necessary to undertake an Exception Test.

Using the SFRA Maps, Data and GIS Layers

Table 5-4 highlights which GIS layers and SFRA data should be used in carrying out the sequential test. The table poses some example questions that are not exhaustive, but should provide some guidance for a user of the SFRA.

Appendix I summarises the steps required to maintain and update the SFRA together with a revision schedule. This should be checked to prior to the SFRA being used at a strategic land allocation scale or on a Development Control level to ensure the most current and up-to-date version of the SFRA is being used. In addition, close consultation with some of the key stakeholders, in particular the EA, may highlight updated flood risk information that may reduce uncertainty and ensure the Sequential Test is as robust as it can be.

Table 5-4: Sequential Test Key - A Guide to using the GIS Layers

Category	GIS Layer	Example Questions
Development Vulnerability	Not applicable refer to Table D2 in PPS25	**Question 1** – Is the proposed development defined as 'highly vulnerable' according to Table D2 in Planning Policy Statement 25?
		Question 2 - Is the proposed development defined as 'more vulnerable' according to Table D2 in Planning Policy Statement 25?
		Question 3 - Is the proposed development defined as 'less vulnerable' according to Table D2 in Planning Policy Statement 25?
		Question 4 - Is the proposed development defined as 'essential infrastructure according to Table D2 in Planning Policy Statement 25?
		Question 5 - Is the proposed development defined as 'water compatible development' according to Table D2 in Planning Policy Statement 25?
Flood Zone Classification	SFRA combined fluvial & tidal FZ2, FZ3a & FZ3b layers. Also examine historical floodplain and take into consideration climate change outlines.	**Question 6** – Through consultation of the Environment Agency's flood zone maps, is the development site located in Flood Zone 1?
		Question 7 - Through consultation of the Environment Agency's flood zone maps, is the development site located in Flood Zone 2?
		Question 8 - Through consultation of the Environment Agency's flood zone maps, is the development site located in Flood Zone 3a?
		Question 9 - Through consultation of the Environment Agency's flood zone maps, is the development site located in Flood Zone 3b?
		Question 10 - Can the development be located in Flood Zone 1?
		Question 11 - Can the development be located in Flood Zone 2?
		Question 12 - Can the development be located in Flood Zone 3a?
	CEH watercourse network & EA main river maps.	**Question 13 -** Is the site located within 20m of a watercourse?

Category	GIS Layer	Example Questions
Other Flood Sources	SFRA combined fluvial and tidal FZ3 & FZ2 outlines plus climate change	**Question 14 –** Is the site impacted by the effects of climate change
	Sewer Flood Layer & Historical Flood Outlines	**Question 15** - Is the site in an area potentially at risk from sewer flooding?
	Historical Flood Outlines, Parish Council data, GEZ, CEH stream network (BFI) and groundwater vulnerability maps	**Question 16** - Is the site in an area potentially at risk from overland flow flooding?
		Question 17 - Is the site located in an area of rising groundwater levels?
		Question 18 - Does the site have a history of flooding from any other source?
Flood Risk Management	Flood Defence Layer (NFCDD), Flood Warning Layer, Areas Benefiting from Flood Defences Layer, Parish Council data	**Question 19** - Does the site benefit from flood risk management measures?
		Question 20 - Can the development be relocated to an area benefiting from flood risk management measures or of lower flood risk?

6 Policy Review

National and local policies have been reviewed against the local flood risk issues and objectives identified by the Environment Agency in the CFMPs covering The River Adur and The River Arun and Western Streams. From these policies the following catchment wide and specific area strategies have been developed under the headings Flood Risk, SuDS, Flood Mitigation and the Water Environment. Integration of these suggested policy considerations into LDF / LDD should ensure that the objectives and aspirations of the Environment Agency and national policy are met whilst strengthening the position of the Local Planning Authority with regard to Flood Risk.

6.1 Flood Risk

Catchment Wide Strategies

1. Allocate all sites in accordance with the Sequential Test reduce the flood risk and ensure that the vulnerability classification of the proposed development is appropriate to the flood zone classification;
2. Flood Risk Assessments (FRAs) should be undertaken for all developments within Flood Zones 2 and 3 and sites with identified flooding sources (according to PPS25 Annex E) to assess the risk of flooding to the development and identify options to mitigate the flood risk to the development, site users and surrounding area;
3. Flood Risk Assessments are required for all major developments in Flood Zone 1 (according to PPS25 Annex E). These are residential developments consisting of sites greater than 0.5 ha or greater than 10 dwellings and commercial developments that are greater than 1 ha or have a floor area greater than 1000 m^2.
4. Flood Risk to development should be assessed for all forms of flooding;
5. Where floodplain storage is removed, the development should provide compensatory storage on a level for level and volume for volume basis to ensure that there is no loss in flood storage capacity.

Area Specific Strategies

1. Surface water flooding should be investigated in detail as part of site specific FRAs for developments located within Category 1 and 2 settlements and early liaison with the Environment Agency and Horsham District Council for appropriate management techniques.
2. Groundwater flooding should be investigated in more detail as part of site specific FRAs for developments located to the south of the District where a potential for groundwater flooding exists (see Level 1 GIS layers and mapping) or where a site is located within a defined groundwater emergence zone.

Through integration of these suggestions, the emerging LDF will comply with PPS25 and the aspirations and policies represented in following:

- Regional policy for the South East of England is split into three documents of which Regional Planning Guidance for the South East (RPG9) is relevant to the study area;
- South East England Regional Assembly – Regional Flood Risk Appraisal;
- Horsham District Council: Local Development Framework 2006;
- River Adur and River Arun & Western Streams Catchment Flood Management Plan;
- Biodiversity Action Plan for Sussex.

6.2 Sustainable Drainage Systems

A guide to Sustainable Drainage Systems (SuDS) is provided in Appendix G. Sustainable Drainage Policies should address the following issues as:

Catchment Wide Strategies

1. Sustainable Drainage Systems should be included in new developments unless where it is demonstrably not possible to manage surface water using these techniques;
2. PPS25 requires the use of SuDS as an opportunity of managing flood risk, improving water quality and increasing amenity and biodiversity;
3. Flood Risk Assessments are required for all major developments in Flood Zone 1 (according to PPS25 Annex E). These are residential developments consisting of sites greater than 0.5 ha or greater than 10 dwellings and commercial developments that are greater than 1 ha or have a floor area greater than 1000 m^2;
4. Runoff rates from new developments on greenfield sites should be not exceed greenfield runoff rates pre-development and should allow for climate change;
5. Runoff rates from previously developed developable land should not exceed existing rates of runoff and should seek betterment. In addition, an allowance should be made for climate change;
6. Runoff and/or discharge rates should be restricted to greenfield runoff rates in areas known to have a history of sewer and/or surface water flooding.

Area Specific Strategies

1. At the site specific FRA level, the suitability of Sustainable Drainage Systems should be investigated for each development. Areas to north of the District (the High and Low Weald areas) may be more suited to attenuation systems.

A list of each site highlighting the underlying geology and soil, together with site specific recommendations for SuDS and FRAs is presented in the Broad Scale Assessment of SuDS at the end of Appendix G.

Through integration of these suggestions, the emerging LDF will comply with PPS25 and the aspirations and policies represented in following:

- Regional policy for the South East of England is split into three documents of which Regional Planning Guidance for the South East (RPG9) is relevant to the study area;
- South East England Regional Assembly – Regional Flood Risk Appraisal;
- Horsham District Council: Local Development Framework 2006;
- River Adur and River Arun & Western Streams Catchment Flood Management Plan;
- Biodiversity Action Plan for Sussex.

6.3 Water Environment

Catchment Wide Strategy

1. Development should not have a detrimental impact on the water environment through changes to water chemistry or resource;
2. Developments should look to incorporate water reuse and minimisation technology;
3. Any development should not be located within 8 metres of the river bank to ensure access for maintenance but amongst other things should ensure a riparian corridor for improvement of the riverine environment.

Through integration of these suggestions, the emerging LDF will comply with PPS25 and the aspirations and policies represented in following:

- Regional policy for the South East of England is split into three documents of which Regional Planning Guidance for the South East (RPG9) is relevant to the study area;
- South East England Regional Assembly – Regional Flood Risk Appraisal;
- Horsham District Council: Local Development Framework 2006;
- River Adur and River Arun & Western Streams Catchment Flood Management Plan;
- Biodiversity Action Plan for Sussex;
- Adur & Ouse and Arun & Western Streams Catchment Abstraction Management Strategies (CAMS).

Flood Risk Management Policies contained within the Catchment Flood Management Plans have been set out by the Environment Agency and assigned to different zones within the SFRA area. The strategies suggested above mesh with these aspirations and if integrated will aid to strengthen the position of the Local Planning Authority.

The area specific strategies have been updated following the application of the Sequential Test to provide more specific strategies for allocated development sites – this is presented in the Broad Scale Assessment of SuDS at the end of Appendix G.

7 Flood Risk Assessment Guidance

7.1 Site Specific Flood Risk Assessment Guidance

The assessment of flood risk is a fundamental consideration regardless of the scale or type of development. Understanding the flood risk to, and arising from, a development is key to managing the risk to people and property thereby reducing the risk of injury, property damage or even death. The effects of climate change may exacerbate future flood risk. Current predictions indicate that milder wetter winters and hotter drier summers will be experienced in the future and there will be a continued rise in sea levels. These changes will potentially lead to an increase in rainfall quantities thus altering the magnitude, frequency and intensity of flood events.

Flooding is not limited to just rivers and sea, in fact flooding can arise from a number of sources, each presenting their own type of risk and requiring management. In addition some areas currently defended from flooding may be at greater risk in the future as the effects of climate change take hold or defence condition deteriorates with age.

Opportunities to manage flooding whilst providing development exist through an understanding and mitigation of the risk. This includes the location, layout and design of developments to enable the management of flood risk through positive planning. This positive planning needs to consider the risks to a development from local flood sources but also the consequences a development may have on increasing flood risk to others. Early identification of flood risk constraints can ensure developments maximise development potential whilst achieving the principles of sustainability.

A Level 1 Strategic Flood Risk Assessment should present sufficient information to assist Local Planning Authorities to apply the Sequential Test and identify where the Exception Test may be required. These documents are predominately based on existing data. The scale of assessment undertaken for a Strategic Flood Risk Assessment is typically inadequate to accurately assess the risks at individual sites within the study area. The Environment Agency and SFRA Flood Zone Mapping do not account for all watercourses within Horsham District. Although, a watercourse may not have a flood zone mapped, as a precautionary principle, it is advised that a Flood Risk Assessment should be requested for all development proposals within 20 m of a watercourse (the water environment). This will ensure that flood risk is managed and that flooding is not increased within or to the surrounding area.

Site specific flood risk assessments are required to assess the flood risk posed to proposed developments and to ensure that, where necessary, appropriate mitigation measures are included in the development. This section presents the recommendations for site specific flood risk assessments prepared for submission with planning applications to South Hams District Council.

The guidance presented in the following sections has been based on:

- the recommendations presented in Planning Policy Statement 25 and the consultation draft of the Practice Guide companion to PPS25
- the information contained within this Level 1 SFRA report.

When is a Flood Risk Assessment Required?

When informing developers of the requirements of a flood risk assessment for a development site, consideration should be given to the position of the development relative to flood sources, the vulnerability of the proposed development and its scale.

In the following situations a Flood Risk Assessment should always be provided with a planning application:

- The development site is located in Flood Zone 2 or 3;
- The proposed development is classed as a major development and located in Flood Zone 1. These are residential developments consisting of sites greater than 0.5 ha or greater than 10 dwellings and commercial developments that are greater than 1 ha or have a floor area greater than 1000 m^2;
- The development site is located in an area known to have experienced flooding problems from any flood source;
- The development is located within 20m (water environment) of any watercourse regardless of Flood Zone classification.

What does a Flood Risk Assessment require?

Annex E of PPS25 presents the minimum requirements for flood risk assessment. These include:

- The consideration of the risk of flooding arising from the development in addition to the risk of flooding to the development;
- Identify and quantify the vulnerability of the development to flooding from different sources and identify potential flood risk reduction measures;
- Assessment of the remaining 'residual' risk after risk reduction measures have been taken into account and demonstrate that this is acceptable for the particular development;
- The vulnerability of those that could occupy and use the development, taking account of the Sequential and Exception Tests and the vulnerability classification, including arrangements for safe access;
- Take consideration of 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;
- Fully account for current climate change scenarios and their effect on flood zoning and risk.

The Practice Guide Companion to PPS25 (consultation document) advocates a staged approach to site specific flood risk assessment with the findings from each stage informing the next and site master plans, iteratively throughout the development process.

The staged approach comprises of three stages:

Level 1 - Screening Study

A level 1 Screening Study is intended to identify if a development site has any flood risk issues that warrant further investigation. This should be based on existing information such as that presented in the Level 1 SFRA. Therefore this type of study can be undertaken by a development control officer in response to the

developer query or by a developer where the Level 1 SFRA is available. Using the information presented in the Level 1 SFRA and associated GIS layers a development control officer could advise a developer of any flooding issues affecting the site. A developer can use this information to further their understanding of how flood risk could affect a development.

Level 2 - Scoping Study

A level 2 Scoping Study is predominately a qualitative assessment designed to further understanding of how the flood sources affect the site and the options available for mitigation. The Level 2 FRA should be based on existing available information where this is available and use this information to further a developers understanding of the flood risk and how they affect the development. This type of assessment should also be used to inform master plans of the site raising a developer's awareness of the additional elements the proposed development may need to consider.

Level 3 – Detailed Study

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 risks, further investigation will be required. For example it is generally considered inappropriate to base a flood risk assessment for a residential care home at risk of flooding from fluvial sources on Flood Zone maps alone. In such cases the results of hydraulic modelling are preferable to ensure details of flood flow velocity, onset of flooding and depth of floodwater is fully understood and that the proposed development incorporates appropriate mitigation measures.

At all stages, the Local Planning Authority, and where necessary the Environment Agency and/or the Statutory Water Undertaker should be consulted to ensure the Flood Risk Assessment provides the necessary information to fulfil the requirements for Planning Applications.

Site Specific Guidance

Further FRA guidance can be found in the site-specific recommendations table at the end of Appendix H.

8 Summary and results of the Sequential Test undertaken by Horsham District Council

The following points provide a summary of this Strategic Flood Risk Assessment.

- Horsham District Council require a Strategic Flood Risk Assessment for the progression of their Local Development Framework, to assist development control and provide information for emergency planning.
- The main watercourses within the Horsham District administrative area are the Rivers Arun and Adur. These rivers are the predominant source of flood risk within the Horsham District with tidal flood sources affecting the south of the area. To a lesser extent, there is a risk of flooding from groundwater, surface water and sewer flooding.
- Focused assessments for urban areas within the categories 1 and 2 of the Sustainable Settlement Hierarchy identified for development have areas that lie within Flood Zone 2 and 3.
- The information provided within this SFRA and the associated appendices has allowed Horsham District Council to perform the Sequential Test as defined in PPS25 (see Appendix F and H).

Using the information provided within this SFRA, Horsham District Council have applied the Sequential Test for potential allocation sites. The following points summarise the results from the application of the Sequential Test.

- 47 of the potential allocation sites lie within Flood Zone 1, 4 sites had areas within Flood Zones 2 and 3 (see Table 8.1 below).

Table 8-1: Potential allocations sites at risk of flooding identified following Sequential Test by HDC.

LDF Allocation		Grid Ref	Site Area	Flood Zone 2		Flood Zone 3 + CC		Flood Zone 3a		Flood Zone 3b	
Policy	Notes		(ha)	Area (Ha)	% of Area	Area (Ha)	% of Area	Area (Ha)	% of Area	Area (Ha)	% of Area
AL2	Lifestyle Ford Bishopric Horsham	E 516717.51 N 130656.25	1.400	0.074	5.26%	0.074	5.26%	0.074	5.25%	0.065	4.63%
CP7	Land west of Horsham west	E 515460.90 N 130191.74	50.580	0.548	1.08%	0.070	0.14%	0.025	0.05%	0.025	0.05%
	Land west of Horsham east	E 515460.90 N 130191.74	49.030	13.930	28.41%	9.829	20.05%	8.762	17.87%	7.421	15.14%
AL14	Brinsbury Centre of Excellence	E 506746.92 N 122558.29	58.760	1.444	2.46%	1.444	2.46%	1.205	2.05%	1.205	2.05%
AL15	Shoreham Cement Works	E 520351.71 N 108818.62	39.420	0.182	0.46%	0.215	0.55%	0.215	0.55%	0.215	0.55%

- Information presented within the Strategic Flood Risk Assessment has allowed Horsham District Council to redefine land use policies using the sequential approach. This has located all built environment within Flood Zone 1, allowing only informal open spaces and water compatible development within Flood Zones 2 and 3.

- It is recommended that a Level 2 SFRA is not required at present because all development can be located within Flood Zone 1. However, changes to the potential allocation sites would require revision of the Sequential Test and where required may facilitate the application of the Exception Test, thus requiring a Level 2 SFRA.

It is noted that CP7 is a strategically important site and has been adopted within the Core Strategy. Identification of alternative sites was therefore not possible. However, using the sequential approach, Horsham District Council has reallocated areas within these sites to ensure that development is located within areas of lowest flood risk. Appendix H provides the revised site layouts proposed for those sites identified in Table 8.1.