



**Rotherham Metropolitan Borough Council
Strategic Flood Risk Assessment (SFRA)
Level 1**

June 2008 (Final)



Rotherham Metropolitan Borough Council
Civic Building
Walker Place
ROTHERHAM

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EXECUTIVE SUMMARY

Introduction

1. The Borough of Rotherham is situated in South Yorkshire spanning the valleys of the River Don, the River Rother, and the River Dearne. Historically development has concentrated around the river and canal network, providing critical water supplies and transport linkages to support the coal mining and steel industries. Decline in these industries since the 1980s has resulted in a need for economic activity to be restored within the Borough. An overview of the Borough is provided in Figure A.
2. It is important to recognise that some of those areas that are at risk of flooding from rivers within the Borough are under pressure from future development. It is essential therefore that the Council are in a position to take informed decisions, providing a careful balance between the risk of flooding and other unrelated planning constraints that may place pressure upon 'at risk' areas. The Rotherham SFRA endeavours to provide specific advice to assist the Council in this regard.
3. **This report (and the supporting mapping) represents the Level 1 SFRA¹, and should be used by the Council to inform the application of the Sequential Test.** Following the application of the Sequential Test, it may be necessary to develop a Level 2 SFRA² should it be shown that proposed allocations fall within a flood affected area of the Borough. The Level 2 SFRA should consider the risk of flooding in greater detail within a local context to ensure that the site can be developed in a safe and sustainable manner.

Why carry out a Strategic Flood Risk Assessment (SFRA)?

4. Flooding can result not only in costly damage to property, but can also pose a risk to life and livelihood. It is essential that future development is planned carefully, steering it away from areas that are most at risk from flooding where possible, and ensuring that it does not exacerbate existing known flooding problems.
5. *Planning Policy Statement (PPS) 25: Development and Flood Risk* has been developed to underpin decisions relating to future development (including urban regeneration) within areas that are subject to flood risk. In simple terms, PPS25 requires local planning authorities to review the variation in flood risk across their Borough, and to steer vulnerable development (e.g. housing) towards areas of lowest risk. Where this cannot be achieved and development is to be permitted in areas that may be subject to some degree of flood risk, PPS25 requires the Council to demonstrate that there are sustainable mitigation solutions available that will ensure that the risk to property and life is minimised (throughout the lifetime of the development) should flooding occur.
6. The Strategic Flood Risk Assessment (SFRA) is the first step in this process, and it provides the building blocks upon which the Council's planning and development control decisions will be made.

What is a Strategic Flood Risk Assessment (SFRA)?

7. The Rotherham Borough Council Strategic Flood Risk Assessment (SFRA) has been carried out to meet the following key objectives:
 - To collate all known sources of flooding, including river, surface water (local drainage), sewers and groundwater, that may affect existing and/or future development within the Borough;

¹ Refer paragraphs 2.32 to 2.35 of the Living Draft of the Practice Guide Companion to PPS25 (February 2007)

² Refer paragraphs 2.36 to 2.42 of the Living Draft of the Practice Guide Companion to PPS25 (February 2007)

- To delineate areas that have a 'low', 'medium' and 'high' probability of flooding within the Borough, in accordance with Planning Policy Statement 25 (PPS25), and to map these;
- Within flood affected areas, to recommend appropriate land uses (in accordance with the PPS25 *Sequential Test*) that will not unduly place people or property at risk of flooding;
- Where flood risk has been identified as a potential constraint to future development, recommend possible flood mitigation solutions that may be integrated into the design (by the developer) to minimise the risk to property and life should a flood occur (in accordance with the PPS25 *Exception Test*).

The Sequential Test

8. The primary objective of PPS25 is to steer vulnerable development towards areas of lowest flood risk. PPS25 advocates a sequential approach that will guide the planning decision making process (i.e. the allocation of sites). In simple terms, this requires planners to seek to allocate sites for future development within areas of lowest flood risk in the initial instance. **Only if it can be demonstrated that there are no reasonably available sites within these areas should alternative sites (i.e. within areas that may potentially be at risk of flooding) be contemplated.** This is referred to as the Sequential Test.
9. As an integral part of the sequential approach, PPS25 stipulates permissible development types. This considers both the degree of flood risk posed to the site, and the likely vulnerability of the proposed development to damage (and indeed the risk to the lives of the site tenants) should a flood occur.
10. The PPS25 Sequential Test is depicted in Figure 3.1 of the Practice Guide Companion to PPS25 (Draft, February 2007) and Section 6.4.1 of this document.

The Exception Test

11. Many towns within England are situated adjacent to rivers, and are at risk of flooding. The future sustainability of these communities relies heavily upon their ability to grow and prosper. PPS25 recognises that, in some Boroughs, including Rotherham Borough Council, restricting residential development from areas designated as Zone 3a High Probability may heavily compromise the viability of existing communities within the Borough.
12. For this reason, PPS25 provides an Exception Test. Where a local planning authority has identified that there is a strong planning based argument for a development to proceed following the application of the Sequential Test, it will be necessary for the Council to demonstrate that the Exception Test can be satisfied.
13. For the Exception Test to be passed it must be demonstrated that:
 - *“...the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared. If the DPD has reached the ‘submission’ stage, the benefits of the development should contribute to the Core Strategy’s Sustainability Appraisal;*
 - *the development should be on developable, previously developed land or if it is not on previously developed land, that there are no reasonable alternative sites on previously developed land; and*
 - *a FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and where possible, will reduce flood risk overall.”*

Outcomes of the Rotherham Borough Council SFRA

14. The Borough of Rotherham has been delineated into zones of low, medium and high probability of fluvial flooding, based upon existing available information provided by the Environment Agency. Detailed flood risk mapping has been made available for the River Don, River Rother and River Dearne. The Environment Agency Flood Zone Maps (April 2008) have been adopted as the basis for the SFRA for other watercourses.
15. A proportion of the Borough is affected by flooding from rivers and/or local waterways. The spatial variation in flood risk across the Borough has been delineated in the following manner:

Zone 3b (Functional Floodplain)

16. Areas subject to flooding up to (and including) once in every 20 years on average have been delineated. These areas have subsequently been sub-delineated on the basis of current land use such that:
 - Areas of existing open space have been defined as Zone 3b Functional Floodplain;
 - Areas that are 'previously developed' have been defined as Zone 3a(i).

This sub-delineation is in accordance with the recommendations of the PPS25 Practice Guide (refer paragraph 3.15), recognising the impact that existing barriers have upon the flooding regime. Specific planning responses have been developed accordingly for both Zone 3b and Zone 3a(i), as set out in Section 6.4.

Within the context of the SFRA, '**previously developed**' areas, delineated as **Zone 3a(i) for planning purposes, relate to sites within which there are existing buildings that are considered to be impermeable to floodwaters**. It is important to recognise that the land surrounding these buildings are critical flow paths and/or flood storage areas, and must be retained.

17. It is important to recognise that all areas within Zone 3b are areas that are subject to relatively frequent flooding, and may be subject to fast flowing and/or deep water. Whilst it may be impractical to refuse all future regeneration within these areas, careful consideration must be given to future sustainability and safety issues. To meet the requirements of the Exception Test, it will be necessary for the Council to demonstrate that the development provides wider sustainability benefits to the community that outweigh flood risk.

Zone 3a High Probability

18. Areas subject to flooding up to (and including) once in every 100 years on average (i.e. Zone 3a High Probability) have been identified. Residential development should be avoided in these areas wherever possible.
19. To meet the requirements of the Exception Test, it will be necessary for the Council to demonstrate that the development provides wider sustainability benefits to the community that outweigh flood risk. The Council must also demonstrate that the development is on developable, previously developed land or if it is not on previously developed land, that there are no reasonable alternative sites on previously developed land.
20. The SFRA has outlined specific development control recommendations that should be placed upon development within Zone 3a High Probability to minimise the damage to property, the risk to life in case of flooding, and the need for sustainable drainage techniques (SuDS) to reduce runoff rates. It is essential that the developer carries out a detailed Flood Risk Assessment to consider the site-based constraints that flooding may place upon the proposed development.

Zone 2 Medium Probability

21. Areas subject to flooding in events exceeding the 100 year event, and up to (and including) once in every 1000 years on average (i.e. Zone 2 Medium Probability) have been identified. 'Highly Vulnerable Development'³, for example emergency services, should be avoided in these areas. There are generally no other restrictions placed upon land use in these areas, however it is important to ensure that the developer takes account of possible climate change impacts to avoid a possible increase in the risk of flooding in future years (achieved through completion of a simple Flood Risk Assessment).

Zone 1 Low Probability

22. There are no restrictions placed on land use within Zone 1 Low Probability (i.e. all remaining areas of Rotherham) by PPS25. It is important to highlight however that those areas affected by flooding within the Borough in recent years have often fallen within Zone 1. It is essential therefore that the Council establish robust local planning policy that addresses those issues not captured by PPS25 through the delineation of fluvial flood zones. Consideration must be given to the potential risk of flooding from other sources (outlined in 'Localised Flooding Issues' below), ensuring that future development is not inadvertently placed at risk. It is also essential to ensure that future development does not exacerbate the current risk posed to existing homes and businesses.

Localised Flooding Issues

23. In addition to fluvial (river) flooding, properties and infrastructure within Rotherham are also at risk of flooding from other, more localised, sources. These include the surcharging of the underground sewer system, the blockage of culverts and gullies (which results in overland flow), and surface water flooding. Evidence of localised flooding of this nature has been captured from discussions with the Council, as depicted in Figures 1 to 16.
24. PPS25 does not address issues of this nature within its delineation of flood zones and what development is acceptable within them. In many instances, localised flooding issues result in only nuisance flooding, and will generally affect only a small number of properties. Incidents of this nature can often be addressed through the design process, and therefore should not affect decision making with respect to the allocation (or otherwise) of sites within Rotherham. The recent flooding throughout England highlights that this is certainly not always the case however, and uncontrolled flooding as a result of particularly heavy rains can create significant damage and disruption.
25. It is difficult to predict the likelihood and anticipated severity of localised flooding. Often incidents of this nature will be as a result of 'on the ground' conditions on any particular day (e.g. litter or leaves on the road may exacerbate a problem). Observed flooding can certainly be captured, however not surprisingly these are generally within areas of existing development. Within other areas of the Borough, topography and geology are generally good initial 'indicators' of areas that may be most at risk (e.g. localised 'low points' in the surrounding topography). Figures C and D provide an overview of the Borough topography and geology respectively.

³ Refer Table D2 (Appendix D) of PPS25

26. The PPS25 Practice Guide (A Living Draft, February 2007) advocates the application of a sequential approach when allocating land, taking into consideration *all* sources of flooding. The local drainage related problems identified within Rotherham are generally very localised, and relate to historical incidents, the source of which is often somewhat uncertain. It is important to recognise therefore that these are not a measure of 'risk', but rather problems that have occurred due to a particular set of local circumstances in the past (for example, the blockage of a local gully inlet). These may or may not reoccur in future years.
27. From a spatial planning perspective therefore, it is considered unreasonable to restrict future development within areas that may have suffered a localised flooding incident in years past. It is essential however not to overlook the potential risk of localised flooding during the design process. Whilst the incidents that have been identified will typically not result in widespread damage or disruption, a proactive approach to risk reduction through design can mitigate the potential for damage, both to the development itself and elsewhere. Specific development control recommendations have been provided accordingly.
28. The implementation of sustainable drainage systems (SuDS) must be ensured and careful consideration to overland flow routes (and avoidance of their obstruction), as part of the site design, should be encouraged.
29. Yorkshire Water and Severn Trent Water were approached for information regarding flooding arising from the surcharging and blockage of surface and foul water sewers. This data, known as DG5 flooding data, is subject to confidentiality issues and specific incidences where individual properties were affected cannot be divulged. However, Yorkshire Water is allowed to detail how many properties have been subject to DG5 flooding per postcode area (the first four digits of the postcode are provided only).

A Proactive Approach – Reduction in Flood Risk

30. It is crucial to recognise that PPS25 considers not only the risk of flooding posed to new development, but that it also seeks to positively reduce the risk of flooding posed to existing properties within the Borough. It is strongly recommended that this principle be adopted as the underlying 'goal' for developers and Council development control teams within Rotherham.
31. Developers should be encouraged to demonstrate that their proposal will deliver a positive reduction in flood risk to the Borough, whether that be by reducing the frequency or severity of flooding (for example, through the introduction of SuDS), or by reducing the impact that flooding may have on the community (for example, through a reduction in the number of people within the site that may be at risk). This should be reflected through the inclusion of a positive statement within the detailed FRA that clearly and concisely summarised how this reduction in flood risk will be delivered.

The Way Forward

32. A proportion of the Rotherham Borough is at risk of flooding. The risk of flooding posed to properties within the Borough arises from a number of sources including river flooding, localised runoff, sewer and groundwater flooding.
33. A planning solution to flood risk management should be sought wherever possible, steering vulnerable development away from areas affected by flooding in accordance with the PPS25 Sequential Test. Specific planning recommendations have been provided for all settlements within the Borough.

34. Where other planning considerations must guide the allocation of sites following the application of the Sequential Test, it will be essential that a Level 2 SFRA is carried out for all potential allocations that fall within a flood affected area. This will ensure that the Council can allocate the site safe in the knowledge that the risk of flooding can be safely (and sustainably) mitigated over the lifetime of the development.
35. Following application of the Sequential Test, and the decision to proceed with development in areas at risk of flooding due to other planning constraints (that outweigh flood risk), it will be necessary for the Exception Test to be applied. Specific recommendations have been provided to assist the Council and the developer to incorporate design features that will mitigate the potential risks of flooding within the site. These should be applied as development control recommendations for all future development. It is essential that these are applied, not only where there is a direct risk of flooding to the proposed development site, but elsewhere within the Borough. It is important to recognise that all development may potentially have an adverse impact upon the existing flooding regime if not carefully mitigated.
36. Council policy is essential to ensure that the development control recommendations can be imposed consistently at the planning application stage. This is essential to achieve future sustainability within the Borough with respect to flood risk management. It is recommended that Council policy within the LDF is developed in a robust manner to support PPS25 and the findings and recommendations of the SFRA process. A SPD is to be developed, building upon the existing Design Code, and this should be reviewed to reflect the specific development control recommendations presented by the Rotherham SFRA. The SPD should also be widened to influence development not only with the town centre, but throughout the Borough as a whole.
37. Emergency planning is imperative to minimise the risk to life posed by flooding within the Borough. It is recommended that the Council advises the local Resilience Forum of the risks raised in light of the Rotherham SFRA, ensuring that the planning for future emergency response can be reviewed accordingly.

A Living Document

38. The Rotherham SFRA has been developed building heavily upon existing knowledge with respect to flood risk within the Borough. A rolling programme of detailed flood risk mapping within the Yorkshire region is underway. This, in addition to observed flooding that may occur throughout a year, will improve the current knowledge of flood risk and may alter predicted flood extents within Rotherham. Furthermore, Communities and Local Government (CLG) are working to provide further detailed advice with respect to the application of PPS25. Given that this is the case, a periodic review of the Rotherham SFRA is imperative.
39. It is recommended that the Rotherham SFRA is reviewed on a regular basis. A series of key questions to be challenged as part of the SFRA review process are set out in Section 7 of this document, providing the basis by which the need for a detailed review of the document should be triggered.

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Glossary

AEP	Annual Exceedance Probability e.g. 1% AEP is equivalent to 1% probability of occurring in any one year (or, on average, once in every 100 years)
Core Strategy	The Development Plan Document within the Council's Local Development Framework, which sets the long-term vision and objectives for the area. It contains a set of strategic policies that are required to deliver the vision including the broad approach to development.
DCLG	Department of Community and Local Government
Defra	Department of Environment, Food and Rural Affairs
Development	The carrying out of building, engineering, mining or other operations, in, on, over or under land, or the making of any material change in the use of a building or other land.
Development Plan Document (DPD)	A spatial planning document within the Council's Local Development Framework, which set out policies for development and the use of land. Together with the Regional Spatial Strategy, they form the development plan for the area. They are subject to independent examination.
EA	Environment Agency
Flood Zone Map	Nationally consistent delineation of 'high' and 'medium' flood risk, published on a quarterly basis by the Environment Agency
Formal Flood Defence	A structure built and maintained specifically for flood defence purposes
Habitable Room	A room used as living accommodation within a dwelling but excludes bathrooms, toilets, halls, landings or rooms that are only capable of being used for storage. All other rooms, such as kitchens, living rooms, bedrooms, utility rooms and studies are counted.
Informal Flood Defence	A structure that provides a flood defence function, however has not been built and/or maintained for this purpose (e.g. boundary wall)
Local Development Framework (LDF)	Consists of a number of documents which together form the spatial strategy for development and the use of land
Planning Policy Guidance (PPG)	A series of notes issued by the Government, setting out policy guidance on different aspects of planning. They will be replaced by Planning Policy Statements.
Planning Policy Statement (PPS)	A series of statements issued by the Government, setting out policy guidance on different aspects of planning. They replace Planning Policy Guidance Notes
PPG25	Planning Policy Guidance 25: Development and Flood Risk Office of the Deputy Prime Minister (ODPM), 2001
PPS25	Planning Policy Statement 25: Development and Flood Risk Department of Community & Local Government, 2006

Previously Developed (Brownfield) Land	Land which is or was occupied by a building (excluding those used for agriculture and forestry). It also includes land within the curtilage of the building, for example, a house and its garden would be considered to be previously developed land.
Residual Risk	A measure of the outstanding flood risks and uncertainties that have not been explicitly quantified and/or accounted for as part of the review process
SEA	Strategic Environmental Assessment
SuDS	Sustainable Drainage System
Supplementary Planning Document (SPD)	Provides supplementary guidance to policies and proposals contained within Development Plan Documents. They do not form part of the development plan, nor are they subject to independent examination.
Sustainability Appraisal (SA)	Appraisal of plans, strategies and proposals to test them against broad sustainability objectives.
Sustainable Development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (The World Commission on Environment and Development, 1987).
Zone 1 Low Probability	This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%)
Zone 2 Medium Probability	This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year
Zone 3a High Probability	This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year
Zone 3b Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Within Rotherham, this has been defined as land which would flood with an annual probability of 1 in 20 (5%) or greater in any year

1 Introduction

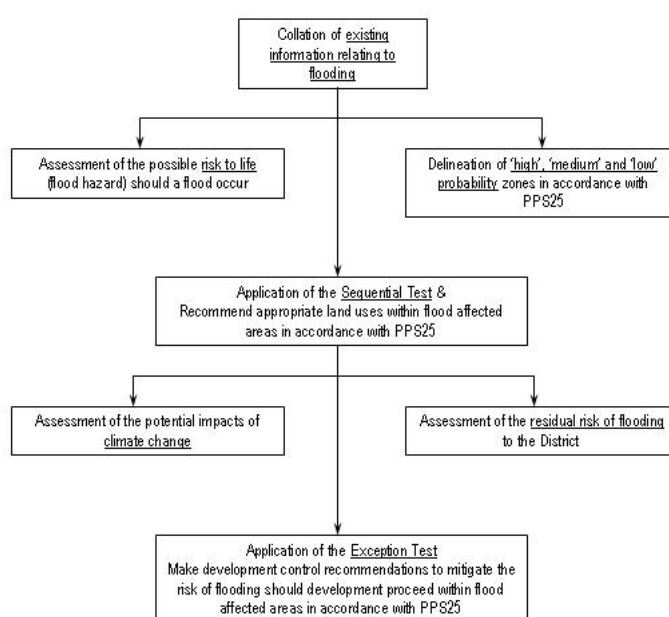
40. The Borough of Rotherham is situated in South Yorkshire spanning the valleys of the River Don, the River Rother, and the River Dearne. Historically development has concentrated around the river and canal network, providing critical water supplies and transport linkages to support the coal mining and steel industries. Decline in these industries since the 1980s has resulted in a need for economic activity to be restored within the Borough. An overview of the Borough is provided in Figure A.
41. Community centres are scattered throughout the region, largely concentrated within the three river valleys mentioned above. To facilitate the regeneration of the Borough in a sustainable fashion, Rotherham Metropolitan Borough Council is devising a Local Development Framework. A key objective of the LDF is the establishment of focus areas (allocations) for future investment.
42. As with many historical places in England, Rotherham faces a risk of flooding. This is due both to the close proximity of its key urban centres to major rivers, and also a legacy of urban drainage systems that are ageing, limited in their capacity to carry runoff from rapidly developing catchment areas, and often susceptible to blockage by debris.
43. Planning Policy Statement (PPS) 25: Development and Flood Risk requires that local planning authorities prepare a Strategic Flood Risk Assessment (SFRA) in consultation with the Environment Agency. The primary purpose of the SFRA is to determine the variation in flood risk across the Borough. Robust information on flood risk is essential to inform and support the Council's revised flooding policies in its emerging Local Development Framework (LDF).
44. Jacobs was commissioned to develop the Rotherham Borough Council Strategic Flood Risk Assessment (SFRA) in March 2006, before the release of PPS25 (December 2006) and the Practice Companion Guide to PPS25 (February 2007). The SFRA has been reviewed accordingly in light of this emerging policy.
45. Rotherham Borough is currently reviewing its planning framework, and this SFRA supplements the evidence base that informs this review process. The SFRA is a technical document that will be submitted to the Secretary of State in due course with the submission Core Strategy. This SFRA will be developed and refined over time and will inform the allocation of sites for future development.
46. **This report (and the supporting mapping) represents the Level 1 SFRA⁴, and should be used by the Council to inform the application of the Sequential Test.** Following the application of the Sequential Test, it may be necessary to develop a Level 2 SFRA⁵ should it be shown that proposed allocations fall within a flood affected area of the Borough. The Level 2 SFRA should consider the risk of flooding in greater detail within a local context to ensure that the site can be developed in a safe and sustainable manner.

⁴ Refer paragraphs 2.32 to 2.35 of the Living Draft of the Practice Guide Companion to PPS25 (February 2007)

⁵ Refer paragraphs 2.36 to 2.42 of the Living Draft of the Practice Guide Companion to PPS25 (February 2007)

2 SFRA Approach

47. The primary objective of the Rotherham SFRA is to inform the revision of flooding policies, including the allocation of land for future development, within the emerging Local Development Framework (LDF). The SFRA has a broader purpose however, and in providing a robust depiction of flood risk across the Borough, it can:
- Inform the development of Council policy that will underpin decision making within the Borough, particularly within areas that are affected by (and/or may adversely impact upon) flooding;
 - Assist the development control process by providing a more informed response to development proposals affected by flooding, influencing the design of future development within the Borough;
 - Help to identify and implement strategic solutions to flood risk, providing the basis for possible future flood alleviation works;
 - Support and inform the Council's emergency planning response to flooding.
48. Whilst general guidance is available as to what should be presented as an outcome of the SFRA process, the Government provides no specific *methodology* for the SFRA delivery. Therefore, to meet these broader objectives in a pragmatic manner that is 'fit for purpose', the SFRA has been developed in consultation with both the Council and the Environment Agency.
49. A considerable amount of knowledge exists with respect to flood risk within the Borough, including information relating both to historical flooding, and the predicted extent of flooding from rivers under extreme weather conditions (i.e. as an outcome of detailed flood risk modelling carried out by the Environment Agency). The Rotherham SFRA has built upon this existing knowledge, underpinning the delineation of the Borough into zones of 'high', 'medium' and 'low' probability of flooding, in accordance with PPS25. These zones have then been used to provide a robust and transparent evidence base for the development of flooding related policy, and the allocation of sites for future housing and employment uses.
50. A summary of the adopted SFRA process is provided in the figure below, outlining the specific tasks undertaken and the corresponding structure of the SFRA report.



Cross Boundary Issues

51. It is important to recognise that planning boundaries do not necessarily coincide with river catchment boundaries. There are areas at risk of flooding downstream of Rotherham, and future development within the Borough could influence the risk of flooding posed to neighbouring areas if not carefully managed. It is imperative that all local authorities clearly understand the core issues that flood risk raises within their respective Boroughs, and adapt their decision making accordingly. They must be aware of the impact that misinformed planning decisions may have, not only locally, but upon adjoining Boroughs.
52. A number of authorities across the North East Region are beginning to carry out similar strategic flood risk investigations. These will help provide the evidence base for the Core Strategies and Site Specific development allocations that will form part of the Local Development Frameworks that all local planning authorities must now produce.
53. Whilst the delivery teams and programmes underpinning these studies vary from one Borough to the next, all are being developed in close liaison with the Environment Agency. Consistency in the adopted approach and decision making with respect to the effective management of flood risk throughout the region is imperative. Regular discussions with the Environment Agency have been carried out throughout the SFRA process to this end, seeking clarity and consistency where needed.

3 Policy Framework

3.1 Introduction

54. This section provides a brief overview of the strategy and policy context relevant to flood risk in Rotherham Borough Council.
55. The success of the SFRA is heavily dependent upon the ability of the Council to implement the recommendations put forward for future sustainable flood risk management, both with respect to planning decisions and development control recommendations. A framework of national and regional policy is in place, providing guidance and direction to local planning authorities. Ultimately however, it is the responsibility of the Council to establish 'sound' planning policies that will ensure future sustainability with respect to flood risk.

3.2 National Planning Policy

3.2.1 Overview

56. National planning policy is set out through a number of Planning Policy Statements (PPSs) and Planning Policy Guidance Notes (PPGs). The Government is currently reviewing all PPGs with revised advice being set out in a PPS and, where necessary, accompanying best practice guidance.
57. PPSs and PPGs cover a full range of planning issues drawing on the central issue of sustainable development. Central themes include the re-use of 'deliverable' previously developed land, promoting economic growth, including the intention to steer inappropriate development away from areas at risk of flooding. Under paragraph 4.31 of 'PPS12: Local Spatial Planning' it is a requirement of Regional Assemblies and Local Authorities to ensure their Regional Spatial Strategies (RSS) or Local Development Frameworks (LDFs) are in conformity with the guidance in PPSs and PPGs. The regional and local policy context for SFRA is set out in the next section.

3.2.2 Planning Policy Statement (PPS) 25: Development and Flood Risk

58. Planning Policy Statement 25 (PPS25) was released in December 2006, and underpins the process by which local planning authorities are to account for flood risk as an integral part of the planning process. The overarching principles set out by PPS25 for the management of flood risk at a planning authority level are encapsulated in Paragraph 6 of the document:

“Regional planning bodies (RPBs) and local planning authorities (LPAs) should prepare and implement planning strategies that help to deliver sustainable development by:

59. Appraising risk
- identifying land at risk and the degree of risk of flooding from river, sea and other sources in their areas;

- preparing Regional Flood Risk Appraisals (RFRAs) or Strategic Flood Risk Assessments (SFRAs) as appropriate, as freestanding assessments that contribute to the Sustainability Appraisal of their plans;

60. Managing risk

- framing policies for the location of development which avoid flood risk to people and property where possible, and manage any residual risk, taking account of the impacts of climate change;
- only permitting development in areas of flood risk when there are no reasonably available sites in areas of lower flood risk and benefits of the development outweigh the risks from flooding;

61. Reducing risk

- safeguarding land from development that is required for current and future flood management, e.g. conveyance and storage of flood water, and flood defences;
- reducing flood risk to and from new development through location, layout and design, incorporating sustainable drainage systems (SuDS);
- using opportunities offered by new development to reduce the causes and impacts of flooding, e.g. surface water management plans; making the most of the benefits of green infrastructure for flood storage, conveyance and SUDS; recreating functional floodplain; setting back buildings;

62. A partnership approach

- working effectively with the Environment Agency, other operating authorities and other stakeholders to ensure that best use is made of their expertise and information so that plans are effective and decisions on planning applications can be delivered expeditiously; and
- ensuring spatial planning supports flood risk management policies and plans, River Basin Management Plans and emergency planning.”

63. These broad objectives effectively set the scope for the specific outcomes of the SFRA process. The SFRA in turn then informs planning and development control decisions to ensure that the objectives set out above can be achieved.

64. The guidance in PPS25 also indicates that Sustainability Appraisals should be informed by the SFRA for their area. Under the Town and Country Planning (Local Development) (England) Regulations 2004, a Sustainability Appraisal (SA) is required for all Local Development Documents (LDDs) which form part of Local Development Frameworks (LDFs). The purpose of SA is to promote sustainable development through better integration of sustainability considerations in the preparation and adoption of plans. The Regulations stipulate that SAs of LDFs should meet the requirements of the Strategic Environmental Assessment (SEA) Directive.

65. It is important to reiterate that PPS25 is not applied in isolation as part of the planning process. The formulation of Council policy and the allocation of land for future development must also meet the requirements of other planning policy statements, including (for example) PPS3: Housing.

66. This may introduce some apparent conflict in national policy direction. For example, PPS3 requires that new housing should be built on ‘deliverable’ previously developed land in preference to Greenfield land. PPS25 reiterates this directive within its Exception Test, however within the Council’s administrative area a proportion of the existing Brownfield land is situated within flood affected areas. The PPS25 Sequential Test recommends that residential development should not be permitted in these areas.

67. Clearly a careful balance must be sought in these instances, and the SFRA aims to assist in this process through the provision of a clear and robust evidence base upon which informed decisions can be made.

3.2.3 Development and Flood Risk: A 'Living Draft' Practice Guide Companion to PPS25

68. In February 2007 the companion guide was published as a consultation paper⁶. This document provides additional guidance on the principles set out in PPS25, which should be considered by Rotherham Borough Council when preparing its LDF. Until the good practice guide is finalised, the level of weight applied to the 'Living Draft' should reflect its current 'consultation draft' status. Notwithstanding this, the companion guide is considered to provide a helpful indication of the ways in which the principles of PPS25 might be applied in practice.
69. The SFRA should be treated as a living document, and reviewed on a regular basis to reflect both emerging knowledge with respect to flood risk, and changing policy. Future reviews of the SFRA findings and recommendations should explicitly consider the impact (if any) of changes to the policy guidance following publication of the final Practice Guide by CLG.

3.2.4 Planning Policy Statement: Planning and Climate Change

70. The final planning policy supplement on climate change was published in December 2007 following a 12 month consultation period. This is intended to supplement the existing PPS1: Delivering Sustainable Development. The document highlights the issue of climate change, and sets out ways planning should prepare for its effect, which includes managing flood risk.

3.3 Regional Planning Policy

3.3.1 Overview

"Government legislation in 2004 saw Regional Planning Guidance - the framework for local authority development plans which oversee development and land use applications - replaced by a Regional Spatial Strategy (RSS). In this region, this is called the Yorkshire and Humber Plan.

Once completed, the RSS, titled the Yorkshire and Humber Plan, will set the framework to guide and direct where and how development and investment takes place across the region. Under new planning law, it will form part of the "development plan" for each local authority and be taken into account in determining planning applications.

The draft RSS includes a broad strategy to shape the future development of cities, towns and villages across the region; regional priorities in terms of location and scale of development for economic development; housing; transport and communications; the environment ; tourism and leisure and urban and rural regeneration. It will also include a regional transport strategy."

3.3.2 The Yorkshire and Humber Plan (RSS 12)

71. This RSS was published in December 2005 and adopted in May 2008. However, it is still relevant when considering the regional policies. The plan guides development up to 2021, and beyond. The plan identifies that the South Yorkshire (Rotherham) Region is forecast to experience significant economic growth and is likely to remain a significant economic driver of the Regions economy
72. The Yorkshire and Humber Plan recognises that climate changes will increase the risk of flooding and Policy YH2 requires Local Authorities to, *"Plan for the successful adaptation of the predicted impacts of climate change by minimising threats from and impact of*

⁶ Communities and Local Government (2007) Development and Flood Risk: A Practice Guide Companion to PPS25 'Living Draft' A Consultation Paper

coastal erosion, increased flood risk, increased storminess, habitat disturbance, increased pressure on water resources supply and drainage systems.”

73. Policy ENV1 Floods and flood risk states that *“development in high flood risk areas will be avoided, where possible, and flood management will be undertaken proactively”*. The purpose of this policy is to inform development on the basis of strategic flood risk assessments and ensure flood management reflects regional spatial and economic priorities, as well as environmental objectives, thereby helping to maintain protection of the major conurbations and communities. Paragraph 15.8 states that

“Local Authorities should undertake strategic flood risk assessments in line with regional Supplementary Planning Guidance and then adopt a risk-based sequential approach to planning for flood risk in line with PPG25; consider specifying higher standards of resilience to flooding for new development in high flood risk areas (e.g. minimum ground floor levels, suitable ground floor uses, height of two storeys); determine the balance between blight and flood risk, especially in regeneration areas”.

74. The Examination in Public into the draft Regional Spatial Strategy (RSS) concluded in October 2006, and the Report of the Panel was released in March 2007. Chapter 6 (Volume 1), Section C of the Panel Report relates specifically to Flood Risk and Water Resources. The Panel Report raises concern that, whilst it is recognised that the draft RSS precedes the final release of PPS25 in December 2006, Policy ENV1 *“does not take adequate account of the need to consider the implications of development in areas of flood risk.”* Furthermore, the Panel Report considers *“the Plan did not give enough prominence to flood risk in relation to strategic patterns of development.”* For this reason, specific amendments to Policy ENV1 have been recommended in line with Environment Agency suggested changes⁷.
75. Finally, paragraph 15.7 states that *“The Environment Agency, landowners, developers, local authorities, internal drainage boards, Yorkshire Forward and other bodies all have important roles and differing levels of funding. These include to lead a strategic, integrated, pro-active approach to catchment management; prioritise flood risk management and ensure protection in line with policy and catchment flood management plans.”* Rotherham Metropolitan Borough Council has invested a considerable sum in the development of the Templeborough to Rotherham Flood Alleviation Scheme. Phase 1 of the scheme is underway at the time of writing, and investment opportunities are being sought from the private and public sectors to facilitate the construction of Phases 2 and 3. Once complete, the scheme will deliver a 1 in 100 year standard of protection to Rotherham town centre, providing the cornerstone for future regeneration of the Borough.

3.4 Local Planning Policy

3.4.1 Rotherham Unitary Development Plan

76. The Rotherham Unitary Development Plan (UDP) was formally adopted in June 1999. The Plan sets out the Council’s policies and proposals for development and land use in the Borough over the plan period up until September 2004.

⁷ Please be aware that, at the time of writing, specific details regarding the suggested EA changes to RSS policy were not available for inclusion in the SFRA

77. The Planning and Compulsory Purchase Act 2004 enabled the Council to 'save' the policies and plans set out in the UDP to September 2007. Beyond this time, only those policies 'approved' by the Secretary of State were retained. At the time of writing therefore (April 2008) the statutory development plan for Rotherham consists of the Regional Spatial Strategy and UDP policies set out in the Saved Policies Direction (refer www.rotherham.gov.uk).
78. There is no specific flood risk related policy evident within the saved suite of UDP policies, however a Design Code has been established for the Rotherham Town Centre River Corridor. This was adopted by the Council as an Interim Planning Statement in October 2005, and will eventually be formalised as a Supplementary Planning Document as part of the LDF (see below).
79. The Design Code is currently heavily focussed upon the physical layout and design of future development within the Town Centre. Whilst no specific reference is made to design criteria to defend against (or to improve resilience to) flooding, this document provides an excellent opportunity to provide clear guidance to developers in this vein. It is recommended that the Design Code is reviewed in due course to reflect the development control recommendations set out in Section 6.4 of the SFRA. It is understood that the Templeborough Rotherham FAS project team has developed a design brief for developers which it is envisaged will also inform this policy update.

3.4.2 Templeborough to Rotherham Flood Alleviation Scheme

80. The Templeborough to Rotherham Flood Alleviation Scheme is being promoted by Rotherham Metropolitan Borough Council's Investment and Development Office (RiDO), in due recognition of the risk the flooding poses to the existing town centre. The primary purpose of the scheme is to provide community wide protection to the existing within the town centre, and to unlock the development potential of brownfield land along the river corridor.
81. The scheme has been carefully considered, planned and delivered to meet Council policy objectives for the Borough, and ensures that future growth will be developed both safely and in a sustainable manner. The policy framework that has underpinned the development of the flood alleviation scheme is set out below.

Urban Renaissance and Public Realm Strategy

General Urban Renaissance Aspirations

82. Rotherham is one of several towns included within Yorkshire Forward's Urban Renaissance programme. This sets out a new agenda for the future of the regions towns.
83. For Rotherham, the first stage in the renaissance programme was the development of the Rotherham Renaissance Charter. This sets out a comprehensive 25 year vision for the town and a series of 10 goals against which future development proposals are to be tested. The first of these goals relates strongly to flood risk management and development of land within the river corridor. It states:-

"We want the river and the canal to form a key part in the town's future. Development along the canal must be of an extraordinary quality and must follow an agreed master plan. We want the river and the canal to become much loved parts of the town with public spaces and walkways lining their banks".

84. The second stage in the renaissance programme was the creation and adoption of the Rotherham Strategic Development Framework that translates the aspirations in the Town Charter into workable solutions. This includes, amongst other issues, the identification of key projects that both individually and collectively will lead to a transformational change of Rotherham's urban centre.

85. In support of the Town Charter, the Strategic Development Framework recognises the role of the public realm in achieving urban renaissance aspirations. The Council therefore commissioned a Public Realm Strategy and this was completed 2007.

Public Realm Strategy

86. The public realm is defined as:-

“Those parts of Rotherham (whether publicly or privately owned) that are available, without charge, for everyone to use or see, including streets, squares and parks”.

87. The Council are looking for the strategy to create a ‘step change’, capturing recent and emerging proposals, and, realising the inherent opportunities in the towns environmental, economic and cultural assets.

88. The Vision for Rotherham’s Public Realm Strategy is:-

“To bring about transformational change in the image and identity of Rotherham by realising the distinctiveness and value of existing environmental assets, creating a sense of place and prosperous identity, attracting and drawing together individual regeneration projects and programmes, and stimulating activity and vitality leading to an increased sense of safety and security”.

89. The public realm strategy is intended to be published in October 2008 and has a number of key objectives. One of the key objectives that affects flood risk management is the need to integrate the river and canal into the town centre, including emphasis on providing riverside access.

Key Development Sites

90. A number of development sites exist along the river corridor. Some of the key ones that form an important part of the Council’s urban renaissance strategy and public realm strategy are:-

- Guest and Chrimes, situated on the north side of the River Don, adjacent to Don Street, Main Street and the railway;
- Westgate/Sheffield Road, situated on the south bank of the River Don upstream and downstream of its confluence with the River Rother;
- Westgate Demonstrator project, situated near Market Street and Rotherham Weir.

91. Large parts of the above sites lie within or in close proximity to the existing floodplain. Appropriate mitigation of the significant constraints imposed on development by flood risk is an important consideration in establishing the most appropriate type of development in these areas. The Flood Alleviation Scheme seeks to ensure that the risk of flooding is addressed holistically, rather than in a piecemeal fashion.

The Flood Alleviation Scheme Explained

92. As highlighted above, the Templeborough to Rotherham Flood Alleviation Scheme is being promoted by Rotherham Metropolitan Borough Council’s Investment and Development Office (RiDO). Throughout the development of this scheme, RiDO have worked in partnership with the Environment Agency, and the Environment Agency will be responsible for the long term operation and maintenance of the scheme.

93. The scheme extends approximately 3.5 km along the river from near Magna in the Templeborough area of Rotherham to Don Bridge, which is a short distance downstream of Rotherham town centre. The standard of protection to be provided by the scheme is 1 in 100 years (i.e. it will reduce the risk of flooding in any year to 1%).

94. Construction of the first phase of this scheme was started in Autumn 2006 and is due to be completed in Autumn 2008. Investigatory works for the detailed design of the second phase of the scheme and work on a public realm strategy were completed in Spring 2008, with detailed design of flood alleviation works starting in early Summer 2008. Funding is being sought from a range of sources to deliver the second phase of the scheme.

3.5 Emerging Local Planning Policy

3.5.1 Rotherham Local Development Framework (LDF)

95. Rotherham Borough Council is currently preparing its LDF, as required under the Planning and Compulsory Purchase Act 2004. Once adopted, this will replace the existing Unitary Development Plan and be used for land use development decisions.
96. The initial step in the LDF process was the establishment of, and consultation on, the Rotherham Borough Core Strategy. Feedback from the consultation on the Core Strategy Preferred Options and the accompanying sustainability appraisal (February 2007) has been collated, and will inform the continuation of the LDF process.
97. The Sustainability Appraisal is a critical element of the LDF process, assessing emerging planning decisions against a suite of key criteria developed in consultation with the wider community. Sustainability Appraisal Objective 14 is "*Reduce Rotherham's vulnerability to flooding and to the impacts of climate change*". This reflects the importance that the Council place upon the effective management of flood risk within the Borough.
98. The early stage in the planning process provides an excellent opportunity for influencing planning policy to ensure a robust and tangible approach to flood risk reduction (or, where possible, avoidance). It is recommended that a thorough review of emerging policy is undertaken to ensure that the key outcomes of the SFRA process (summarised in Section 6.4) are integrated into the forward planning and development control functions of the Council. The Design Code for the Town Centre should be reviewed (refer above). When replaced by the SPD, consideration should be given to broadening elements of the code (relating to flood risk) to the whole Borough.

4 Data Collection

4.1 Overview

99. A considerable amount of knowledge exists with respect to flood risk within the Borough, including (but not limited to):
- Historical river flooding information;
 - Information relating to localised flooding issues (surface water, groundwater and/or sewer related), collated in consultation with the Borough Council and the Environment Agency;
 - Detailed flood risk mapping;
 - Environment Agency Flood Zone Maps (April 2008);
 - Topography (OS mapping & LiDAR).
100. These data have been sourced from the Council and the Environment Agency, forming the core dataset that has informed the SFRA process. The application of this data in the delineation of zones of 'high', 'medium' and 'low' probability of flooding, and the formulation of planning and development control recommendations, is explained in Section 5 below. An overview of the core datasets, including their source and their applicability to the SFRA process, is outlined below.

4.2 Environment Agency Flood Zone Maps

101. The Environment Agency's Flood Map shows the natural floodplain, ignoring the presence of defences, and therefore areas potentially at risk of flooding from rivers or the sea. The Flood Map shows the area that is susceptible to a 1 in 100 (1% annual exceedance probability (AEP)) chance of flooding from rivers, and a 1 in 200 (0.5% AEP) chance of tidal flooding⁸, in any one year. It also indicates the area that has a 1 in 1000 (0.1% AEP) chance of flooding from rivers and/or the sea in any given year. This is also known as the Extreme Flood Outline.
102. The Flood Map outlines have been produced from a combination of a national generalised computer model, more detailed local modelling (if available), and some historic flood event outlines⁹. The availability of detailed modelling for the Borough is further discussed in Section 4.4. The Environment Agency's Flood Map provides a consistent picture of flood risk for England and Wales.
103. The Environment Agency's knowledge of the floodplain is continuously being improved by a variety of studies, detailed models, data from river flow and level monitoring stations, and actual flooding information. Updates are made on a quarterly basis.

4.3 Historical Flooding

104. Detailed discussions have been held with the Borough Council and the Environment Agency to identify areas that are known to have been susceptible to flooding in the past. Flooding from the River Don and River Rother has been mapped by the Environment Agency following the widespread flooding of 1947, 1958, 2000, and this information is presented in Figure E.

⁸ The Borough of Rotherham is situated a considerable distance from the coast, and is not susceptible to tidal flooding

⁹ Including the June 2007 flooding event, incorporated within Zone 2 Medium Probability

105. Issues of a localised nature have also been identified, largely through discussions with long serving members of the Council, and these are reflected in the adjoining flood zone maps. These incidents are events in which properties have been affected not only by flooding from local rivers, but also from issues including surcharging of the underground sewer system, blockage of culverts and gullies, and/or surface water runoff (flash flooding). Where possible, the perceived source of flooding has been identified. It is important to recognise however that these recorded incidents are very unlikely to be all-encompassing, and many issues are likely to have gone unrecorded.
106. It is clear that many of the localised incidents that have occurred in recent years are situated outside of the delineated high probability flood zones. This is an important reminder that the risk of flooding must always be carefully considered when planning future development, irrespective of the site's proximity to a local river or watercourse. Development control decisions must consider all forms of potential flooding to the site. They must also be made with due consideration to the potential impact that future development may have upon known existing flooding problems if not carefully managed.

June 2007 Flood Event

107. A number of areas throughout England, including South Yorkshire, were affected by widespread flooding in June 2007. Prolonged intense rainfall fell over areas of Rotherham and adjoining Sheffield, resulting in flash flooding. Following the event, both the Environment Agency and the Council carried out a comprehensive data collection exercise to capture information relating to the source and severity of the flooding.
108. The return period associated with the June 2007 event has not been accurately determined, and is variable across the region. It is clear however that this exceeded the 1% (100 year) design event. For this reason, those areas that were affected by river flooding in the June 2007 event have been now included within Zone 2 Medium Probability (EA, April 2008), and this is reflected in the adopted Rotherham SFRA maps.
109. Further detailed information has been collated by Rotherham MBC, discussing the nature of the flooding throughout the Borough, and possible measures that may be available to alleviate the risk of flooding in future years. This is provided on the Council's website at www.rotherham.gov.uk¹⁰.

4.4 Detailed Hydraulic Modelling

110. Detailed flooding investigations have been carried out by the Environment Agency within the study area¹¹, encompassing the River Rother, the River Don and the River Dearne. These studies generally incorporate the development of a detailed hydraulic model, providing a more robust understanding of the localised fluvial flooding regime in line with Section 105 (2) of the Water Resources Act.
111. It should be noted that the detailed hydraulic models developed on behalf of the Environment Agency assume 'typical' conditions within the respective river systems that are being analysed. The predicted water levels may change if the operating regimes of the rivers involved are altered, e.g. culverts are permitted to block, or the condition of the river channel is allowed to deteriorate.

¹⁰ <http://www.rotherham.gov.uk/graphics/Environment/Streetpride/Drainage/EDSFlooding2007.htm>

¹¹ completed early 2007

112. Further subsequent modelling was also undertaken to reflect the construction of the initial phase of the Templeborough to Rotherham FAS (i.e. Phase 1), and this is reflected in the adopted SFRA flood maps. It is important to recognise however that PPS25 requires a local authority to consider flood risk assuming the absence of flood defences. This is simply because flood defences do not fully remove the risk of flooding – there will always be a residual risk of an engineered structure collapsing, resulting in the inundation of a protected area. Planning decisions must consider this residual risk, and consequently Zone 3a High Probability is delineated assuming that no defences are in place.
113. The flood extents derived from detailed hydraulic models are generally considered to be more refined and accurate than the existing Flood Zone Map in the study area, which currently shows the flood zones produced from a National Generalised Model. Therefore the extents derived from the detailed hydraulic models (where available) have been used to underpin the delineation of flood risk in this Strategic Flood Risk Assessment, as described in Section 5.2 below.

4.5 Flood Defences

114. Flood defences are typically raised structures that alter natural flow patterns and prevent floodwater from entering property in times of flooding. They are generally categorised as either 'formal' or 'informal' defences. A 'formal' flood defence is a structure that was built specifically for the purpose of flood defence, and is maintained by its respective owner, which could be the Environment Agency, Local Authority, or an individual. An 'informal' flood defence is a structure that has not been specifically built to retain floodwater, and is not maintained for this specific purpose, but may afford some protection against flooding. These can include boundary walls, industrial buildings, railway embankments and road embankments situated immediately adjacent to rivers.
115. The Environment Agency has no statutory responsibility to maintain rivers and/or flood defences within the UK. This remains the responsibility of the riparian land owner. The EA retain 'permissive powers' however, and using these powers the EA carry out a programme of monitoring and maintenance. Government funding is clearly finite however, and the long term structural integrity of the defences can never be fully guaranteed. Homes and businesses within defended areas will always face a residual risk of possible failure, as was graphically demonstrated in New Orleans during Hurricane Katrina (2005).
116. Within defended areas there will always be a residual risk of flooding. This may be due to an extreme event that overtops the design 'height' of the defence, changing climatic conditions that increases the frequency and severity of extreme flooding, a structural failure of the constructed flood defence system, or flooding behind the defences due to local runoff or groundwater. It is incumbent on both the Council and developers to ensure that the level and integrity of defence provided within developing areas can be assured for the lifetime of the development.
117. The River Rother and River Don are both 'defended' systems, the flow regime governed to a large degree by a complex system of controlled washlands that store (and pass) flow in a regulated manner. In addition however, Rotherham Metropolitan Borough Council has recently completed Phase 1 of the Templeborough to Rotherham Flood Alleviation Scheme, comprising both a dedicated (natural) upstream flood storage area and a raised flood defence wall that extends towards Rotherham Town Centre. The FAS is reflected in the adjoining SFRA flood maps.
118. Finally, there are a relatively large number of existing buildings, boundary walls and road/rail embankments throughout the Rotherham area that alter the path of flood flows overland. The influence of these informal flood defences, and more importantly their structural integrity in the longer term, should be considered as an integral part of the detailed site based Flood Risk Assessment.

4.6 Consultation

119. Consultation has formed a key part of the data collation phase for the Rotherham Borough SFRA. The following key stakeholders have been comprehensively consulted to inform the current investigation:

Rotherham Metropolitan Borough Council

Planning: Consulted to identify areas under pressure from development and/or regeneration

Drainage: Consulted to identify areas potentially at risk from river flooding, urban drainage and groundwater

Environment Agency

The Environment Agency has been consulted to source specific flood risk information to inform the development of the SFRA. The Environment Agency is a statutory consultee under PPS25 and therefore must be satisfied with the findings and recommendations for sustainable flood risk management into the future. For this reason, the Environment Agency has been consulted during the development of the SFRA to discuss potential flood risk mitigation measures and planning recommendations.

Dove and Dearne Internal Drainage Boards

Consulted to discuss the risk of flooding within the rural areas of the Dearne Valley.

Yorkshire Water & Severn Trent Water

Yorkshire Water and Severn Trent Water¹² are responsible for the management of urban drainage (surface water) and sewerage within the Borough. The utility companies were consulted to discuss the risk of localised flooding associated with the existing drainage/sewer system. Unfortunately the feedback provided was very general in nature, providing simply a summary of the number of recorded incidents per post code. It is not possible therefore to pinpoint known capacity problems and/or infrastructure at risk of structural failure.

It is highlighted that issues associated with failures of the underground drainage/sewer systems are often relatively localised, and should not preclude development. Notwithstanding this however, specific problems have been highlighted by the SFRA process through consultation with the Council (refer SFRA flood maps), and careful consideration should be given to the potential impact of future intensification and/or redevelopment.

It is essential to ensure that future development does not exacerbate known existing problems. Planning decisions should be made with due consideration to potential drainage and sewer capacity problems (to be advised by Yorkshire Water or Severn Trent Water as part of the statutory LDF consultation process), and conditions should be placed upon future development to ensure that these capacity issues are rectified before development is permitted to proceed.

¹² Responsible for water and wastewater management in only the southernmost areas of the Borough

4.7 Topography & Geology

4.7.1 Topography

120. The topography of the Borough of Rotherham is presented in Figure C. The Borough is characterised by a ridge that extends broadly from North Anston in the south to Bramley in the north. To the west of the ridge, the Borough slopes gently towards the River Rother and River Don valley, which flows through Rotherham town centre in a northerly direction towards Doncaster. To the east of the ridge, the Borough falls in an easterly direction towards the River Trent.
121. The Borough topography is undulating with no particularly steep sloping land. Within the flatter low lying areas however, there are a number of local ponds, many likely to be the result of subsidence and/or historical mining. These are fairly characteristic of the Borough, and there are a number of relatively low lying areas (many urbanised) that may be susceptible to localised ponding following heavy rainfall.

4.7.2 Geology

122. The geology of the Borough is presented in Figure D. The Borough is characterised in large part by Westphalian (including coal measures) throughout a large proportion of the area. To the east of the natural ridge (refer Section 4.7.1) however, the Borough overlays limestone and mudstone.
123. The soils throughout the Borough are typically very shallow, and British Geological Society (BGS) mapping reflects only the alluvium layer that follows the valleys of the River Rother, River Don and River Dearne.
124. The impervious nature of the soils (and underlying bedrock) throughout the River Don catchment (i.e. to the west of the ridge) would suggest that perhaps infiltration techniques may not always be suitable for sustainable drainage design (SuDS). Careful consideration should be given to soil types at an early stage of the design process, and a wealth of guidance is available from both CIRIA¹³ and the Environment Agency to assist in this regard (refer Section 6.6.3).

¹³ <http://www.ciria.org.uk/>

5 Flood Risk in Rotherham Borough

5.1 Overview

125. A number of properties within Rotherham are at risk of fluvial flooding from the River Don, the River Rother, the River Dearne, and smaller tributaries of these main rivers. A number of localised flooding issues have also been identified, perceived to be a result of localised problems including (for example) the blockage of culverts and/or gullies, or simply intense rainfall falling upon paved surfaces, resulting in ponding. An overview of these risks, and how they may influence future development within the Borough, is provided in the following sections.

5.2 Fluvial Flooding - Delineation of the PPS25 Flood Zones

126. It is emphasised that the **risk** of an event (in this instance a flood event) is a function of both the **probability** that the flood will occur, and the **consequence** to the community as a direct result of the flood. PPS25 endeavours to assess the likelihood (or probability) of flooding, categorising the Borough into zones of low, medium and high probability. It then provides recommendations to assist the Council to manage the consequence of flooding in a sustainable manner, for example through the restriction of vulnerable development in areas of highest flood risk.
127. To this end, a key outcome of the SFRA process is the establishment of the Sequential Test in accordance with Figure 3.1 of the PPS25 Practice Guide. To inform the planning process, it is necessary to review flood risk across the area, categorising the area in terms of the likelihood (or probability) that flooding will occur.
128. The Borough has been delineated into the flood zones summarised below.

Zone 3b The Functional Floodplain

Areas of the Borough susceptible to river flooding within which “*water has to flow or be stored in times of flood*” (PPS25).

Zone 3a High Probability

Land assessed as having a 1 in 100 or greater annual probability of river flooding in any year (i.e. 1% AEP).

Zone 2 Medium Probability

Land assessed as having between a 1 in 100 (i.e. 1% AEP) and 1 in 1000 (i.e. 0.1% AEP) annual probability of river flooding in any year.

Zone 1 Low Probability

Land assessed as having a less than 1 in 1000 annual probability of river flooding in any year (i.e. 0.1% AEP).

129. The delineation of the PPS25 flood zones is discussed in Section 5, and presented in Figures 1 to 16.

5.2.1 Delineation of Zone 3b Functional Floodplain

130. Zone 3b Functional Floodplain is defined as those areas in which “*water has to flow or be stored in times of flood*”. The definition of functional floodplain remains somewhat open to subjective interpretation. PPS25 states that “*SFRAs should identify this Flood Zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes.*” For the purposes of the Rotherham SFRA, Zone 3b has been defined in the following

manner:

- land where the flow of flood water is not prevented by flood defences or by permanent buildings or other solid barriers from inundation during times of flood;
 - land which provides a function of flood conveyance (i.e. free flow) or flood storage, either through natural processes, or by design (e.g. washlands and flood storage areas);
 - land subject to flooding in the 5% AEP (20 year) flood event (i.e. relatively frequent inundation expected, on average once every 20 years).
131. Detailed modelled flood extents for the 1 in 20 year design event were adopted for the basis of Zone 3b Functional Floodplain delineation along the River Rother, River Don and River Dearne. Areas of designated washland were also adopted as Zone 3b Functional Floodplain.
- Sub-delineation of Zone 3b*
132. A small number of existing settlements within the river corridors are affected by flooding in the 5% AEP (20 year) flooding event. The recent release of the Living Draft of the Practice Guide Companion to PPS25 (paragraph 3.15) highlights the importance of considering existing land use when delineating areas that are to be treated as 'functional floodplain' for planning purposes.
133. Discussions with the Environment Agency have confirmed that, due to the obstructions to overland flow paths posed by existing development within flood affected areas, existing buildings (that are impermeable to floodwater) should not be considered as falling within the functional floodplain. The land surrounding existing buildings form important flow paths and flood storage areas however. These must be protected, and planning decisions should be taken accordingly.
134. For this reason, those areas affected by flooding in the 5% (20 year) design event have been sub-delineated on the basis of current land use such that:
- Areas of existing open space have been defined as *Zone 3b Functional Floodplain*;
 - Areas that are 'previously developed' have been defined as *Zone 3a(i)*.

Clear planning responses for both sub-zones have been provided in Section 6.4 below.

5.2.2 Delineation of Zone 3a High Probability

135. Zone 3a High Probability is defined as those areas of the Borough that are situated below (or within) the 1% AEP (100 year) fluvial flood extent. The adopted flood extents are based upon 2007 predictions, and do NOT include the potential impacts of future climate change. Planning policy must consider climate change however, and specific recommendations are provided accordingly within Sections 5.6 and 6.4.
136. The detailed modelling outputs developed by the Environment Agency, where available (River Don, River Rother and River Dearne), have been adopted for the delineation of Zone 3a High Probability. Only in those areas within which detailed flood mapping is not available has the Environment Agency's Flood Zone Maps (April 2008) have been adopted to underpin the SFRA process. At these locations, detailed topography has been used to carry out a 'sensitivity check' of the flood zone maps. This check has sought to ensure that the predicted floodplain extents are sensible in light of surrounding ground levels. No alterations have been made to the maps in this instance.

5.2.3 Delineation of Zone 2 Medium Probability

137. Zone 2 Medium Probability is defined as those areas of the Borough that are situated between the 0.1% AEP (1 in 1000 year) and the 1% AEP (1 in 100 year) flood extents. In this instance, Zone 2 Medium Probability is defined in accordance with the Environment Agency Flood Zone Map (April 2008).

5.2.4 Delineation of Zone 1 Low Probability

138. Zone 1 Low Probability is defined as those areas of the Borough that are situated above (or outside of) the 0.1% AEP (1000 year) flood extent. For SFRA purposes, this incorporates all land that is outside of the shaded Zone 2 and Zone 3 flood risk areas (as defined above).

5.3 Reservoir Failure

139. A number of reservoir facilities have been identified within the Borough as indicated in Figure B. These include both regulated washland facilities, owned and operated by the Environment Agency, and water storage reservoirs that are the responsibility of third parties.
140. The potential risk to property and life associated with reservoir failure was emphasised in a dramatic fashion in June 2007 when a slip failure at the Ulley Reservoir resulted in the need for emergency response to avoid a catastrophic collapse of the earth dam wall.
141. Whilst the potential *consequence* of dam failure is extremely high, typically the *likelihood* of sudden collapse is very low. This is particularly the case where, due to the size and proximity of the reservoir to local communities, the facilities fall under the auspices of the Reservoirs Act. These reservoirs require regular and stringent monitoring, providing forewarning of a potential failure (as demonstrated at Ulley).
142. The flood storage reservoirs within Rotherham are all owned, operated and maintained by the Environment Agency. A small number of these flood storages (including Killamarsh) fall under the Reservoirs Act, and may cause a potential risk to life within Rotherham should a sudden failure occur. Rigorous monitoring ensures that the risk of failure is very low. The remaining flood storages are either at ground level, or are online (i.e. fill as a result of the 'damming' of the river), and in both instances there is no risk to life or property as a result of failure.
143. The water storage reservoirs within (or near) the Borough are the responsibility of third parties, and it is understood that all are monitored and maintained in accordance with the strict requirements of the Reservoirs Act. The potential risk of failure is therefore once again very low.
144. In summary, the risk to life and property associated with reservoir failure is typically extremely low, however it should be taken into account through spatial planning decisions (i.e. the allocation of the land for future development).

5.4 Local Drainage Issues

145. As discussed in Section 4.6, consultation has been carried out with a number of stakeholders to identify known and/or perceived problem areas relating to flooding from other (non river) sources. These problems are reflected in Figures 1 to 16, and are generally attributed to inundation due to poor maintenance (e.g. culvert blockages) and/or surface water flooding.

146. Within the urban areas of the Borough, it is inevitable that localised flooding problems arising from under capacity drainage and/or sewer systems will occur, particularly given the mounting pressure placed upon ageing systems as a result of climate change. Input has been sought from Yorkshire Water and Severn Trent Water to pinpoint known and/or perceived problem areas, however the information provided is very general.
147. The PPS25 Practice Guide (A Living Draft, February 2007) advocates the application of a sequential approach when allocating land, taking into consideration *all* sources of flooding. The local drainage related problems identified within Rotherham are generally very localised however, and relate to historical incidents, the source of which is often somewhat uncertain. It is important to recognise therefore that these are not a measure of 'risk', but rather problems that have occurred due to a particular set of local circumstances in the past (for example, the blockage of a local gully inlet). These may or may not reoccur in future years. Importantly, one should recognise that the absence of flooding in the past certainly in no way guarantees that a site will not be susceptible to localised flooding in the future.
148. From a spatial planning perspective therefore, it is considered unreasonable to restrict future development within areas that may have suffered a localised flooding incident in years past. It is essential however not to overlook the potential risk of localised flooding during the design process. Whilst the incidents that have been identified will typically not result in widespread damage or disruption, a proactive approach to risk reduction through design can mitigate the potential for damage, both to the development itself and elsewhere.
149. Strict planning requirements should be placed upon developers to ensure that best practice measures are implemented to mitigate any potential increase in loading upon existing drainage system(s). Recommended design measures to mitigate the risk of localised flooding are provided in Section 6.4 accordingly. It is also important for developers to ensure that they consider the potential impact of overland flooding when the capacity of the designed site drainage system is exceeded.
150. The Environment Agency strongly advocates the use of Sustainable Drainage Systems (SuDS). A wide variety of SuDS techniques are available (refer Section 6.6.3), potentially providing both water quality and water quantity improvement benefits on a site by site basis throughout Rotherham. Wherever possible within brownfield areas, the developer should seek to reduce the rate of runoff from the site to the equivalent greenfield runoff rates (i.e. the rate of runoff generated from the site assuming it were an open grassed area). This is usually within the range of 5 to 9 litres per second per hectare (l/s/ha), depending on site slope and soil porosity. Collectively, the effective application of SuDS as part of all future development has the potential to reduce the risk of flooding within Rotherham.

5.5 Groundwater Flooding

151. The risk of groundwater flooding is, by its very nature, highly variable and heavily dependent upon local conditions at any particular time. There are no recorded incidents of groundwater flooding within the Borough, and with due consideration to the Borough geology (refer Section 4.7.2), the risk of flooding from groundwater sources in this instance is considered particularly low.
152. Given the degree of variability (and indeed uncertainty) that exists when considering the potential risk of groundwater flooding however, this should be assessed in a localised context as part of the design process. In accordance with PPS25, future development will require an appropriate Flood Risk Assessment (FRA) at the planning application stage, commensurate with the level of flood risk posed to the site. The FRA should incorporate a site based assessment of the potential risk of groundwater flooding to the site, confirming (or otherwise) the absence of this source of flood risk.

153. Where a potential risk of groundwater flooding is identified, it may be appropriate to (for example) incorporate flood proofing measures and/or the raising of entry thresholds to mitigate possible damages. The adopted design will need to ensure that it does not result in any worsening to the risk posed to adjoining properties.
154. Another consideration with respect to groundwater is the effectiveness (or otherwise) of SuDS. The design of proposed developments should carefully consider the impact that raised groundwater levels may have upon the operation of SuDS during periods of heavy rainfall.

5.6 Climate Change

155. A considerable amount of research is being carried out worldwide in an endeavour to quantify the impacts that climate change is likely to have on flooding in future years. Climate change is perceived to represent an increasing risk to low lying areas of England, and it is anticipated that the frequency and severity of flooding will change measurably within our lifetime. PPS25 (Appendix B) states that a 10% increase in the 1% AEP (100 year) river flow can be expected within the next 20 years, increasing to 20% within the next 50 to 100 years.
156. It is essential that developers consider the possible change in flood risk over the lifetime of the development as a result of climate change. The likely increase in flow and/or tide level over the lifetime of the development should be assessed proportionally to the guidance provided by the EA as outlined above.
157. The detailed modelling of the potential impact of climate change upon the River Don, River Rother and/or River Dearne flooding regimes has not been carried out. In the absence of a definitive flood outline therefore, in accordance with current best practice, the anticipated extent of the 1% AEP (100 year) flood affected area in 2106 can be approximated by the current 0.1% AEP (1000 year) flood outline (i.e. Zone 2 Medium Probability). It is reiterated that, for planning purposes, this is the best information currently available at the time of writing. The SFRA is a living document, and the predicted flood extents may change over time as a result of better information coming to light.

Spatial Planning (Land Allocation)

158. In planning terms, it is essential that Rotherham Borough Council consider their response to the potential impacts of climate change within the Borough. **Adopting the pragmatic comparison between Zone 3a and Zone 2 above (i.e. where detailed modelling has not been carried out), it is clear that climate change may increase the extent of flooding.** This could suggest that areas that are currently situated outside of Zone 3 High Probability will be at risk of flooding in future years, particularly within the River Rother corridor (i.e. Rotherham town centre). This is an important conclusion from a spatial planning perspective.
159. It is recognised that the Environment Agency flood zone maps do introduce a degree of uncertainty as discussed earlier, and detailed modelling of the 1 in 1000 year event is likely to reduce the predicted flood extents. Furthermore, it is understood that the Templeborough to Rotherham FAS has been designed to enable raising of the defence system to mitigate the impacts of climate change through the town centre in future years.
160. PPS25 does recognise the limitations associated with current climate change predictions, and does not (at this stage) require local authorities to include climate change in the delineation of Zone 3a High Probability for land allocation purposes. The potential risks associated with climate change should be borne in mind by the Council however, and it is strongly recommended that future reviews of the SFRA re-consider this issue as better, more robust information comes to light.

Development Control

161. In the immediate short term however, it is clear that **those properties (and areas) that are currently at risk of flooding may be susceptible to more frequent, more severe flooding in future years**. It is essential therefore that the development control process (influencing the design of future development within the Borough) carefully mitigates against the potential impact that climate change may have upon the risk of flooding to the property.
162. For this reason, all of the development control recommendations set out in Section 6.4 below require all floor levels, access routes, drainage systems and flood mitigation measures to be designed with an allowance for climate change. This provides a robust and sustainable approach to the potential impacts that climate change may have upon the Borough over the next 100 years, ensuring that future development is considered in light of the possible increases in flood risk over time.
163. Finally, it is emphasised that the potential impacts of climate change will affect not only the risk of flooding posed to property as a result of river flooding, but it will also potentially increase the frequency and intensity of localised storms over the Borough. This may exacerbate localised drainage problems. It is important therefore that the site based detailed Flood Risk Assessment (i.e. prepared by the developer at the planning application stage as outlined in Section 6) takes due consideration of climate change.

5.7 Residual Risk of Flooding

164. It is essential that the risk of flooding be minimised over the lifetime of the development in all instances. It is important to recognise however that flood risk can never be fully mitigated, and there will always be a residual risk of flooding.
165. This residual risk is associated with a number of potential risk factors including (but not limited to):
 - a flooding event that exceeds that for which the flood risk management measures (for example, upstream storage) have been designed;
 - general uncertainties inherent in the prediction of flooding;
 - the potential risk of structural failure and/or overtopping of a flood defence;
 - the potential risk of structural failure and/or overtopping of water infrastructure (i.e. a reservoir or a canal).
166. The SFRA process has carried out a review of flood risk within the Borough in accordance with PPS25, identifying areas that are subject to varying degrees of flood risk. The modelling of flood flows and flood levels is not an exact science. There are limitations in the methodologies used for prediction, and the models developed are reliant upon observed flow data for calibration, much of which is often of questionable quality. For this reason, there are inherent uncertainties in the prediction of flood levels used in the assessment and management of flood risk.
167. It is difficult to quantify uncertainty. Some of the adopted flood zones underpinning the Rotherham SFRA are based upon the detailed flood mapping within areas adjoining the River Don, River Dearne and River Rother. Whilst these provide a robust depiction of flood risk for specific modelled conditions, all detailed modelling requires the making of core assumptions and the use of empirical estimations relating to (for example) rainfall distribution and catchment response.
168. Taking a conservative approach for planning purposes, it is understood that the Environment Agency generally adopt a 300mm allowance for uncertainty within areas that have been modelled in some detail. The degree of uncertainty in areas reliant upon the Environment Agency's national generalised computer model will clearly be somewhat higher. This allowance is to be added onto the design floor levels for buildings, as discussed in Section 6.6.2 below.

169. It is incumbent on developers to carry out a detailed Flood Risk Assessment as part of the design process. A review of uncertainty, including the residual risk to a site should a structure fail behind which water is stored during flooding conditions (irrespective of the water source), must be undertaken as an integral outcome of this more detailed investigation.

6 Sustainable Management of Flood Risk

6.1 Overview

170. An ability to demonstrate 'sustainability' is a primary government objective for future development within the UK. The definition of 'sustainability' encompasses a number of important issues ranging broadly from the environment (i.e. minimising the impact upon the natural environment) to energy consumption (i.e. seeking alternative sources of energy to avoid the depletion of natural resources). Of particular importance however is sustainable development within flood affected areas.
171. Recent history has shown the devastating impacts that flooding can have on lives, homes and businesses. A considerable number of people live and work within areas that are susceptible to flooding, and ideally development should be moved away from these areas over time. It is recognised however that this is often not a practicable solution. For this reason, careful consideration must be taken of the measures that can be put into place to minimise the risk to property and life posed by flooding. These should address the flood risk not only in the short term, but throughout the lifetime of the proposed development. This is a requirement of PPS25.
172. The primary purpose of the SFRA is to inform decision making as part of the planning and development control process, taking due consideration of the scale and nature of flood risk affecting the Borough. Responsibility for flood risk management resides with all tiers of government, and indeed individual landowners, as outlined below.

6.2 Responsibility for Flood Risk Management

173. There is no statutory requirement for the Government to protect property against the risk of flooding. Notwithstanding this however, the Government recognise the importance of safeguarding the wider community, and in doing so the economic and social well being of the nation. An overview of key responsibilities with respect to flood risk management is provided below.
174. The Environment Agency exercises permissive powers to provide flood management and defence in England. It assists the planning and development control process through the provision of information and advice regarding flood risk and flooding related issues.
175. The Local Planning Authority is responsible for carrying out a Strategic Flood Risk Assessment. The SFRA should consider the risk of flooding throughout the Borough and should inform the allocation of land for future development, development control policies and sustainability appraisals. Local Planning Authorities have a responsibility to consult with the Environment Agency when making planning decisions.
176. Landowners & Developers¹⁴ have the primary responsibility for protecting their land against the risk of flooding. They are also responsible for managing the drainage of their land such that they do not adversely impact upon adjoining properties.
177. The Environment Agency has developed a guide entitled "Living on the Edge" that provides specific advice regarding the rights and responsibilities of property owners, the Environment Agency and other bodies. The guide is targeted at owners of land situated alongside rivers or other watercourses, and is a useful reference point outlining who is responsible for flood defence, and what this means in practical terms. It also discusses how stakeholders can work collaboratively to protect and enhance the natural environment of our rivers and streams. This guide can be found on the Environment Agency's website at www.environment-agency.gov.uk.

¹⁴ Referred to also as 'landowners' within PPS25

6.3 Strategic Flood Risk Management - The Environment Agency

6.3.1 Overview

178. With the progressive development of urban areas along river corridors, particularly during the industrial era, a reactive approach to flood risk management evolved. As flooding occurred, walls or embankments were built to prevent inundation to developing areas. Needless to say, construction of such walls should be carefully assessed so that it does not result in the redistribution of floodwater, inadvertently increasing the risk of flooding elsewhere.
179. The Environment Agency in more recent years has taken a strategic approach to flood risk management. The assessment and management of flood risk is carried out on a 'whole of catchment' basis. This enables the Environment Agency to review the impact that proposed defence works at a particular location may have upon flooding at other locations throughout the catchment.
180. A number of strategic investigations are underway within the region, encompassing the river systems that influence flood risk within the Rotherham. A brief overview of this investigation is provided below.

6.3.2 Catchment Flood Management Plan (CFMP)

181. *"One of the Environment Agency's main goals is to reduce flood risk from rivers and the sea to people, property and the natural environment by supporting and implementing government policies.*
182. *Flooding is a natural process – we can never stop it happening altogether. So tackling flooding is more than just defending against floods. It means understanding the complex causes of flooding and taking co-ordinated action on every front in partnership with others to reduce flood risk by:*
 - *Understanding current and future flood risk;*
 - *Planning for the likely impacts of climate change;*
 - *Preventing inappropriate development in flood risk areas;*
 - *Delivering more sustainable measures to reduce flood risk;*
 - *Exploring the wider opportunities to reduce the sources of flood risk, including changes in land use and land management practices and the use of sustainable drainage systems.*
183. *Catchment Flood Management Plans (CFMPs) are a planning tool through which the Agency aims to work in partnership with other key decision-makers within a river catchment to explore and define long term sustainable policies for flood risk management. CFMPs are a learning process to support an integrated approach to land use planning and management, and also River Basin Management Plans under the Water Framework Directive.*¹⁵
184. A CFMP is being developed for the River Don catchment, and it is understood that this is due for completion in mid 2008. The River Don CFMP will provide the framework beneath which future investment decisions relating to flood risk management will be made within the catchment. In simple terms, the CFMP will consider (for example) whether further investment in flood mitigation is warranted, or whether future sustainability - measured in both economic and environmental terms - within the wider region can only be achieved by 'walking away', allowing the natural floodplain to re-establish. This balance will be assessed on a reach by reach basis along the length of the river(s).

¹⁵ Catchment Flood Management Plans – Volume 1 (Guidance), Version 1.0, July 2004

6.3.3 River Don Flood Risk Management Strategy (FRMS)

185. The River Don FRMS commenced in 2001, however due to funding constraints placed upon the Environment Agency, was stalled in 2003. The strategy process has now recommenced, and is due to present recommended options for flood risk management within the catchment in early 2009. The primary outcome of the strategic process is the identification of tangible and achievable actions to mitigate the risk posed by flooding throughout the catchment. The strategy adopts a holistic approach, considering the catchment in its entirety from Chesterfield (upstream of Rotherham) to Goole (at the downstream extent of the River Don).

6.4 Planning & Development Control – Rotherham Metropolitan Borough Council

6.4.1 Planning Solutions to Flood Risk Management

The Sequential Test

186. Historically urbanisation has evolved along river corridors, the rivers providing a critical source of water, food and energy. This leaves many areas of England with a legacy of key urban centres that, due largely to their close proximity to rivers, are at risk of flooding.
187. The ideal solution to effective and sustainable flood risk management is a planning led one, i.e. steer urban development away from areas that are susceptible to flooding. PPS25 advocates a sequential approach that will guide the planning decision making process (i.e. the allocation of sites). In simple terms, this requires planners to **seek to allocate sites for future development within areas of lowest flood risk** in the initial instance. **Only if it can be demonstrated that there are no suitable sites within these areas** should alternative sites (i.e. within areas that may potentially be at risk of flooding) be contemplated. This sequential approach is referred to as **The Sequential Test**, and is summarised in Figure 3.1 of the PPS25 Practice Companion Guide (A Living Draft, February 2007).

It is absolutely imperative to highlight that the SFRA does not attempt, and indeed cannot, fully address the requirements of the PPS25 Sequential Test. As highlighted in Section 6.4.1 and Figure 3.1 of the PPS25 Practice Guide, it is necessary for the Council to demonstrate that sites for future development have been sought within the lowest flood risk zone (i.e. Zone 1 Low Probability). Only if it can be shown that suitable sites are not available within this zone can alternative sites be considered within the areas that are at greater risk of possible flooding (i.e. Zone 2, and finally Zone 3).

188. As indicated by the bottom right hand corner of the flow chart in Figure 3.1 of the Practice Guide, PPS25 stipulates permissible development types. This considers both the degree of flood risk posed to the site, and the likely vulnerability of the proposed development to damage (and indeed the risk to the lives of the site tenants) should a flood occur.
189. The Council should restrict development to the permissible land uses summarised in PPS25 Appendix D (Table D2). This may involve seeking opportunities to 'swap' more vulnerable allocations at risk of flooding with areas of lesser vulnerability that are situated on higher ground. This is discussed further below.

190. It is important to recognise that the principles of the sequential approach are applicable throughout the planning cycle, and **refer equally to the forward planning process (delivered by Council as part of the LDF) as they do to the assessment of windfall sites**. Where windfall sites come forward for consideration, it is essential that the developer to consider the planning 'need' for the proposed site (adopting a sequential approach in accordance with PPS25). The Council will assist where possible with supporting information. Prior to commencing the detailed FRA, the developer will be required to demonstrate the careful and measured consideration of whether indeed there is an alternative site available within an area of lesser flood risk, in accordance with the PPS25 Sequential Test.
191. The Level 1 SFRA has been developed to inform the Sequential Test. It will be the responsibility of the Council to carry out the Sequential Test on the basis of this information, allocating potential sites for future development accordingly. Furthermore, the developer will be required to demonstrate within the detailed Flood Risk Assessment that the Sequential Test has been applied¹⁶, and (where appropriate) that the risk of flooding has been adequately addressed in accordance with PPS25.

The Exception Test

192. It is recognised that there may be other, non flooding related, planning 'needs' that may warrant further consideration of these areas that are susceptible to a degree of flood risk. Should this be the case, and following the application of the Sequential Test, the Council and potential future developers are required to work through the **Exception Test** (PPS25 Appendix D) where applicable. For the Exception Test to be passed:
- *"It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared. If the DPD has reached the 'submission' stage, the benefits of the development should contribute to the Core Strategy's Sustainability Appraisal;*
 - *the development should be on developable, previously developed land or if it is not on previously developed land, that there are no reasonable alternative sites on previously developed land; and*
 - *a FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and where possible, will reduce flood risk overall."*
193. The first two points set out in the Exception Test are planning considerations that must be adequately addressed. A planning solution to removing flood risk must be sought at each specific location in the initial instance, seeking to relocate the proposed allocation to an area of lower flood risk (i.e. Zone 1 Low Probability or Zone 2 Medium Probability) wherever feasible.
194. The management of flood risk throughout the Borough must be assured should development be permitted to proceed, addressing the third critical element of the Exception Test. The SFRA has provided specific recommendations that ultimately should be adopted as design features, with evidence provided of how they will be fulfilled prior to permission being granted for all future development. It is the responsibility of the prospective developer to build upon these recommendations as part of a detailed Flood Risk Assessment to ensure that the specific requirements of PPS25 can be met.
195. An overview of flood risk throughout the Borough has been provided in Section 6.5 and in Figures 1 to 16. **Future planning decisions should consider the spatial variation in flood risk across the Borough, as defined by the delineated flood zone that applies at the specified site location, and apply the recommendations provided below accordingly**. Once again, it is reiterated that PPS25 applies equally to both allocated sites identified within the emerging LDF and future windfall sites.

¹⁶ In the case of an allocated site within the LDF, the developer should be in a position to simply reference the Council's planning framework to demonstrate successful application of the Sequential Test. Further analysis will be required for windfall sites however as these will generally not have been tested as part of the Council's spatial planning process.

6.4.2 A Proactive Approach – Positive Reduction of Flood Risk through Development

196. It is crucial to reiterate that PPS25 considers not only the risk of flooding posed to new development. It also seeks to positively *reduce* the risk of flooding posed to *existing* properties within the Borough. It is strongly recommended that this principle be adopted as the underlying 'goal' for developers and Council development control teams within Rotherham.
197. Developers should be encouraged to demonstrate that their proposal will deliver a positive reduction in flood risk to the Borough, whether that be by reducing the frequency or severity of flooding (for example, through the introduction of SuDS), or by reducing the impact that flooding may have on the community (for example, through a reduction in the number of people within the site that may be at risk). This should not be seen as an onerous requirement, and indeed if integrated into the design at the conceptual stage, will place no added demands upon the development and/or planning application process.
198. Possible risk reduction measures for consideration may include the following:
- The integration of SuDS to reduce the runoff rate from the site;
 - A change in land use to reduce the vulnerability of the proposed development;
 - A reduction in the building platform area;
 - The raising of internal floor levels and flood proofing (within existing buildings) to reduce potential flood damage;
 - The rearrangement of buildings within the site to remove obstructions to overland flow paths;
 - The placement of buildings to higher areas within the site to limit the risk of flood damage.
199. It is recommended that a clear statement is requested within each and every detailed FRA that concisely summarises how a reduction in flood risk has been achieved within the proposed (re)development. This may be specified as (for example) a reduction in flow from the site, a reduction in water levels within (or adjacent to) the site, or a reduction in the consequences of flooding.

6.4.3 Localised Flood Risk within the Planning Process

200. The PPS25 Practice Guide advocates the application of a sequential approach when allocating land, taking into consideration *all* sources of flooding. The local drainage related problems that have been identified within Rotherham as part of the SFRA consultation process are generally very localised, and relate to historical incidents, the source of which is often somewhat uncertain. It is important to recognise that these are not a measure of 'risk', but rather problems that have occurred due to a particular set of local circumstances in the past (for example, the blockage of a local gully inlet). These may or may not reoccur in future years. More importantly, it is essential to recognise that areas that have not experienced flooding in the past may indeed be susceptible to problems of a localised nature in the future.
201. From a spatial planning perspective therefore, it is considered unreasonable to restrict future development within areas that may have suffered a localised flooding incident in years past. It is essential however not to overlook the potential risk of localised flooding during the design process. Whilst the incidents that have been identified will typically not result in widespread damage or disruption, a proactive approach to risk reduction through design can mitigate the potential for damage, both to the development itself and elsewhere. Specific development control recommendations have been provided accordingly.

6.4.4 Spatial Planning & Development Control Recommendations

PPS25 Requirement	PPS25 Flood Zone					
	Zone 3a (i)	Zone 3b Functional Floodplain	Zone 3a High Probability		Zone 2 Medium Probability	Zone 1 Low Probability
			Undefended Areas	Defended Areas		
SPATIAL PLANNING RECOMMENDATIONS						
Important Considerations	<p>It is important to recognise that Zone 3a(i) relates solely to <u>existing buildings</u> that are impermeable to flood water. The land surrounding these buildings are important flow paths and/or flood storage areas that must be retained.</p> <p>It should be recognised that property situated within this zone will be subject to frequent flooding, on average, no less than once in every 20 years. There are clear sustainability implications to be considered in this regard, and it is highly questionable whether insurance against flooding related damages will be available in the longer term.</p>		Future development within Zone 3a High Probability can only be considered following application of the Sequential Test		Future development within Zone 2 Medium Probability can only be considered following application of the Sequential Test	It is important to recognise that sites within Zone 1 may be susceptible to flooding from other sources. Development may contribute to an increase in flood risk elsewhere if not carefully mitigated
Land Use (refer Table D2 of PPS25)	Proactively seek a reduction in risk by reducing the vulnerability of the existing land use	Water Compatible Development	Land use should be restricted to Water Compatible or Less Vulnerable development. More Vulnerable development may only be considered if Exception Test can be passed		Land use should be restricted to Water Compatible, Less Vulnerable or More Vulnerable development. Highly Vulnerable development may only be considered if Exception Test can be passed	No restrictions
Permitted Development & Property Subdivision	There should be a presumption against all building extensions (including out-buildings). Property subdivision may increase the population at risk, and should not be permitted	N/A	Building extensions (including out-buildings) should be discouraged to avoid raising flood levels elsewhere. Property subdivision may increase the intensity of development, and the population at risk, and should be discouraged		N/A	N/A
DEVELOPMENT CONTROL RECOMMENDATIONS						
Detailed Flood Risk Assessment (FRA)	Required	Required	Required	Required	Required	Required for all sites greater than 1ha in area. Recommend that all sites carry out an assessment of localised flood risks (including surface water (flash) flooding)
Floor Level	To be situated a minimum of 300mm above the 1 in 100 year river flood level, including climate change					No minimum level stipulated by PPS25
Site Access & Egress	For residential property, dry access is to be provided in the 1 in 100 year river flood. For commercial property, access must be 'safe' in accordance with Defra "Flood Risk to People" (FD2320 & FD2321)	N/A	To ensure the safety of residents and employees during a flood, access and egress routes must be designed to meet Environment Agency defined criteria, as set out in Appendix A. It is essential to ensure that the nominated evacuation route does not divert evacuees onto a 'dry island' upon which essential supplies (i.e. food, shelter and medical treatment) will not be available for the duration of the flood event.			No minimum level stipulated by PPS25
Basements	Not permitted	N/A	No sleeping accommodation permitted at basement level. All basements must have an access point that is above the 1 in 100 year river flood level, including climate change	No restrictions	No restrictions	No restrictions
Site Runoff	Implement SuDS to ensure that runoff from the site (post redevelopment) does not exceed greenfield runoff rates. Any SuDS design must take due account of groundwater and geological conditions (refer Section 6.6.3). Any sites situated within the eastern fringes of the District (including Iver, Iver Heath, Riching Parks, Denham, Denham Green, Higher Denham, New Denham and Willow bank) must consider the BW guidance included as Appendix B					
Buffer Zone	A minimum 8m buffer zone must be provided to 'top of bank' within sites immediately adjoining a river corridor. This relates to both open waterways and culverted waterway corridors. Reference should be made to the Environment Agency's "Living on the Edge" guide (www.environment-agency.gov.uk) that discusses any development situated in, over, under or adjacent to rivers and/or streams.					
Other	<p>Ensure that the proposed development does not result in an increase in maximum flood levels within adjoining properties. This may be achieved by ensuring (for example) that the existing building footprint is not increased, that overland flow routes are not truncated by buildings and/or infrastructure, or hydraulically linked compensatory flood storage is provided within the site (or upstream)</p> <p>As an integral part of the government's "Making Space for Water" agenda, the Environment Agency is actively seeking the renaturalisation of culverted watercourses as part of any future development. Realistic opportunities to reinstate the natural open waterway within existing culverted reaches of the river(s) should be promoted</p>					

6.4.5 Building Extensions

202. Concern is mounting throughout England that valuable floodplain areas are being progressively lost to extensions and/or outbuildings that are below a specified size. These are 'permitted' developments that can take place without specific planning approval. Whilst each individual extension may not result in a measurable impact upon localised flood levels, the cumulative impact of building extensions has the potential to be considerable.

203. It is recognised that permitted development rights heavily limits the ability of a local authority to restrict some developments. Article 4 of the Town and Country Planning General Permitted Development Order provides a possible vehicle for removal of these rights in exceptional circumstances, however this measure has implications for property rights. As such, it may be open to compensation claims from affected landowners. A more pragmatic approach is therefore required on a local level.

204. Notwithstanding this however, the importance of a long term sustainable view on the loss of floodplain to building extensions is widely accepted. At the time of writing, it is the intention of the Government to relax permitted development rights to remove domestic extensions from the realm of planning. For this reason, it is strongly recommended that a lobby is established, seeking the exclusion of properties situated within Zones 2 and 3 from this relaxation in planning requirements.

6.5 Overview of Flood Risk & SFRA Interpretation

205. The spatial variation in flood risk across the Borough is depicted in the adjoining maps, and described below. The Rotherham SFRA (Level 1) should be used by both the Council and prospective developers to meet their obligations under PPS25 throughout the planning cycle. Instructions for use are provided below:

Rotherham Metropolitan Borough Council (Forward Planning)

Figures 1 to 16 provide an overview of the spatial variation in *fluvial* flood risk throughout the Borough (i.e. the risk of flooding from rivers), based upon current climate predictions. It is necessary to adopt a sequential approach when considering where land should be allocated for future development, and this is described in Section 6.4. These figures should be used to inform this sequential approach. Furthermore, PPS25 provides clear guidance on permissible land use within areas potentially at risk from flooding, and this too is discussed in Section 6.4.

Whilst there is no particular constraint placed upon land use within areas of Zone 1 Low Probability within the Borough, it is strongly recommended that the Council takes due consideration of flooding from other sources (i.e. non fluvial). Observed incidents of localised flooding are depicted in Figures 1 to 16, and once again these should be used to inform design to ensure that future development does not exacerbate these existing problems. Many of these localised sources of flooding within Rotherham can be effectively managed through the design process, however it is recommended that advice is taken from the Environment Agency to ensure that the severity of the local issue that may affect (or be exacerbated by) the proposed development is fully appreciated.

Rotherham Metropolitan Borough Council (Development Control) & Developers

It is important that the potential risk of flooding is considered as an integral part of all proposed development within the Borough. Figures 1 to 16 provide a measure of the severity of flooding within the proposed development site. These should be used to trigger a more detailed assessment of flood risk related issues within the site, as described in Section 6.4 and Section 6.7.

The assessment of localised flooding related issues is imperative for all proposed development, irrespective of its location and/or scale within the Borough, and the SFRA provides some helpful tools to assist in this regard:

- Figures 1 to 16 provide an indication of areas that have been susceptible to localised flooding historically. This is not a comprehensive record of flooding, and relies upon community reports of flooding made to the Council(s). It is a good indication of areas that may be susceptible however, and reiterates the importance of considering flood risk related issues in areas that are outside of the designated PPS25 flood zones. Figure E provides an overview of areas that have been susceptible to flooding from rivers in years past.
 - Local water storage and conveyance infrastructure is depicted in Figure B. Any future development within close proximity of this infrastructure should consider the potential risk of structural failure and/or overtopping, as discussed in Section 5.3.
 - An overview of the Borough topography and geology is provided in Figures C and D respectively. These maps can be used to offer an indication of overland flow routes (i.e. once the dedicated drainage systems have been surcharged). The design of SuDS is also heavily influenced by the underlying geology.
206. An overview of the risk of flooding within the towns and villages of the Borough is outlined below.

6.5.1 Wath upon Dearne (Figure 1)

207. A sizeable swathe of land within this area is affected by Zone 3a High Probability, associated primarily with Brook Dike. A number of localised flood risk issues have also been identified within this area. Discussions with Council and EA have confirmed that the risk of flooding within the Brook Dike system is due primarily to limited capacity culverts and/or culvert blockage. Regular maintenance is carried out by Council to reduce the likelihood of blockage in times of flood, however the accumulation of debris during wet weather periods is inevitable, resulting in localised flooding. The land adjoining the watercourse is also relatively flat and low lying. This exacerbates the flood risk, and prevents the free flow of water overland
208. The remaining proportion of this area is situated within Zone 1 Low Probability.

6.5.2 Brampton (Figure 2)

209. With the exception of those areas situated immediately adjacent to the Knoll Beck waterway corridor, the entire area is situated within Zone 1 Low Probability. No localised flood risk issues have been identified within this area.

6.5.3 Swinton, Kilnhurst, Sandhill & Ryecroft (Figure 3)

210. A sizeable area immediately adjoining the River Don and Sheffield & South Yorkshire Navigation Canal corridors within this area are designated Zone 3b Functional Floodplain, representing washland areas that are frequently affected by river flooding. Additional areas adjoining the waterway corridor fall within Zone 3a High Probability.
211. The remaining proportion of this area is situated within Zone 1 Low Probability.

6.5.4 Thorpe Hesley, Wentworth & Nether Haugh (Figure 4)

212. With the exception of those areas situated immediately adjacent to the local waterway corridor, the entire area is situated within Zone 1 Low Probability. There is a potential risk of localised flooding in the vicinity of Wentworth Road (Thorpe Hesley) due to blockages in the open overland gullies and drains.

6.5.5 Rawmarsh, Eastwood, Dalton & Greasbrough (Figure 5)

213. Low lying areas situated immediately adjacent to the River Don and Sheffield & South Yorkshire Navigation Canal corridors are situated within Zone 3a High Probability. The waterway corridors of Dalton Brook and Greasbrough Dike may also represent a source of flood risk, and are similarly delineated as Zone 3a High Probability.
214. A proportion of the area, adjoining the main river corridor, is delineated as Zone 2 Medium Probability. The remaining areas are situated within Zone 1 Low Probability.
215. A localised flooding issue has been identified, associated with a hydraulic constriction (under capacity culvert) on Dalton Brook, situated to the east of the River Don. Recent development within the Dalton Brook corridor has incorporated the introduction of a balancing pond to mitigate the potential increase in site runoff, however localised flooding is still experienced.

6.5.6 Ravenfield (Figure 6)

216. With the exception of those areas situated immediately adjacent to the Hooton Brook waterway corridor, the entire area is situated within Zone 1 Low Probability. No localised flood risk issues have been identified within this area.

6.5.7 Masbrough, Templebrough & Kimberworth (Figure 7)

217. Rotherham Metropolitan Borough Council has committed future funding to secure a 1% (100 year) standard of protection for the Templebrough to Rotherham reach of the River Don. This will be delivered through the introduction of a system of raised defences, and will secure the river corridor as a defended area suitable for future regeneration. The first phase of the Templeborough to Rotherham FAS is now underway, and once complete (to be constructed progressively in 3 stages) the FAS will provide a 1 in 100 year standard of protection to the surrounding area. It is imperative however that development is strictly regulated within the intervening period to ensure that the risk to development within the river corridor is adequately managed on a site-by-site basis until the full 1% (100 year) standard of protection can be assured. The adopted Rotherham SFRA flood maps reflect the completed scheme (Phase 1).
218. The remaining areas of this area are situated within Zone 1 Low Probability
219. A number of localised flood risk issues have been identified within the area:
- The River Mas represents a localised flood risk issue, due primarily to limited capacity culverts and culvert blockage;
 - Ickles Goit and Holmes Goit are a small catchments that cater for localised drainage. Future (re)development upstream is anticipated to heavily influence the localised flooding regime if not carefully mitigated.

6.5.8 Brinsworth, Moorgate & Whiston (Figure 8)

220. Low lying areas situated immediately adjacent to the River Rother corridor are situated within Zone 3b Functional Floodplain. These areas encompass the River Rother washlands.
221. The remaining areas of the area are situated within Zone 1 Low Probability.
222. A number of localised flooding issues have been identified in relation to the River Whiston as a result of hydraulic constrictions and low banks on one side. The local community are heavily involved in the maintenance of the river however no properties are adversely affected by flooding at this location. The Environment Agency FZM indicates a potential risk of fluvial flooding along the River Whiston corridor.

6.5.9 Maltby & Hellaby (Figure 9)

223. With the exception of those areas situated immediately adjacent to the Maltby Dike and Hellaby Brook waterway corridors, the entire area is situated within Zone 1 Low Probability.
224. Properties adjoining Hellaby Brook and Maltby Dike have experienced few flooding issues. The catchment is substantial however, and includes some industrial development. Careful mitigation of upstream flows is essential to ensure against a potential risk of flooding to residential areas downstream. Adjoining the brook, a SSSI is 'defended' at upper Maltby.

6.5.10 Laughton en le Morthen (Figure 10)

225. With the exception of those areas situated immediately adjacent to the Brookhouse Dike waterway corridor, the entire area is situated within Zone 1 Low Probability. Brookhouse Brook is subject to localised flooding during wet weather, due largely to restricted weirs and localised channel obstructions.

6.5.11 Treeton, Aughton, Catcliffe & Orgreave (Figure 11)

226. Low lying areas situated immediately adjacent to the River Rother corridor are situated within Zone 3b Functional Floodplain. These areas encompass the River Don washlands, controlled and managed by the Environment Agency.
227. A proportion of this area been delineated as Zone 3a High Probability (including the River Rother and Ulley Brook corridors), and in this instance the detailed modelling of the River Rother system is broadly in agreement with the Environment Agency FZM.
228. The remaining areas of the area are situated within Zone 1 Low Probability.
229. Handsworth Beck has historically represented a localised risk of flooding to the existing Catcliffe development, with adjoining areas of Sheffield City Council draining into the watercourse. Recent sewer improvement works have been carried out to alleviate this issue, and a diversion of the Handsworth Beck outfall into the River Rother (as part of broad scale proposed future development) will ensure that the localised risk of flooding to Catcliffe is addressed.

6.5.12 Aston & Wales (Figure 12)

230. A small proportion of this area (i.e. within the River Rother corridor) is delineated Zone 3a High Probability. The remaining area is situated within Zone 1 Low Probability.
231. Pigeon Bridge Brook at Swallownest is recognised as a sensitive area. A number of localised land drainage issues have been identified in this vicinity.

6.5.13 Norwood & Harthill (Figure 13)

232. With the exception of those areas situated immediately adjacent to the County Dike waterway corridor, the entire area is situated within Zone 1 Low Probability. There are no known localised flood risk issues within this area.

6.5.14 Netherthorpe (Figure 14)

233. With the exception of those areas situated immediately adjacent to the local waterway corridor, the entire area is situated within Zone 1 Low Probability. There are no known localised flood risk issues within this area.

6.5.15 Thorpe Salvin, Kiveton Park & South Anston (Figure 15)

234. With the exception of those areas situated immediately adjacent to the Broad Bridge Dike, Anston Brook and Chesterfield Canal waterway corridors, the entire area is situated within Zone 1 Low Probability. A number of properties have been affected in the vicinity of Hard Lane (Kiveton Park) historically due to the limited capacity, and susceptibility to potential blockage, of the Brook Bridge Dike culvert.

235. Having stated this however, it should be noted that there is an area of Zone 3a High Probability sitting just outside of the bounds of Rotherham Metropolitan Borough Council, and any future development within the district should be carried out with a view to not exacerbate flooding outside of the region.

6.5.16 Todwick, North Anston & Dinnington (Figure 16)

236. With the exception of those areas situated immediately adjacent to the Anston Brook and Cramfit Brook waterway corridors, the entire area is situated within Zone 1 Low Probability.
237. The upper reaches of Cramfit Brook represent a localised flood risk at Dinnington as a result of poor land drainage and limited capacity culverts. Localised flooding issues have also been identified at the rear of the Severn Trent STW (Eel Mires Dike), resulting in the flooding of a small number of houses in the vicinity of Church Lane. This is due largely to the relatively low lying and flat nature of the surrounding topography, preventing the free flow of runoff overland.

6.5.17 Remaining Areas of the Borough

238. All remaining areas are situated on higher ground within Zone 1 Low Probability, and/or are not subject to any future development pressures. Some localised drainage issues may exist, however these should not preclude future development.
239. There are no specific flood risk related constraints placed upon land use within Zone 1 Low Probability (in accordance with PPS25), however a Flood Risk Assessment will be required for sites greater than 1ha in area in compliance with PPS25 and current guidance and policy. This will involve the introduction of SuDS techniques. Any SuDS design must take due account of groundwater and geological conditions

6.6 Detailed Flood Risk Assessment (FRA) – The Developer

6.6.1 Scope of the Detailed Flood Risk Assessment

240. The SFRA is a strategic document that provides an overview of flood risk throughout the Borough. Once the Sequential Test has been applied to determine the allocation of sites for future development, it is imperative that a site-based Flood Risk Assessment (FRA) is carried out by the developer (at the planning application stage) for all proposed developments, as outlined in Section 6.4 above. This should be submitted as an integral part of the planning application. **It is emphasised that, for windfall sites, it will be necessary for the developer to demonstrate that the Sequential Test has been applied (in accordance with PPS25) within the detailed FRA.**
241. The FRA should be commensurate with the risk of flooding to the proposed development. For example, where the risk of flooding to the site is negligible (e.g. Zone 1 Low Probability), there is little benefit to be gained in assessing the potential risk to life and/or property as a result of flooding. Rather, emphasis should be placed on ensuring that runoff from the site does not exacerbate flooding lower in the catchment. The particular requirements for FRAs within each delineated flood zone are outlined below.

It is highlighted that the description of flood risk provided in the discussions above (Section 6.5) place emphasis upon the primary source of flood risk (i.e. river flooding). In all areas, a localised risk of flooding may also occur, typically associated with local catchment runoff following intense rainfall passing directly over the Borough. This localised risk of flooding must also be considered as an integral part of the detailed Flood Risk Assessment.

242. Proposed Development within Zone 3a High Probability, Zone 3a(i) & Zone 3b Functional Floodplain

All FRAs supporting proposed development within Zone 3b Functional Floodplain and Zone 3a High Probability should include an assessment of the following:

- The vulnerability of the development to flooding from other sources (e.g. surface water drainage, groundwater) as well as from river flooding. This will involve discussion with the Council and the Environment Agency to confirm whether a localised risk of flooding exists at the proposed site.
- The vulnerability of the development to flooding over the lifetime of the development (including the potential impacts of climate change) **for all sources of flooding**, i.e. maximum water levels, flow paths and flood extents within the property and surrounding area. The Environment Agency may have carried out detailed flood risk mapping (with respect to fluvial flooding) within localised areas that could be used to underpin this assessment. Where available, this will be provided at a cost to the developer. Where detailed modelling is not available, hydraulic modelling by suitably qualified engineers will be required to determine the risk of flooding to the site. The propensity of culverted systems to block, increasing the risk of flooding, should be considered.
- The potential of the development to increase flood risk elsewhere through the addition of hard surfaces, the effect of the new development on surface water runoff, and the effect of the new development on depth and speed of flooding to adjacent and surrounding property. This will require a detailed assessment, to be carried out by a suitably qualified engineer. It is emphasised that the detailed assessment of potential impacts elsewhere should not be limited (in a geographical sense) to the Borough of Rotherham. Future development within the Borough may adversely affect sites within adjoining Boroughs, and it is essential that this is mitigated.
- A demonstration that residual risks of flooding (after existing and proposed flood management and mitigation measures are taken into account) are acceptable. Measures may include flood defences, flood resistant and resilient design, effective flood warning and emergency planning.

- A review of public safety under flooding conditions in the 1% (1 in 100) design event. The site should be developed to ensure both that the site can be accessed safely by the emergency services in the 1% (1 in 100) design event, and that people can be evacuated safely from the site in the same event. In this instance, 'safe' is to be defined in accordance with Defra guidance FD2320 (Flood Risks to People).
- Details of existing site levels, proposed site levels and proposed ground floor levels. All levels should be stated relevant to Ordnance Datum
- Details of proposed sustainable drainage systems (SuDS) that will be implemented to ensure that runoff from the site (post redevelopment) does not exceed greenfield runoff rates. Any SuDS design must take due account of groundwater and geological conditions (refer Section 6.6.3);
- The developer must provide a clear and concise statement summarising how the proposed (re)development has contributed to a positive reduction in flood risk within the Borough;

243. Proposed Development within Zone 2 Medium Probability

- For all sites within Zone 2 Medium Probability, a high level FRA commensurate with the level of risk posed to the site should be prepared based upon readily available existing flooding information, sourced from the EA. It will be necessary to demonstrate that the residual risk of flooding to the property is effectively managed through, for example, the provision of raised floor levels (refer Section 6.6.2) and the provision of a planned evacuation route and/or safe haven.
- The risk of alternative sources of flooding (e.g. urban drainage and/or groundwater) must be considered, and sustainable urban drainage techniques must be employed to ensure no worsening to existing flooding problems elsewhere within the area. Once again, it is reiterated that future development within the Borough may adversely affect sites within adjoining Boroughs, and it is essential that this is mitigated.
- As part of the high level FRA, the developer must provide a clear and concise statement summarising how the proposed (re)development has contributed to a positive reduction in flood risk within the Borough.
- Details of proposed sustainable drainage systems (SuDS) that will be implemented to ensure that runoff from the site (post redevelopment) does not exceed greenfield runoff rates. Any SuDS design must take due account of groundwater and geological conditions;

244. Proposed Development within Zone 1 Low Probability

For all sites greater than 1ha in area, a simple Flood Risk Assessment must be prepared. The risk of alternative sources of flooding (e.g. urban drainage and/or groundwater) must be considered. Details of proposed sustainable drainage systems (SUDS) that will be implemented to ensure that runoff from the site (post redevelopment) does not exceed greenfield runoff rates. Any SUDS design must take due account of groundwater and geological conditions.

245. Liaison with the Environment Agency

To assist local planning authorities, the Environment Agency has produced standing advice to inform on their requirements regarding the consultation process for planning applications on flood risk matters. Full details of their Flood Risk Standing Advice can be found on the website: www.pipernetworking.com.

The Environment Agency is an excellent source of information to inform the development of the detailed FRA. The external relations team should be contacted as early as possible to source information relating to (for example) historical flooding, hydraulic modelling and topography (LiDAR). It is emphasised that the information provided within the SFRA is the best available at the time of writing. More up to date information may be available, and contact should always be made with the EA at an early stage to ensure that the detailed site based FRA is using the most current datasets, avoiding unnecessary re-work.

The Borough of Rotherham falls across two Environment Agency offices within the North East

and Midlands Regions respectively, and reference should be made to the EA website at www.environment-agency.gov.uk for the appropriate contact details. It is strongly recommended that a draft of the detailed FRA is provided to the EA for review and comment before submitted with the Planning Application, thereby reducing potentially costly delays to the planning process.

6.6.2 Raised Floor Levels & Basements (Freeboard)

246. The raising of floor levels above the 1% AEP (100 year) fluvial flood level will ensure that the damage to property is minimised. Given the anticipated increase in flood levels due to climate change, the adopted floor level should be raised above the 1% AEP (100 year) predicted flood level assuming a 20% increase in flow over the next 100 years, plus an allowance for freeboard (see below).
247. Floor levels should be situated a minimum of 300mm above the 1% AEP (100 year) plus climate change flood level, determined as an outcome of the site based FRA. A minimum of 600mm above the 1% AEP (100 year) flood level should be adopted if no climate change data is available. The height that the floor level is raised above flood level is referred to as the 'freeboard', and is determined as a measure of the residual risks.
248. The use of basements within flood affected areas should be discouraged. Where basement uses are permitted however, it is necessary to ensure that the basement access points are situated 300mm above the 1% AEP (100 year) flood level plus climate change. The basement must be of a waterproof construction to avoid seepage during flooding conditions. Habitable uses of basements within flood affected areas should not be permitted. It must be demonstrated that any below ground construction does not adversely increase the risk of groundwater flooding to adjoining properties.

6.6.3 Sustainable Drainage Systems (SuDS)

249. SuDS is a term used to describe the various approaches that can be used to manage surface water drainage in a way that mimics the natural environment. The management of rainfall (surface water) is considered an essential element of reducing future flood risk to both the site and its surroundings. Indeed reducing the rate of discharge from urban sites to greenfield runoff rates is one of the most effective ways of reducing and managing flood risk within the Borough. The integration of sustainable drainage systems into a site design can also provide broader benefits, including an improvement in the quality of runoff discharged from the site, the capture and re-use of site runoff for irrigation and/or non potable uses, and the provision of greenspace areas offering recreation and/or aesthetic benefits.
250. SuDS may improve the sustainable management of water for a site by¹⁷:
 - reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding downstream;
 - reducing volumes and the frequency of water flowing directly to watercourses or sewers from developed sites;
 - improving water quality over conventional surface water sewers by removing pollutants from diffuse pollutant sources;
 - reducing potable water demand through rainwater harvesting;
 - improving amenity through the provision of public open space and wildlife habitat;
 - replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained.
251. In catchment terms, any reduction in the amount of water that originates from any given site is likely to be small. But if applied across the catchment in a consistent way, the cumulative affect

¹⁷ Interim Code of Practice for Sustainable Drainage Systems National SuDS Working Group, 2004

of a number of sites could be significant.

252. There are numerous different ways that SuDS can be incorporated into a development and the most commonly found components of a SuDS system are described in the following table¹⁸. The appropriate application of a SuDS scheme to a specific development is heavily dependent upon the topography and geology of the site and its surrounds. For example, infiltration techniques are unlikely to function effectively in areas of impermeable and/or particularly shallow soils (e.g. areas overlying shallow coal measures). Careful consideration of the site characteristics must be assured to ensure the future sustainability of the adopted drainage system.

Pervious surfaces	Surfaces that allow inflow of rainwater into the underlying construction or soil.
Green roofs	Vegetated roofs that reduce the volume and rate of runoff and remove pollution.
Filter drain	Linear drains consisting of trenches filled with a permeable material, often with a perforated pipe in the base of the trench to assist drainage, to store and conduct water; they may also permit infiltration.
Filter strips	Vegetated areas of gently sloping ground designed to drain water evenly off impermeable areas and to filter out silt and other particulates.
Swales	Shallow vegetated channels that conduct and retain water, and may also permit infiltration; the vegetation filters particulate matter.
Basins, Ponds and Wetlands	Areas that may be utilised for surface runoff storage.
Infiltration Devices	Sub-surface structures to promote the infiltration of surface water to ground. They can be trenches, basins or soakaways.
Bioretention areas	Vegetated areas designed to collect and treat water before discharge via a piped system or infiltration to the ground

253. For more guidance on SuDS, the following documents and websites are recommended as a starting point:
- Interim Code of Practice for Sustainable Drainage Systems, National SuDS Working Group, 2004
 - Planning Policy Statement 25, Annex F, CLG (2006)
 - The SUDS Manual C697 (CIRIA, February 2007)
 - www.ciria.org.uk/SUDS/

6.7 Local Community Actions to Reduce Flood Damage

254. There will always be a residual risk of flooding, whether that be (for example) from an event that is more extreme than that considered, or whether as a result of a flood defence system that fails unexpectedly. Flood resistance and flood resilience may need to be incorporated into the design of buildings for this reason.
255. In all areas at risk of flooding, a basic level of flood resistance and resilience will be achieved by following good building practice and complying with the requirements of the Building Regulations 2000¹⁹. The difference between 'resilience' and 'resistance' is explained below:
- *Flood resistance*, or 'dry proofing', where flood water is prevented from entering the building. For example using flood barriers across doorways and airbricks, or raising floor levels.

¹⁸ Interim Code of Practice for Sustainable Drainage Systems National SUDS Working Group, 2004

¹⁹ Office of Deputy Prime Minister (ODPM) – now Communities & Local Government (CLG)

- *Flood resilience*, or 'wet proofing', accepts that flood water will enter the building and allows for this situation through careful internal design for example raising electrical sockets and fitting tiled floors. The finishes and services are such that the building can quickly be returned to use after the flood.
256. Examples of both flood-resistant and flood resilient design are given in Improving the Flood Performance of New Buildings (Flood Resilient Construction), CLG (2007).
257. A number of homes and businesses within the Borough are at risk of flooding. It is essential therefore to ensure a broad awareness with respect to flood risk, providing the community with the knowledge (and tools) that will enable them to help themselves should a flood event occur.
258. The following 'community based measures' are cost effective solutions that local communities may introduce to minimise the damage sustained to their own homes in the case of flooding. Further guidance is provided by the EA, Defra and CLG²⁰ (refer the National Flood Forum (www.floodforum.gov.uk)).
259. It is recommended that the Local Authority seek to proactively raise awareness within the community with respect to flooding (and indeed 'self help' flood risk reduction opportunities) through, for example, the circulation of a targeted newsletter to affected residents to coincide with the release of the Rotherham SFRA.

6.7.1 Flood Proofing

260. The 'flood proofing' of a property may take a variety of forms:

For new homes and/or during redevelopment

- Raising of floor levels

The raising of floor levels above the anticipated maximum flood level ensures that the interior of the property is not directly affected by flooding, avoiding damage to furnishings, wiring and interior walls. It is highlighted that plumbing may still be impacted as a result of mains sewer failure.

- Raising of electrical wiring

The raising of electrical wiring and sockets within flood affected buildings reduces the risks to health and safety, and reduces the time required after a flood to rectify the damage.

For existing homes

- Flood boards

The placement of a temporary watertight seal across doors, windows and air bricks to avoid inundation of the building interior. This may be suitable for relatively short periods of flooding, however the porosity of brickwork may result in damage being sustained should water levels remain elevated for an extended period of time. This may lessen the effectiveness of flood proofing to existing properties affected by flooding from larger river systems such as the Thames.

²⁰ Improving the Flood Performance of New Buildings – Flood Resilient Construction (May 2007)

6.8 Emergency Planning

261. The Council is designated as a Category 1 Responder under the Civil Contingencies Act 2004. As such, the Council has defined responsibilities to assess risk, and respond appropriately in case of an emergency, including (for example) a major flooding event. The Council's primary responsibilities are²¹:
- a. *from time to time assess the risk of an emergency occurring;*
 - b. *from time to time assess the risk of an emergency making it necessary or expedient for the person or body to perform any of his or its functions;*
 - c. *maintain plans for the purpose of ensuring, so far as is reasonably practicable, that if an emergency occurs the person or body is able to continue to perform his or its functions;*
 - d. *maintain plans for the purpose of ensuring that if an emergency occurs or is likely to occur the person or body is able to perform his or its functions so far as necessary or desirable for the purpose of:*
 - i. *preventing the emergency,*
 - ii. *reducing, controlling or mitigating its effects, or*
 - iii. *taking other action in connection with it*
262. The Environment Agency monitors river levels within the main watercourses affecting the Borough of Rotherham, including the River Don, the River Rother and the River Dearne. Based upon a sophisticated in-house forecasting computer model, the Agency makes an assessment of the anticipated maximum water level that is likely to be reached within the proceeding hours (and/or days). Where these predicted water levels are expected to result in the inundation of populated areas²², the Environment Agency will issue a series of flood warnings within defined flood warning areas, encouraging residents to take action to avoid damage to property in the first instance.
263. As water levels rise and begin to pose a risk to life and/or livelihood, it is the responsibility of the emergency services to coordinate the evacuation of residents. This evacuation will be supported by the Council. It is essential that a robust plan is in place that clearly sets out (as a minimum):
- roles and responsibilities;
 - paths of communication;
 - evacuation routes;
 - community centres to house evacuated residents;
 - contingency plans in case of loss of power and/or communication.
264. Coordination with the emergency services and the Environment Agency is imperative to ensure the safety of residents in time of flood. A relatively small proportion of Rotherham is at risk of river flooding (as indicated by the shaded PPS25 flood risk zones in the adjoining maps). Flooding of this nature will typically occur following relatively long duration rainfall events, and consequently forewarning will generally be provided to encourage preparation in an effort to minimise property damage and risk to life. It is worth highlighting however that the benefits of flood warning are often compromised to a large degree by the lack of 'take up' within the local community. This emphasises the extreme importance of raising local awareness with respect to the potential risks of flooding.
265. Areas suffering from localised flooding issues will tend to be at greater risk. These areas are susceptible to 'flash' flooding, associated with storm cells that pass over the Borough resulting in high intensity, often relatively localised, rainfall. It is anticipated that events of this nature will occur more often as a result of possible climate change over the coming decades. Events of this nature are difficult to predict accurately, and the rapid runoff that follows will often result in flooding that cannot be sensibly forewarned.

²¹ Civil Contingencies Act 2004

²² Restricted to those urban areas situated within Environment Agency flood warning zones

266. All urbanised areas are potentially at some degree risk of localised flooding due to heavy rainfall. The blockage of gullies and culverts as a result of litter and/or leaves is commonplace, and this will inevitably lead to localised problems that can only realistically be addressed by reactive maintenance.
267. It is recommended that the Council advises the local Resilience Forum of the risks raised in light of the Rotherham SFRA, ensuring that the planning for future emergency response can be reviewed accordingly.

6.9 Insurance

268. Many residents and business owners perceive insurance to be a final safeguard should damages be sustained as a result of a natural disaster such as flooding. Considerable media interest followed the widespread flooding of 2000 when it became clear that the insurance industry were rigorously reviewing their approach to providing insurance protection to homes and businesses situated within flood affected areas. Not surprisingly, the recent widespread flooding of July 2007 has further exacerbated the discussion surrounding the future of insurance for householders and business owners situated within flood affected areas.
269. The following quotations are an extract from the Association of British Insurers (ABI) website, dated August 2007:

“The UK is unique in offering flood cover as a standard feature of household and most business policies. Unlike much of Europe and worldwide, cover is widely available to the UK’s 23.5 million householders.

In the long term, this situation could worsen, unless we take action to reduce flood risk to people and property. Climate change will increase winter rainfall, the frequency of heavy rainfall, and sea levels and storm surge heights. With no change in Government policies or spending, climate change could increase the number of properties at risk of flooding to 3.5 million. Furthermore, continued pressure on land could mean even more new developments being situated in floodplains.

By spreading the risk across policy holders, insurance enables householders and businesses to minimize the financial cost of damage from flooding. In the modern competitive insurance market, premiums reflect the risks that customers face. This enables insurance to be offered at very competitive prices to customers living in low flood risk areas.

In 2003 ABI members agreed to extend their commitment to provide flood insurance to the vast majority of UK customers. The result of discussions between Government and insurers was a Statement of Principles, which aims to provide reassurance to the overwhelming majority of insurance customers living in the floodplain about the continued availability of insurance in future.

Individual property owners can do much to increase the resistance and resilience of their properties to flood damage - further information is available. ABI has issued a factsheet for property owners on a range of measures that could be taken by a homeowner to improve the resilience of their property to flood damage.”

270. In summary, for the time being, residents and business owners can be assured that insurance will be available to assist in recovery following a flood event. It would appear fair to say however that the future availability of flood insurance within the UK will be heavily dependant upon commitment from the government to reduce the risk of flooding over time, particularly given the anticipated impacts of climate change. Investment is required in flood defence and improving the capacity of sewage and drainage infrastructure, however it is also essential to ensure that spatial planning decisions do not place property within areas at risk of flooding.

7 Conclusion & Recommendations

271. A number of properties within Rotherham are at risk of flooding. The risk of flooding posed to properties within the Borough arises from a number of sources including river flooding, surface water and sewer flooding.
272. Planning policy needs to be informed about the risk posed by flooding. A collation of potential sources of flood risk has been carried out in accordance with PPS25, developed in close consultation with both the Council and the Environment Agency. The Borough has been broken down into zones of 'high', 'medium' and 'low' probability of flooding in accordance with PPS25, providing the basis for the application of the PPS25 Sequential Test.
273. A planning solution to flood risk management should be sought wherever possible, steering vulnerable development away from areas affected by flooding in accordance with the PPS25 Sequential Test. Specific planning recommendations have been provided for all settlements within the Borough (refer Section 6.4).
274. Where other planning considerations must guide the allocation of sites and the Sequential Test has been applied, specific recommendations have been provided to assist the Council and the developer to address the requirements of the Exception Test. These should be applied as development control recommendations for all future development (refer Section 6.4).
275. Council policy is essential to ensure that the development control recommendations can be imposed consistently at the planning application stage. This is essential to achieve future sustainability within the Borough with respect to flood risk management. It is recommended that Council policy within the LDF is developed in a robust manner to support PPS25 and the findings and recommendations of the SFRA process. A SPD is to be developed, building upon the existing Design Code, and this should be reviewed to reflect the specific development control recommendations presented by the Rotherham SFRA. The SPD should also be widened to influence development not only with the town centre, but throughout the Borough as a whole.
276. Emergency planning is imperative to minimise the risk to life posed by flooding within the Borough. It is recommended that the Council advises the local Resilience Forum of the risks raised in light of the Rotherham SFRA, ensuring that the planning for future emergency response can be reviewed accordingly.

A Living Document

277. The SFRA has been developed building heavily upon existing knowledge with respect to flood risk within the Borough. A rolling programme of detailed flood risk mapping within the North East region is underway. This, in addition to observed flooding that may occur throughout a year, will improve the current knowledge of flood risk within the Borough and may marginally alter predicted flood extents within Rotherham. Furthermore, Communities and Local Government (CLG) are working to provide further detailed advice with respect to the application of PPS25,. Given that this is the case, a periodic review of the Rotherham Borough SFRA is imperative.
278. It is recommended that the Rotherham Borough SFRA is reviewed on a regular basis. The following key questions should be addressed as part of the SFRA review process:

Question 1

Has any flooding been observed within the Borough since the previous review? If so, the following information should be captured as an addendum to the SFRA:

- What was the mapped extent of the flooding?
- On what date did the flooding occur?
- What was the perceived cause of the flooding?
- If possible, what was the indicative statistical probability of the observed flooding event? (i.e. how often, on average, would an event of that magnitude be observed within the Borough?)
- If the flooding was caused by overtopping of the riverbanks, are the observed flood extents situated outside of the current Zone 3a? If it is estimated that the frequency of flooding does not exceed, on average, once in every 100 years then the flooded areas (from the river) should be incorporated into Zone 3a to inform future planning decision making.

Question 2

Have any amendments to PPS25 or the Practice Companion Guide been released since the previous review? If so, the following key questions should be tested:

- Does the revision to the policy guidance alter the definition of the PPS25 Flood Zones presented within the SFRA?
- Does the revision to the policy guidance alter the decision making process required to satisfy the Sequential Test?
- Does the revision to the policy guidance alter the application of the Exception Test?
- Does the revision to the policy guidance alter the categorisation of land use vulnerability, presented within Table D2 of PPS25 (December 2006)?

If the answer to any of these coare questions is 'yes' then a review of the SFRA recommendations in light of the identified policy change should be carried out.

Question 3

Has the Environment Agency issued any amendments to their flood risk mapping and/or standing guidance since the previous policy review? If so:

- Has any further detailed flood risk mapping been completed within the Borough, resulting in a change to the 20 year, 100 year or 1000 year flood outline? If yes, then the Zone 3b and Zone 3a flood outlines should be updated accordingly.
- Has the assessment of the impacts that climate change may have upon rainfall and/or river flows over time altered? If yes, then a review of the impacts that climate change may have upon the Borough is required.
- Do the development control recommendations provided in Section 6.4 of the SFRA in any way contradict emerging EA advice with respect to (for example) the provision of emergency access, the setting of floor levels and the integration of sustainable drainage techniques? If yes, then a discussion with the EA is required to ensure an agreed suite of development control requirements are in place.

It is highlighted that the Environment Agency review the Flood Zone Map on a quarterly basis. If this has been revised within the Borough, the updated Flood Zones will be automatically forwarded to the Council for their reference. *It is recommended that only those areas that have been amended by the Environment Agency since the previous SFRA review are reflected in Zone 3 and Zone 2 of the SFRA flood maps.* This ensures that the more rigorous analyses carried out as part of the SFRA process are not inadvertently lost by a simple global replacement of the SFRA flood maps with the Flood Zone Maps. .

Question 4

Has the implementation of the SFRA within the spatial planning and/or development control functions of the Council raised any particular issues or concerns that need to be reviewed as part of the SFRA process?