London Borough of Hounslow
Strategic Flood Risk Assessment (SFRA)

July 2007 (Final)
EXECUTIVE SUMMARY

Introduction

1. The London Borough of Hounslow is situated immediately to the east of Heathrow Airport, bounded by the River Thames, the River Crane and the River Brent to the south, east and west respectively.

2. The Borough covers an area of approximately 5,600 hectares and has a population of 212,344 (2001 Census). It is estimated that there are over 95,000 properties within the London Borough of Hounslow, based on address point data. Approximately 16,000 of these homes and businesses are potentially at risk of flooding in a 0.1% (1 in 1000 year) flood event.

3. It is worth noting that 95% of the damages sustained by a residential property as a result of flooding occur within the first 9 inches of water. Furthermore, whilst the average burglary results in a financial loss of £900, the average financial loss to a family as a result of flooding is £28,000.

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, 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 district, 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 London Borough of Hounslow 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;

- 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:

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1 Sourced from the Environment Agency National Property Dataset (2006)

July 2007 (Final)
Areas of ‘high’ probability of flooding are assessed as having a 1 in 100 or greater chance of river flooding (>1%) or 1 in 200 (>0.5%) chance of tidal flooding in any year, and are referred to as High Risk Zone 3;

Areas of ‘medium’ probability of flooding are assessed as having between a 1 in 100 and 1 in 1000 chance of river and/or tidal flooding (1% to 0.1%) in any year, and are referred to as Zone 2 Medium Probability;

Areas of ‘low’ probability of flooding are assessed as having a less than 1 in 1000 chance of flooding (<0.1%) in any year, and are referred to as Zone 1 Low Probability.

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 suitable 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 districts, including the Borough of Hounslow, 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 that does not meet the requirements 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 Hounslow Borough SFRA

14. The Borough of Hounslow has been delineated into zones of low, medium and high probability of flooding, based upon existing available information provided by the Environment Agency. Detailed flood risk mapping has been made available for the River Thames and its tributaries. The Environment Agency Flood Zone Maps (January 2007) have been adopted as the basis for the SFRA for other watercourses.

15. A proportion of the Borough is affected by flooding from the River Thames and its tributaries. 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 been sub-delineated on the basis of current land use, i.e. open space or currently undeveloped areas (i.e. ‘Zone 3b Functional Floodplain (Undeveloped)’) vs areas that are ‘previously developed’ (i.e. ‘Zone 3b Functional Floodplain (Developed)’). Within the context of the SFRA, ‘previously developed’ areas are solely existing buildings that are impermeable to floodwaters. The land surrounding these buildings are important flow paths and/or flood storage areas that 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. A suite of spatial planning and development control policies have been developed accordingly.

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. It is recognised however that there may be strong planning arguments as to why housing may be required in these areas.

19. To meet the requirements of the Exception Test therefore, 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 conditions 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. Essential community services, including emergency services, should be avoided in these areas. There are generally no other restrictions placed upon future development 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 development within Zone 1 Low Probability (i.e. all remaining areas of the Borough). It is important to remember however that development within these areas, if not carefully managed, may exacerbate existing flooding and/or drainage problems downhill. It is necessary therefore to ensure that developers carry out a Surface Water Flood Risk Assessment. This should demonstrate that the proposed drainage system design will mitigate any possible increase in runoff that may occur from the site as a result of the proposed development.

Localised Flooding Issues

23. In addition to fluvial (river) and tidal flooding, properties within the London Borough of Hounslow are also affected by a risk of flooding stemming from issues of a relatively localised nature. These include surcharging of the underground sewer system, the blockage of culverts and gullies resulting in overland flow, and surface water flooding. There is also a potential (albeit minimal) risk of groundwater flooding within the Borough.

24. Issues of this nature are unlikely to affect the allocation (or otherwise) of sites within the Borough. It is absolutely imperative however that future development does not exacerbate localised flooding problems. The implementation of sustainable urban drainage systems must be ensured, and careful consideration to overland flow routes (e.g. avoiding obstructing these) as part of the site design should be encouraged.

A Proactive Approach – Reduction in Flood Risk

25. It is crucial to recognised 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 Hounslow.

26. 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

27. A proportion of the Borough of Hounslow 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.

28. 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 urban centres within the Borough.

29. 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 meet the Exception Test. These should be applied as development control conditions 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.

30. Council policy is essential to ensure that the recommended development control conditions 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 supplementary planning guidance is developed to build upon emerging Council policy, in light of the suggested development control conditions presented by the Hounslow Borough SFRA.

31. Emergency planning is imperative to minimise the risk to life posed by flooding within the Borough. It is recommended that the Council review their adopted flood risk response plan in light of the findings and recommendations of the SFRA.

A Living Document

32. The Hounslow Borough SFRA has been developed in accordance with PPS25. The SFRA has been developed building heavily upon existing knowledge with respect to flood risk within the Borough. The Environment Agency regularly review and update their Flood Zone Maps (on a quarterly basis) and a rolling programme of detailed flood risk mapping within the South East region is underway. This will improve the current knowledge of flood risk within the Borough, and may marginally alter predicted flood extents within the Borough over time. This may therefore influence future development control decisions within these areas.

33. In summary, it is imperative that the SFRA is adopted as a ‘living’ document and is reviewed regularly in light of emerging policy directives and an improving understanding of flood risk within the Borough. It is recommended that the SFRA is reviewed on an annual basis during the first quarter of each year (January to March).
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## Glossary

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<td>AEP</td>
<td>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)</td>
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<td>Core Strategy</td>
<td>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.</td>
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<td>DCLG</td>
<td>Department of Community and Local Government</td>
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<td>Defra</td>
<td>Department of Environment, Food and Rural Affairs</td>
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<tr>
<td>Development</td>
<td>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.</td>
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<td>Development Plan Document (DPD)</td>
<td>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.</td>
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<td>DPD</td>
<td>Development Planning Document</td>
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<td>EA</td>
<td>Environment Agency</td>
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<td>Flood Zone Map</td>
<td>Nationally consistent delineation of ‘high’ and ‘medium’ flood risk, published on a quarterly basis by the Environment Agency</td>
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<td>Formal Flood Defence</td>
<td>A structure built and maintained specifically for flood defence purposes</td>
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<td>Zone 3b Functional Floodplain</td>
<td>PPS25 Flood Zone, defined as areas at risk of flooding in the 5% AEP (1 in 20 chance) design event</td>
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<td>Habitable Room</td>
<td>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.</td>
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<td>Zone 3a High Probability</td>
<td>PPS25 Flood Zone, defined as areas at risk of flooding in the 1% AEP (1 in 100) design event</td>
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<td>Informal Flood Defence</td>
<td>A structure that provides a flood defence function, however has not been built and/or maintained for this purpose (e.g. boundary wall)</td>
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<td>Local Development Framework (LDF)</td>
<td>Consists of a number of documents which together form the spatial strategy for development and the use of land</td>
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<td>Zone 1 Low Probability</td>
<td>PPS25 Flood Zone, defined as areas outside of Zone 2 Medium Probability</td>
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<td>Zone 2 Medium Probability</td>
<td>PPS25 Flood Zone, defined as areas at risk of flooding in events that are greater than the 1% AEP (1 in 100), and less than the 0.1% AEP (1 in 1000) design event</td>
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<td>Planning Policy Guidance (PPG)</td>
<td>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.</td>
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<tr>
<td>Planning Policy Statement (PPS)</td>
<td>A series of statements issues by the Government, setting out policy guidance on different aspects of planning. They replace Planning Policy Guidance Notes</td>
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<td>Previously Developed (Brownfield) Land</td>
<td>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.</td>
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<td>Residual Risk</td>
<td>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</td>
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<td>SEA</td>
<td>Strategic Environmental Assessment</td>
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<td>SUDS</td>
<td>Sustainable Drainage System</td>
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<td>Supplementary Planning Document (SPD)</td>
<td>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.</td>
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<td>Sustainability Appraisal (SA)</td>
<td>Appraisal of plans, strategies and proposals to test them against broad sustainability objectives.</td>
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<td>Sustainable Development</td>
<td>Development that meets the needs of the present without compromising the ability of future generations to meet their own needs&quot; (The World Commission on Environment and Development, 1987).</td>
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1 Introduction

1.1 Overview

34. The London Borough of Hounslow is situated immediately to the east of Heathrow Airport, bounded by the River Thames, the River Crane and the River Brent to the south, east and west respectively.

35. The Borough covers an area of approximately 5,600 hectares and has a population of 212,344 (2001 Census). It is estimated that there are over 95,000 properties within the London Borough of Hounslow, based on address point data. Approximately 16,000 of these homes and businesses are potentially at risk of flooding in a 0.1% (1 in 1000 year) flood event. Flooding represents a risk to both life and property. It is essential therefore that planning decisions are informed, and take due consideration of the risk posed to (and by) future development by flooding.

36. 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).

37. Jacobs was commissioned to develop the Hounslow Borough Strategic Flood Risk Assessment (SFRA) in July 2006. The London Borough of Hounslow 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 with the submission Core Strategy and supporting Development Planning Document (DPD). This SFRA will be developed and refined over time and will feed into the Council’s emerging ‘preferred options’ for site allocation.

1.2 Future Development in Hounslow Borough

38. Hounslow is generally an economically buoyant part of West London. In addition to its close proximity to the River Thames and its tributaries, key characteristics of the local area are its relationship with Heathrow Airport, its large industrial estates and the Great West Road (providing a key transport link into greater London). The Borough’s urban centres include Hounslow, Brentford, Chiswick, Bedfont, Feltham, Isleworth, Heston, Cranford and Hanworth.

39. Although there is continual pressure for new development, the Borough is in competition with European and world markets for inward investment. A number of regeneration areas have been identified by the Council, offering the potential for increased employment and the revitalisation of local communities. In accordance with The London Plan Housing Provision Targets, Waste and Minerals Alterations adopted in December 2006, Hounslow will be expected to provide an additional 4,450 homes over the period 2007/8 to 2016/17.

40. The Council is currently preparing a Local Development Framework (LDF) in accordance with the Planning and Compulsory Purchase Act 2004. The LDF will replace the existing Unitary Development Plan (UDP) and provide the basis for land use and spatial planning in the Borough. The Brentford Area Action Plan (BAAP) is being prepared as part of the LDF, and this will look specifically at issues relating to Brentford town centre (a core regeneration area), and riverside areas stretching north to the Great West Road.

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2 Sourced from the Environment Agency National Property Dataset (2006)
3 Adopted December 2003
2 SFRA Approach

41. The primary objective of the Hounslow Borough 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 attenuation works;
- Support and inform the Council’s emergency planning response to flooding.

42. The Government provides no specific methodology for the SFRA process. Therefore, to meet these broader objectives, the SFRA has been developed in a pragmatic manner in close consultation with both the Council and the Environment Agency.

43. 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 under extreme weather conditions (i.e. as an outcome of detailed flood risk modelling carried out by the Environment Agency). The Hounslow Borough 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.

44. 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.
45. The River Thames catchment encompasses a large number of Boroughs within the Greater London area, and future development within the region could severely 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 careless planning may have, not only locally, but upon adjoining Boroughs.

46. A number of authorities across Greater London 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. Whilst the delivery teams and programmes underpinning these studies vary from one district 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 sub 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

47. This section provides a brief overview of the strategy and policy context relevant to flood risk in the Borough.

48. The success of the SFRA is heavily dependent upon the Council’s ability to implement the recommendations put forward for future sustainable flood risk management, both with respect to planning decisions and development control conditions (refer Section 6.4). A framework of national and regional policy directive is in place, providing guidance and direction to local planning authorities. Ultimately however, it is the responsibility of the Council to establish robust policies that will ensure future sustainability with respect to flood risk.

3.2 National Policy

3.2.1 Introduction

49. This section provides a brief overview of planning policy relating to Hounslow in terms of flood risk. The SFRA is a key point of reference to the Council in developing their flood risk policies, and this part of the document is designed to facilitate policy development.

50. The success of the SFRA is heavily dependent upon the Council’s ability to implement the recommendations put forward for future sustainable flood risk management, both with respect to planning decisions and development control conditions (ref Section 6.). A framework of national and regional policy directives is in place, providing guidance and direction to local planning authorities. Ultimately, however, it is the responsibility of the Council to establish robust policies that will ensure future sustainability with respect to flood risk.

3.2.2 Planning Policy Statement 25: Development and Flood Risk

51. Planning Policy Statement 25 (PPS25) was published in December 2006 and sets out the planning objectives for flood risk management. It states that all forms of flooding and their impacts are material planning considerations, which gives much weight to the issue of flooding. The aim of PPS25 is to ensure that flood risk is taken into account at all stages of the planning process in order to prevent inappropriate development in ‘at risk’ areas.

52. The key objectives for planning are appraising, managing and reducing flood risk. To appraise the risk it is stated that flood risk areas need to be identified, and that the level of risk needs to be identified. To facilitate this, PPS25 indicates that Regional Flood Risk Appraisals and Strategic Flood Risk Assessments should be prepared.

53. To manage the risk, Local Planning Authorities (LPAs) need to develop policies which “avoid flood risk to people and property where possible, and manage any residual risk, taking account of the impacts of climate change”. LPAs should also only permit development in flood risk areas if there are no feasible alternatives located in areas of lower flood risk.

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54. To *reduce* the risk, PPS25 indicates that land needed for current or future flood management should be safeguarded; new development should have an appropriate location, layout and design and incorporate sustainable drainage systems (SUDS); and new development should be seen as an opportunity to reduce the causes and impacts of flooding by measures such as provision of flood storage, use of SUDS, and re-creating the functional flood plain.

55. A partnership approach is stressed in PPS25 to ensure that LPAs work with partners such as the Environment Agency. The Environment Agency can provide both information and advice relating to flood risk, and should always be consulted when preparing policy or making decisions which will have an impact on flood risk.

56. The future impacts of climate change are highlighted in PPS25, as climate change will lead to increased flood risk in many places in the years ahead. When developing planning policy, LPAs need to consider if it is necessary to encourage the relocation of existing development to locations at less of a risk from flooding in order to prevent future impacts of flooding.

57. PPS25 also gives specific advice for determining planning applications, which needs to be considered when developing policy. LPAs should ensure that flood risk assessments (FRAs) are submitted with planning applications where this is appropriate; they should apply the sequential approach (defined in the PPS) which ensures that lower risk areas are considered preferable to higher risk areas; priority should be given to the use of SUDS; and new development should be designed to be resilient to flooding as appropriate.

58. The Practice Guide Companion to PPS25 was released in draft form for consultation by Communities and Local Government in February 2007, providing additional guidance on the principles set out in PPS25.

### 3.2.3 Consultation Planning Policy Statement: Planning and Climate Change

59. The proposed planning policy statement for climate change was published for consultation in December 2006. When finalised, it will supplement the existing PPS1: Delivering Sustainable Development. The document highlights the issue of climate change, and sets out ways planning should prepare for its effects, which includes managing flood risk. Little detail is given about flooding in this document as PPS25 already does this.

### 3.3 Regional Planning Policy

#### 3.3.1 The London Plan

60. The London Plan is the adopted regional spatial strategy relevant to Hounslow. This document includes a number of policies relevant to flood risk in the London area within which Hounslow is situated. The three key policies relate to flood plains; flood defences; and sustainable drainage.

61. Policy 4C.6 “Flood Plains” states that boroughs should identify areas at risk from flooding and highlights the need to refer to PPS25. This SFRA document identifies areas at risk from flooding and covers many of the issues highlighted in PPS25. The policy also indicates that boroughs should avoid permitting built development in functional flood plains. To ensure that this policy is complied with it is important that any allocations for new built development in emerging policy for Hounslow are not located in any of the functional flood plains.

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62. Policy 4C.7 “Flood Defences” highlights the need to set back permanent development from flood defences to allow for replacement or repair of the defences. This is an issue for Hounslow as there are a number of flood defences located in the borough, such as the Thames Tidal Defences. The London Borough of Hounslow will need to ensure that any new development near to the defences is set back from them, and that any new development does not undermine or breach the defences.

63. Policy 4C.8 “Sustainable Drainage” seeks to ensure that surface water run-off is managed close to its source and recommends that sustainable urban drainage systems (SuDS) are promoted for new developments unless there are practical reasons for not doing so. To ensure compliance with this policy it is suggested that a policy on sustainable drainage is included in emerging development documents for Hounslow.

3.3.2 The London Plan, Housing Provision Targets, Waste and Minerals Alterations

64. The housing, waste and minerals alterations provide an update to the housing, waste and minerals policies in the London Plan. The document was adopted in December 2006, and includes a revised housing target for Hounslow, which is to provide an additional 4,450 homes over the period 2007/8 to 2016/17. There are no other policies in the document of particular relevance to flood risk.

3.3.3 Draft Further Alterations to the London Plan

65. The London Plan Further Alterations is the emerging regional policy for the London area. The plan is yet to go through the inquiry stage, but as emerging policy it is worth consideration. However, the Further Alterations document makes no changes to the key flooding policies in the adopted London Plan apart from re-numbering them as follows: policy 4C.6 has been changed to policy 4A.5v; policy 4.C.7 has been changed to policy 4A.5vi; and policy 4C.8 has been changed to policy 4A.5vii. These policies are referenced above. Climate change is increasingly influencing planning policy.

3.3.4 Sub-Regional Development Framework West London

66. The Sub-Regional Development Framework West London provides guidance specific to West London, including guidance relating to flood risk. The document states that new development proposals within the indicated flood risk area will need to have a flood risk assessment, and notes the importance of carrying out an SFRA for areas along the rivers Thames, Brent and Crane. The document also highlights a number of other points raised in PPS25.

67. Surface water run-off is mentioned in guidance on restoration of rivers. The document highlights that the areas around tributary rivers, particularly the Brent, should be sustainably managed to ensure that the overall water management of these rivers more closely reflects natural patterns. The document also states that provision should be made for the storage of surface water during storms within the functional flood plain. The London Borough of Hounslow will need to consider these points when preparing their policies.

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3.4 Local Planning Policy

3.4.1 London Borough of Hounslow Unitary Development Plan

68. The Hounslow Unitary Development Plan was adopted in December 2003 and has a few policies relating to flood risk. As the UDP was prepared several years before PPS25 was published, the policies do not follow all the points made in PPS25. The most relevant policies are policies ENV-W2.4 and ENV-P1.3 on floodwater and surface run off respectively.

69. Policy ENV-W.2.4 states that in areas at risk from flooding:
   “there will be a general presumption against new development or the intensification of existing development unless it can be demonstrated that there will be no increased risk of flooding either on site or elsewhere, to the satisfaction of the Council and the Environment Agency. All new development requiring planning permission must make provision to safeguard occupiers who might be placed at risk from flooding”.

70. Although this policy attempts to deal with flood risk issues it does not go far enough to satisfy the requirements of PPS25. To accord with PPS25 the policy would need to mention the sequential test. Developers would need to follow the sequential test to prove that there were no other suitable sites available at less of a risk from flooding, and the Council would need to do the same when allocating sites. Developers would now be required to undertake a Flood Risk Assessment (FRA) if proposing development in an area at risk from flooding, so the need for an FRA would also need to be mentioned in the policy.

71. Policy ENV-P.1.3 encourages the use sustainable urban water drainage which does accord with PPS25. The rest of the policy indicates a presumption against new developments which are likely to have negative impacts in terms of surface water run-off, and requires the use of attenuation measures. This is also in accordance with PPS25.

72. There are two other policies in the UDP which mention flooding. Policy ENV-W.2 is a general environmental policy and states that increased risk from flooding should be prevented. Policy ENV-P.2.2 on landfill states that land-filling will not be permitted in areas at risk from flooding. Neither of these policies contradicts anything in PPS25, and both are seen as positive.

73. The UDP is under review and will be replaced by the London Borough of Hounslow Local Development Framework which is discussed below.

3.4.2 London Borough of Hounslow Local Development Framework (LDF)

74. The London Borough of Hounslow is still in the early stages of preparing its Local Development Framework (LDF), and as such there are no policies yet to consider. This provides the London Borough of Hounslow with the opportunity to ensure that their LDF is in accordance with PPS25 from the start, giving due regard to national and regional policies and guidance.

75. The points raised above will help the Council to write its policies in accordance with national and regional policy, which should hopefully result in the production of a set of robust policies relating to flood risk. The SFRA will also provide evidence to be used as part of the sustainability appraisal of the LDF.

76. Among others, key points to include in emerging LDF policy are: the sequential test, the need for FRA, and increased use of SuDS. Furthermore however, it is recommended that future revisions to the policy are developed with due consideration to the specific recommendations for future development within flood affected areas as set out in Section 6.5 of this document. These recommendations have been identified and agreed in close consultation with the Environment Agency and the Council. They represent the minimum conditions that will be expected by the Environment Agency should development be permitted to proceed, and it is recommended that these are included in a supplementary planning document (SPD) to support the over-arching policies.

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3.4.3 Brentford Area Action Plan (BAAP) Preferred Options

77. Although much of the LDF is yet to be developed, the Brentford Area Action Plan has reached the Preferred Options stage. Flooding does not feature heavily in the document but one of the overall objectives of the BAAP is “to ensure that new development results in a positive impact on […] areas at risk of flooding.” Therefore the issue of flood risk is considered. Furthermore, the policy on sustainable living indicates that all development proposals will need to include sustainable urban drainage systems, which will help to follow the aspect of PPS25 relating to drainage.

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11 London Borough of Hounslow (2006), Brentford Area Action Plan Preferred Options
4 Data Collection

4.1 Overview

78. 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 Council and the Environment Agency;
- Detailed flood risk mapping;
- Environment Agency Flood Zone Maps (December 2006);
- Topography (LiDAR).

79. All of this data has 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

80. 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 flooding, 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.

81. 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 outlines. 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.

82. 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. They have an ongoing programme of improvement, and updates are made on a quarterly basis.

4.3 Historical Flooding

83. Detailed discussions have been held with the Council to identify those areas within the Borough that are known to have been exposed to flooding in recent years. These have been highlighted in the adjoining flood risk maps, and are summarised below. It is important to recognise that the incidents listed are events in which properties have been affected not only by flooding from local watercourses, but also from surcharging of the underground sewer system, blockage of culverts and gullies, and/or surface water runoff.
Surface Water Flooding (backing-up of drainage network)

- The Alders/Swan Close at Hanworth
- Shaftsbury Avenue/Gladstone Avenue at Feltham, east of the Feltham Arena

Surcharging of Surface Water and Combined Sewers

- Hounslow Road/Saxon Avenue/Pevensey Road, south east of Feltham, between Hanworth Park and the River Crane
- London Road at Isleworth Iron Bridge, north of Isleworth, between Woodlands and Spring Grove
- Boston Manor Road, east of Brentford
- Boston Garden
- Manor Vale
- Windmill Road

River (fluvial) Flooding – River Thames & River Brent

- Brentford – Ham Dock Road and Ferry Lane
- Chiswick Mall

River (fluvial) Flooding - Duke of Northumberland

- Mogden Lane and Rugby Road near Twickenham Rugby Stadium

84. Many of the properties affected by flooding 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.

4.4 Detailed Hydraulic Modelling

85. A number of detailed flooding investigations have been carried out by the Environment Agency within the study area. 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.

86. The River Brent and River Crane are currently being modelled, both separately and as part of Lower Thames Flood Risk Mapping Project (due for completion in late 2007). The Environment Agency has also commenced a Brent Flood Risk Management Strategy, incorporating much of Hounslow, investigating the risks of flooding at a more detailed level. This strategy is seeking to identify potential measures to reduce flood risk. A detailed River Brent flood mapping project is also in progress, and draft modelled outlines have been provided for SFRA purposes.

87. 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. engineering works which may be implemented in the future), culverts are permitted to block, or the condition of the river channel is allowed to deteriorate.

88. 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

89. 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. Within the context of the London Borough of Hounslow, a degree of defence against flooding is also provided by the River Thames barrier.

90. Formal raised flood defences within the Borough have been identified in consultation with the Environment Agency. The defences identified are located mainly on the River Thames, as indicated on the adjoining maps.

91. The Environment Agency has no statutory responsibility to maintain 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 along the Thames Tidal Defences (TTD). 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).

92. 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.

93. No informal raised flood defences providing protection from flooding have been specifically identified in the London Borough of Hounslow as part of the SFRA process although some may exist.

4.6 Consultation

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

London Borough of Hounslow

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

Street Planning and Public Protection: Consulted to identify areas potentially at risk from river flooding and/or urban drainage

Emergency Planning: Consulted to discuss the Borough’s existing emergency response to flooding
Environment Agency

The Environment Agency has been consulted to source specific flood risk information to inform the development of the SFRA. In addition, 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.

Thames Water

Thames Water is responsible for the management of urban drainage (surface water) and sewerage within the Borough. Thames Water was 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 postcode. 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 (refer Section 6.5), 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 Thames 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.

Communities and Local Government (CLG)

PPS25 was released in final form in December 2006, midway through the development of the Hounslow Borough SFRA. Similarly, the Practice Guide Companion to PPS25 was released in draft form in February 2007. Whilst the underlying principles of the policy guidance did not change, some subtle modifications were made to the document, resulting in a need to seek clarity from CLG (authors of PPS25) by both the Council and the Environment Agency. CLG were consulted on a number of specific issues throughout the SFRA process, including (but not limited to) the definition of Zone 3b Functional Floodplain, and the incorporation (or otherwise) of climate change impacts within the delineation of the PPS25 flood zones.

4.7 Topography & Geology

95. Within a large proportion of the area, detailed flood risk mapping has been carried out, providing a robust means of delineating zones of ‘high’ probability (i.e. 1% (100 year) design to flooding. Dependence must be placed upon the Environment Agency Flood Zone Map for the 0.1% (1000 year) flood extent however, providing a relatively coarse depiction of flood risk for this more extreme event. Given that this is the case, a ‘sensibility’ check has been carried out for those events in which detailed modelling is currently not available. The primary purpose of this check is to ensure that the adopted Environment Agency Flood Zone Map is generally representative of anticipated flooding conditions.

96. Indeed it is important to ensure that the Environment Agency Flood Zone Map reflects the fact that water flows downhill, and that water levels across the river (i.e. on either bank of the river at the same location) are equal. The Environment Agency LiDAR data has been used to reflect the topography of the Borough in this instance.
97. Finally, the geology of the Borough is characterised by river terrace deposits overlying London Clay. The use of sustainable drainage techniques to reduce the rate (and volume) of runoff from future development is a clear requirement, and it is imperative that this is designed with careful consideration to the underlying geology and site topography.
5 Flood Risk in the Borough of Hounslow

5.1 Overview

98. The River Thames poses a potential risk of flooding to properties within Hounslow. Notwithstanding this however, the vast majority of property in Brentford, Chiswick and Isleworth is protected by the River Thames Tidal Defences (TTD) up to the 1 in 1000 year event. This is provided that the River Thames Barrier is operated to protect against storm surges from the North Sea and to provide a pool for the River Thames to drain into during extreme fluvial events at high tides.

99. It is essential to recognise that defences do not fully remove the risk of flooding to properties within the Borough. There is always a residual risk of system malfunction, overtopping and/or structural failure. Whilst the risk of flooding from rivers and/or the sea may be reduced through the presence of defences, it is also important to remember that localised flooding (i.e. resulting from local catchment runoff and/or sewer system failure following heavy rainfall) may flood properties within defended areas.

100. In addition to the River Thames, the River Brent and the River Crane also pose a potential risk of flooding to properties within Hounslow. These smaller river systems affect fewer properties within the Borough than the River Thames, however they are far more susceptible to flash flooding resulting from localised intense rainfall. With changing climate patterns, it is expected that storms of this nature will become increasingly common. It is vitally important that planning decisions recognise the potential risk that these watercourses pose to property and plan development accordingly so that future sustainability can be assured.

101. The overloading of the sewer system due to inflows exceeding the underground system capacity (i.e. resulting in surcharging) is a known problem in some areas. Note that surface water networks are typically designed to cater for events up to a 1 in 30 year. Surface water flooding will occur when the sewer system is overloaded.

102. Thames Water carries out detailed analysis to highlight potential problem areas within their sewer systems (which may combine the foul and surface water networks) however these were not made available for the purposes of the SFRA process. Rather, a review of the Borough’s topography has been carried out to identify potential surface water flow paths, and areas where there is a sudden change in gradient. This provides a good indication of where surface water flooding may be expected to cause a flooding concern to property. This may occur, for example, at the base of a steep escarpment (i.e. where the ground suddenly flattens out), or where a localised ‘hollow’ may result in ponding.

5.2 Fluvial Flooding - Delineation of the PPS25 Flood Zones

103. 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.

104. 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.
105. The Borough has been delineated into the flood zones summarised below.

Zone 3b The Functional Floodplain
Areas of the region susceptible to 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 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).

106. The delineation of the PPS25 flood zones is discussed in Section 5, and presented in the adjoining Flood Risk Maps.

### Flood mapping source definition

<table>
<thead>
<tr>
<th>Flood Zone</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 2</td>
<td>National Flood Zone Mapping FZ2 (Environment Agency)</td>
</tr>
<tr>
<td>Zone 3a</td>
<td>National Flood Zone Mapping FZ3 (Environment Agency)</td>
</tr>
<tr>
<td>Zone 3b</td>
<td>Thames - LiDAR generated flood shape 5.34mAOD</td>
</tr>
<tr>
<td></td>
<td>Brent - 1:20 chance event Detailed Flood Mapping</td>
</tr>
<tr>
<td></td>
<td>Crane - 1:50 chance event Detailed Flood Mapping</td>
</tr>
<tr>
<td>Climate Change</td>
<td>Thames - LiDAR generated flood shape 5.64mAOD</td>
</tr>
<tr>
<td></td>
<td>Brent &amp; Crane - No data available</td>
</tr>
</tbody>
</table>

**5.2.1 Delineation of Zone 3b Functional Floodplain**

107. 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 Hounslow Borough 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).

108. Within the London Borough of Hounslow, this encompasses primarily those low-lying areas immediately adjoining the River Thames, the River Brent and the River Crane.\(^{12}\) Any development within these areas is likely to measurably impact upon the existing flooding.

\(^{12}\) Note that the definition of Zone 3b Functional Floodplain within the River Crane catchment has been adopted as the 2% (50 year) design flood envelope.
regime, increasing the severity and frequency of flooding elsewhere.

109. Many existing urban areas along the River Thames corridor are affected by flooding in the 5% AEP (20 year) flooding event. The recent release of the PPS25 Practice Companion Guide highlights the importance of considering existing land use when delineating areas that are to be treated as ‘functional floodplain’ for planning purposes.

110. 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. For this reason, a sub-delineation within Zone 3b has been provided, making reference to ‘developed’ and ‘undeveloped’ areas as described in Section 6.4 below.
111. It is important to recognise that all areas within Zone 3b are subject to relatively frequent flooding – on average, flooding once in every 20 years. There are clear safety, sustainability and insurance implications associated with future development within these areas, and informed planning decisions must be taken with care. This is reflected in Section 6.4 below.

5.2.2 Delineation of Zone 3a High Probability

112. 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.

113. For planning purposes, the Environment Agency has issued a series of Flood Zone Maps as depicted on the Environment Agency’s website (www.environment-agency.gov.uk). Only in those areas within which detailed flood mapping is not available and/or fit for purpose, the Environment Agency’s Flood Zone Maps have been adopted to underpin the SFRA process. At these locations, detailed topography has been used to carry out a ‘sensibility 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.

114. The detailed modelling outputs developed by the Environment Agency, where available (refer Section 4), have been adopted for the delineation of Zone 3a High Probability, superseding the current EA flood zone map (December 2006). It is highlighted however that subsequent revisions of the EA web based mapping will incorporate this more detailed information in due course, updating the flood zone map so that it is consistent with the detailed modelled outlines provided.

115. It is important to recognise that the delineation of Zone 3a encompasses those areas that are protected against flooding through the presence of flood defences (including the Thames Tidal Defences), reflecting the fact that a residual risk of flooding remains. The ‘actual’ risk of flooding to property is clearly reduced within these defended areas however, and therefore spatial planning and development control decisions can be taken accordingly. For this reason, specific recommendations have been provided in Section 6.4 relating to ‘defended’ and ‘undefended’ areas within Zone 3a.

5.2.3 Delineation of Zone 2 Medium Probability

116. 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.

5.2.4 Delineation of Zone 1 Low Probability

117. 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 Assessment of Risk to Life (Flood Hazard)

118. The assessment of flood risk has thus far considered the maximum extent to which flooding will occur during a particular flood event. This provides the basis for assessing broadly the areas potentially impacted by flooding. Of equal importance however is the speed with which flooding occurs as river levels rise. The inundation of floodwaters into low lying areas can pose a considerable risk to life.
119. Substantial research has been carried out internationally into the risk posed to pedestrians during flash flooding. This research has concluded that the likelihood of a person being knocked over by floodwaters is related directly to the depth of flow, and the speed with which the water is flowing. This is referred to as 'Flood Hazard'.

120. For example, if a flood flow is relatively deep but is low energy (i.e. slow moving), then an average adult will be able to remain standing. Similarly, if the flow of water is moving rapidly but is very shallow, then once again an average adult should not be put off balance. If however the flow is both relatively deep and fast flowing, then a person will be washed off their feet, placing them at considerable risk. The risk to health and safety as a result of submerged hazards during flooding conditions (given the often murky nature of floodwaters) is also a consideration.

121. Defra and the Environment Agency have recently collaborated to develop a document entitled ‘Flood Risk to People’ (FD2320). This provides guidance to aid in the review of flood hazard within the UK. Future detailed site based Flood Risk Assessments should make reference to this document when assessing the potential risk to life posed by flooding (and flood defence failure) as outlined below.

122. The risk to life (as a result of flooding) within the Borough of Hounslow has been assessed to inform the allocation of land within the Borough for future development. A summary of the methodology used, and the findings, is presented below:

- **Flood hazard due to flood defence failure**

  **Structural (breach) Failure**

  A number of raised defences, including the TTD, have been identified within the London Borough of Hounslow (refer Figure 2), providing protection against fluvial and tidal flooding. Flood defences are typically raised structures that alter natural flow patterns and prevent floodwater from entering property in times of flooding.

  There is always a residual risk that these defences may fail, resulting from either overtopping and/or breach failure. The latter could result in rapid inundation into overbank areas behind the defence, posing a potential risk to residents, pedestrians and property that may be in the path of the floodwaters.

  It is recognised that a breach failure of the River Thames defences will, over a period of time, result in the inundation of a relatively large area. The extent of inundation will be entirely dependant on the height of the defence and height of the river level. In most cases however, following the initial ‘burst’ of water through the defences the flood wave will be relatively shallow and unlikely to pose a risk to life. The greatest Flood Hazard is the rapid, deep and fast flowing water immediately behind the breach.

  To assess the potential risk to life as a result of breach failure, a two dimensional model of the Thames Tidal Defence system was developed. In simple terms, the two dimensional model simulates the inundation of floodwaters into the Borough that occurs when a 30m length of the river defences collapse without warning. A ‘worst case’ scenario was adopted in which the model assumes that the water level in the river at the time of collapse is just about to overtop the flood wall.

  The TTD within Hounslow vary considerably, and in many areas the defences comprise (for example) flood gates on riverfront homes. These are clearly not subject to the catastrophic structural failure that is being considered in this instance. Furthermore, many areas of the Borough behind the River Thames are actually relatively high (refer Figure 4), above the design defence height. Once again, these areas will not be subject to rapid inundation should the TTD collapse suddenly.

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13 TuFlow
Within those areas that are likely to be rapidly inundated following a sudden collapse of the raised defences, breach modelling has been carried out. Once again it is reiterated that the purpose of this assessment is to consider only that area within which the depth and speed of the flow will result in a risk to life. This is mapped as the 'rapid inundation zone' provided in Figure 7. Specific planning recommendations have been provided for this zone within Section 6.4.

**Structural Condition**

Spatial planning decisions are taken to allocate land for future development that will provide homes and business premises for decades, if not centuries. It is argued that the structural condition of the defences at the time of the decision is somewhat irrelevant. It is not possible for the planning process for ‘foretell’ decisions with respect to future investment in flood defence. Rather a ‘worst case’ situation must be considered, such that the planning decision can be made with the assurance that the residual risk of defence failure does not affect the future sustainability of the proposed development.

Notwithstanding this however, it is essential that the structural condition of the defences is reviewed at the time of construction (planning application). The commitment to long term maintenance must also be considered to ensure the future integrity of the defence over the lifetime of the development. To this end, it is important to recognise that the structural integrity of the existing flood defences is integral to the sustainability of both existing and future development in Chiswick, Brentford and Isleworth. Without the raised defences, the severity and frequency of flooding in these areas will increase. It is essential that the detailed site based Flood Risk Assessment for all potential future development in defended areas of the Borough considers both the likelihood and consequence of defence failure near the proposed site.

- **Flood hazard due to reservoir failure**

Osterley Middle Lake is situated within the Borough of Hounslow, as depicted in Figure 2\(^{14}\). The catastrophic failure of reservoirs may potentially pose a risk to property and life downstream.

The reservoirs are managed and maintained in accordance with current UK legislation. The Water Act 2003 amended the Reservoirs Act 1975, requiring the preparation of dedicated Flood Plans for reservoirs. A Flood Plan is a set of documents that describe the arrangements to be put into operation in response to a sudden large release of water from a reservoir that could pose a threat to property and life downstream. A Flood Plan will include an assessment of the impacts of dam failure, a review of the measures that can be taken by the reservoir operator to prevent the catastrophic failure, and an assessment of the emergency response mechanism required to minimise risk to life and property should a failure occur.

Dedicated Flood Plans will be required for all reservoirs within the next few years. In the interim, regular inspections are carried out by suitably qualified engineers. This ensures a risk-based approach, enabling mitigation measures to be put into place as early as possible should there be any cause whatsoever for concern. On this basis the possible risk of failure of these reservoirs is considered to be minimal. Indeed, research recently carried out by Jacobs on behalf of Defra and Thames Water has indicated that the average annual risk of failure for reservoirs that fall under the auspice the Reservoirs Act is approximately 2 \(x\) \(10^{-5}\), i.e. a 1 in 50,000 chance that the reservoir will fail in any one year. This is clearly substantially less than the risk regime considered by PPS25.

\(^{14}\) It is highlighted that there are no other reservoirs either within Hounslow, or adjoining Boroughs, that are considered to pose any form of risk to properties within the Borough
5.4 Fluvial Flood Risk from the Thames Tributaries

5.4.1 River Brent (and the Grand Union Canal)

123. The catchment of the River Brent covers an area of approximately 151 km$^2$ flowing into the River Thames near Brentford. The tidal extent of the River Thames ends at the last lock of the River Brent (Brentford Lock & Weir). While the tide does not normally affect water levels above this lock, at very high tides the River Thames can result in raised water levels in the River Brent for up to some 2.75 km upstream. According to British Waterways, there is potential for significant flooding during storm flood events if they (i.e. the storms) coincide with high tides. This is consistent with TE2100 findings.

124. Between Hanwell and Brentford the River Brent is canalised, known as the Grand Union Canal. The Grand Union Canal was constructed wide and deep to be navigable for barges, however, there has been recorded flooding of the banks onto the towpath. The water level is maintained in the canal behind locks and is controlled through the river loops (former meanders) using weirs.

5.4.2 River Crane

125. The catchment of the River Crane covers an area of approximately 124 km$^2$ flowing into the River Thames near Isleworth. The tidal extent of the River Thames is up to 800 m from the River Crane mouth during spring tides, approximately to Chertsey Road, but the mean high tide level reaches the weir at Northcote Road. From Northcote Road, private gardens back directly onto the river and historic flooding due to a combination of high fluvial flows and high tides has occurred here, flooding gardens on several occasions when the tidal gate did not function correctly.

126. At the mouth of the River Crane, there is a hydraulically operated automated gate, controlling the flow of rising tides. Downstream of the tidal gate, the river banks have been reinforced for flood defence purposes. Approximately 300 m of river walls immediately upstream of the River Thames confluence have been recently raised and replaced with 12 m high steel sheet piling and reinforced concrete retaining walls.

5.4.3 Duke of Northumberland River (DON)

127. The Duke of Northumberland river is an artificial channel dating from the 16th century and a main tributary of the River Crane, originally built to supply water from the River Colne to Syon Park.

128. The eastern section (within Hounslow) was constructed to supply water to the flourmills at Isleworth. It is 4 km long and the Mereway weir controls the flow to 3 m$^3$/s. A deep basin is located at the confluence with the River Thames, just downstream of the Richmond Road Bridge, to prevent tidal water backing up the Duke of Northumberland River. Just before the basin, Kidd’s Mill sluice gates ensure a minimum water level in the upstream channel of approximately 2 meters above bed level. It is noted that the London Borough of Hounslow Council is constructing a new bridge at St Johns Road. This will remove an existing constriction, and will reduce the risk of channel blockage at this location.

5.5 Local Drainage Issues

129. As discussed in Section 4.6, consultation has been carried out with the Environment Agency and the Council to identify known and/or perceived problem areas. These drainage problems may to be attributed to inundation due to poor maintenance, associated with (for example) culvert blockages, and/or increased overland flow due to development during heavy rainfall. Issues of this nature are often relatively localised, affecting generally a small number of properties.

130. A number of known localised problems have been identified throughout the Borough, highlighted as an outcome of flooding experienced by local residents or businesses. It is important to note that a number have subsequently been addressed through subsequent maintenance to rectify the problem (e.g. removal of localised blockages).
131. Within the urban centres 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 Thames Water to pinpoint known and/or perceived problem areas, however the information provided is very general. Further more detailed information relating to observed localised flooding within the Borough has been provided by the Council, and this is reflected in the adjoining flood zone maps.

132. Once again however, it should be noted that issues of this nature are generally localised, and can be addressed as part of the design process. They therefore will generally not influence the decision as to whether or not land will be allocated for future development. It is essential however to ensure that future development does not exacerbate existing flooding problems. Strict planning conditions 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).

133. 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 the Borough. Clear development control recommendations have been provided in Section 6.4 below. Collectively, the effective application of SUDS as part of all future development will assist in reducing the risk of flooding to the Borough.

5.6 Groundwater Flooding

134. The risk of groundwater flooding is typically highly variable and heavily dependent upon local conditions at any particular time, nevertheless the risk of groundwater flooding in this instance is considered to be relatively low. There are no recorded incidents of groundwater flooding within the Borough.

135. Notwithstanding this, an area of gravel geology has been identified within the Borough, as presented in Figure 6. Raised water levels within adjacent rivers and streams can raise the water table beneath the surface, resulting in localised groundwater flooding through permeable gravel ‘lenses’.

136. 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.

5.7 Climate Change

137. 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. In tidally affected areas within the east of England, an increasing rate of change in predicted sea levels is to be assumed with time, as summarised in the table below.
138. 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.

139. The detailed modelling of the River Thames system (and tributaries) has considered the potential impact of climate change over the next 50 years. It is important to recognise that an increase in flow of simply 20% cannot be applied where the river level is a result of fluvial and tidal phenomena, influenced by the operation of the River Thames Barrier. Peak predicted water levels have been provided by the EA for the year 2052. These are depicted as Zone 3aCC in the adjoining flood maps.

140. In other areas (i.e. in which detailed modelling is not available), experience has shown that, in simple terms, the anticipated extent of the 1% AEP (100 year) flood affected area in 2056 can be approximated by the current 0.1% AEP (1000 year) flood outline, i.e. Zone 2 Medium Probability. Within Hounslow Borough, this indicates a relatively small increase in the number of properties at risk of flooding.

141. For planning (and development control) purposes, the SFRA has provided a risk-based approach to future development within Zone 2 Medium Probability (approximately equivalent to the 1% (100 year) flood outline incorporating climate change), as outlined in Sections 6.4 and 6.6 respectively. This takes due account of the relatively limited risk of flooding posed to ‘highly vulnerable’ development today (i.e. 2006) in accordance with PPS25. It also 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.

142. 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 both the site based detailed Flood Risk Assessment and the Surface Water Flood Risk Assessment (i.e. prepared by the developer at the planning application stage as outlined in Section 6) take due consideration of climate change.

5.8 Residual Risk of Flooding

143. It is essential that the risk of flooding is 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.

144. 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.
145. The SFRA process has carried out a review of flood risk within the Borough in accordance with the PPS25 Sequential Test, identifying a number of areas that fall within Zone 3a High Probability. 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.

146. It is difficult to quantify uncertainty. The adopted flood zones underpinning the Hounslow Borough SFRA are based upon the detailed flood mapping within areas adjoining the River Thames and tributaries. 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.

147. Taking a conservative approach for planning purposes, it is understood that the Environment Agency (Thames Region) generally adopt a 250mm 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.

148. It is incumbent on developers to carry out a detailed Flood Risk Assessment as part of the design process. A review of uncertainty should be undertaken as an integral outcome of this more detailed investigation.
6 Sustainable Management of Flood Risk

6.1 Overview

149. 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.

150. 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.

151. 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

152. 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.

153. The Greater London Authority should consider flood risk when reviewing strategic planning decisions including (for example) the provision of future housing and transport infrastructure.

154. 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.

155. The Local Planning Authority is responsible for carrying out a Strategic Flood Risk Assessment. The SFRA should consider the risk of flooding throughout the district 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.

156. Landowners & Developers\(^{15}\) 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.

\(^{15}\) Referred to also as ‘landowners’ within PPS25

July 2007 (Final)
6.3 Strategic Flood Risk Management - The Environment Agency

6.3.1 Overview

157. 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.

158. 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.

159. A number of flood risk management strategies are underway within the region, encompassing the large river systems that influence flood risk within the Borough of Hounslow. A brief overview of these investigations is provided below.

6.3.2 Catchment Flood Management Plan (CFMP) - Thames Region

160. “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.

161. 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.

162. 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.6

163. A CFMP is being developed for the River Thames catchment. A consultation summary document has recently been provided outlining the main messages from the CFMP (January 2007).
164. Four over arching key messages have been highlighted by the CFMP:

- Flood defences cannot be built to protect everything;
- Climate change will be the major cause of increased flood risk in the future;
- The floodplain is our biggest asset in managing flood risk;
- The ongoing cycle of development and urban regeneration is a crucial opportunity to manage flood risk.

165. Specific messages have been provided for characteristic reaches along the River Thames, including areas that are protected against flooding through the presence of raised defences (i.e. a large proportion of the London Borough of Hounslow). The Thames CFMP states that, within these areas:

- At present it is still possible and effective to maintain these flood defences.
- Climate change will mean that these defences will become less effective in the future. We therefore need to make sure that:
  - any redevelopment reduces the residual flood risk in the areas benefiting from these flood defences using the measures set out in PPS25;
  - the natural flood plain is used upstream and downstream of these areas to accommodate additional floodwater.

166. Further key messages for the lower reaches of the River Brent and River Crane catchments are also provided within the CFMP, and these are provided in adjoining Appendix C. In summary, the CFMP seeks a sustainable ‘planning’ led solution to flood risk management within the Greater London area. The CFMP encourages local authorities (and indeed developers) to strive for a positive reduction in flood risk through future development and regeneration. This is striving to ensure that collectively decisions taken not only avoid the creation of a future legacy of new development at risk of flooding, but also progressively reduces the risk of flooding to existing development. This is a key objective of PPS25.

6.3.3 Thames 2100 Strategy (TTD)

167. The Thames Estuary 2100 project is currently developing a strategic plan for managing flood risk in the River Thames Estuary over the next 200 years and beyond. It covers the areas around the River Thames up to Teddington Lock where the tidal limit formally ends. This means that it includes the Brentford, Isleworth and Chiswick areas.

168. As part of this project, a report on the tidal/fluvial interaction on tributaries of the Tidal Thames was produced, including comments about the River Brent as follows:

- Under normal flow and tide conditions the water level upstream of the lock and weir at the entrance to the Grand Union Canal at Brentford is greater than that in the River Thames; consequently this Lock is the tidal limit of the River Thames.

- For extreme tides on the River Thames the River Brent backs up from the River Thames Lock for a distance of 2.75km from the confluence and high Thames water levels can cause flooding on the 2.7km long section upstream of the River Thames confluence (1.5km upstream of the extent of Thames tidal defences). High Thames levels will exacerbate medium sized fluvial flooding on the River Brent.

- Extreme Brent fluvial events are only influenced by the tide over the short length between the River Thames weir and the confluence.

- The relatively narrow channel on the River Brent upstream of the weir at the River Thames lock has a greater influence on flood risk than the tide.

169. The plan above indicates the extent of the River Thames tidal influence on the River Brent. Under ‘normal’ flow conditions on the River Brent, the tidal limit is at the weir upstream of Boston Manor Park. Under ‘extreme’ flows on the River Brent, the influence of the River Thames is reduced so that it extends only to the River Thames Lock at Brentford.
6.4 Planning & Development Control – London Borough of Hounslow

6.4.1 Planning Solutions to Flood Risk Management

The Sequential Test

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.

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. This is summarised in the flow chart below.

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Figure 3.1 (Application of the Sequential Test), A Practice Guide Companion to PPS25, Consultation Paper, February 2007
173. As indicated by the bottom right hand corner of the flow chart above, 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.

174. Wherever possible, 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 in Sections 6.4.2 to 6.4.6 below.

The Exception Test

175. It is recognised that only a relatively small proportion of the Borough of Hounslow is situated within Zone 3a High Probability. Prohibiting future residential development in these areas is unlikely to have a detrimental impact upon the economic and social welfare of the existing community, however there may be pressing planning ‘needs’ that may warrant further consideration of these areas. Should this be the case, 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 development land or if it is not on previously developed land, that there are no reasonable alternative sites on previously development 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.”

176. 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.

177. The SFRA has been developed to inform the Sequential Test (and, where necessary, the Exception Test) within the Borough. It will be the responsibility of the developer (in all instances within Zone 3a High Probability) to develop a detailed Flood Risk Assessment that can demonstrate that the Sequential Test has been applied, and (where appropriate) that the risk of flooding has been adequately addressed in accordance with PPS25.

178. The management of flood risk throughout the Borough must be assured should development be permitted to proceed, and the SFRA has provided specific recommendations that ultimately should be adopted as planning conditions 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.

179. Specific planning and development control recommendations for future development within the Borough are presented below. A ‘user guide’ to assist in the application of the SFRA recommendations is provided in Appendix A.
180. An overview of flood risk throughout the Borough has been provided in Section 6.5 and adjoining Figures 3.1 to 3.6. **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.** It is highlighted that PPS25 applies equally to both allocated sites identified within the emerging LDF and future windfall sites.

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

181. 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 Hounslow.

182. 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.

183. 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.

184. 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.

6.4.3 Future Development within Zone 3b Functional Floodplain (Undeveloped Areas)

**Planning Recommendations – Allocation of Land for Future Development**

Areas of Functional Floodplain that are currently undeveloped should be protected for flood storage purposes. Future development should be restricted to water-compatible uses and essential infrastructure that has to be there (in accordance with PPS25). Careful consideration should be given to the Council’s emergency response in times of flood to ensure that public safety is not compromised.

**Development Control Recommendations – Minimum Requirements**

Future development, with the exception of water compatible uses and essential infrastructure, should not be permitted. The frequency and severity of flooding within these areas are such that no engineered mitigation measures could be implemented to safely and effectively minimise the risk to life and property over the lifetime of the development.

It is important to recognise that, in accordance with PPS25, the Exception Test must be satisfied if essential infrastructure is proposed within Zone 3b Functional Floodplain. This will require the submission of a detailed Flood Risk Assessment in accordance with Section 6.6.1 below.
6.4.4 Future Development within Zone 3b Functional Floodplain (Developed Areas)

It is important to recognise that, within Zone 3b Functional Floodplain, ‘previously developed land’ relates solely to existing buildings that are impermeable to flood water. The land surrounding these buildings are important flow paths and/or flood storage areas that must be retained.

Planning Recommendations – Allocation of Land for Future Development

1. Zone 3b is subject to relatively frequent inundation. There is an aspiration within this zone to reduce the risk posed to life and property, and it is essential therefore that future land uses contribute to achieving this reduction in risk. The intensification of development must be avoided, and permitted land uses should reduce the vulnerability to flooding (in accordance with PPS25 vulnerability categorisations), for example replacing existing residential development (‘more’ vulnerable) with commercial development (‘less’ vulnerable).

2. In all instances, it will be necessary to ensure that the requirements of the Exception Test are satisfied. In planning terms, it must be demonstrated that “the development provides wider sustainability benefits to the community that outweigh flood risk”. It should be recognised that property situated within Zone 3b Functional Floodplain 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.

3. There should be a presumption against all building extensions (including out-buildings) within Zone 3b Functional Floodplain.

4. To satisfy the remaining criteria of the Exception Test, all development within Zone 3b Functional Floodplain (existing developed areas only) should be conditioned in accordance with the development control recommendations below.

Development Control Recommendations – Minimum Requirements

1. A positive reduction in the risk of flooding within the Borough should be demonstrated as an outcome of the proposed development. This may be achieved through, for example, a reduction in the building footprint area, and/or the realignment of buildings within the site to reduce constrictions to overland flow paths. This is discussed further in Section 6.4.2;18.

2. All proposed future development within Zone 3b Functional Floodplain will require a detailed Flood Risk Assessment (FRA), in accordance with the risk-based approach outlined in Section 6.6 below;

3. Floor levels must be situated above the 1% (100 year) predicted maximum flood level plus climate change, incorporating an allowance for freeboard;

4. Basements are not permitted within Zone 3b Functional Floodplain;

5. 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;

6. 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 D. 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;

7. 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 and/or compensatory flood storage is provided within the site (or upstream)19;

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18 Refer also Section C of D9 (PPS25)
19 Compensatory flood storage must be provided on a ‘level for level’ basis (i.e. the loss of available storage volume at each incremental height above
8. A minimum 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. The minimum buffer width is 8m, however this may be increased to 16m in areas adjoining tidally influenced rivers, and therefore consultation with the Environment Agency is required at an early stage.

6.4.5 Future Development within Zone 3a High Probability

Defended Areas within Zone 3a High Probability

A relatively large proportion of the London Borough of Hounslow is situated within Zone 3a High Probability, indicating a potential risk of fluvial and tidal flooding. It is important to recognise however that a considerable number of properties are offered a degree of protection against flooding through the provision of raised defences. Whilst it is recognised that there is a government led commitment to the retention of this system of defences, the statutory responsibility for flood defence remains with the individual landowner. For this reason, all future development must assess (and mitigate) the residual risk of flooding should the defences fail and/or fall into disrepair in future years.

The assessment of flood hazard (refer Section 5.3) has identified areas within which there may be a risk to life should these raised defences fail in a catastrophic manner (i.e. the Rapid Inundation Zone). Where possible, future development should be avoided in these areas. For all areas of Zone 3a High Probability situated behind the River Thames defences, a suite of specific development control recommendations have been provided, as detailed below.

Planning Recommendations – Allocation of Land for Future Development

1. Future development within Zone 3a High Probability should be restricted to ‘less vulnerable’ land uses, in accordance with PPS25 (Appendix D) Table D2. ‘More vulnerable’ land uses, including residential development, should be steered towards zones of lower flood risk (i.e. Zone 2 Medium Probability or Zone 1 Low Probability) within which suitable land may be available in adjoining character areas.

2. Where non-flood risk related planning matters dictate that ‘more vulnerable’ (residential) development should be considered further, it will be necessary to ensure that the requirements of the Exception Test are satisfied. In planning terms, it must be demonstrated that “the development provides wider sustainability benefits to the community that outweigh flood risk”, and that “the development is on developable previously developed land, or that there are no reasonable alternative sites on previously developed land”.

3. To satisfy the remaining criteria of the Exception Test, all development within Zone 3a High Probability should be conditioned in accordance with the development control recommendations below

Development Control Recommendations – Minimum Requirements (Undefended Areas)

1. A positive reduction in the risk of flooding within the Borough should be demonstrated as an outcome of the proposed development. This may be achieved through, for example, a reduction in the building footprint area, and/or the realignment of buildings within the site to reduce constrictions to overland flow paths. This is discussed further in Section 6.4.2\(^{20}\).

2. All proposed future development within Zone 3a High Probability will require a detailed Flood Risk Assessment (FRA);

3. Floor levels must be situated above the 1% (100 year) predicted maximum flood level plus climate change, incorporating an allowance for freeboard;

4. 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 D. 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;

river level must be replaced at an equivalent elevation), and must be hydraulically linked to the floodplain so that floodwaters can recede naturally. The
\(^{20}\) Refer also Section C of D9 (PPS25)
5. Basements are not to be utilised for habitable purposes. All basements must provide a safe evacuation route in time of flood, providing an access point that is situated above the 1% (100 year) peak design plus climate change flood level;

6. 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;

7. 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 and/or compensatory flood storage is provided within the site (or upstream)\(^{21}\);

8. A minimum 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. The minimum buffer width is 8m, however this may be increased to 16m in areas adjoining tidally influenced rivers, and therefore consultation with the Environment Agency is required at an early stage.

Development Control Recommendations – Minimum Requirements (Defended Areas)

1. A positive reduction in the risk of flooding within the Borough should be demonstrated as an outcome of the proposed development. This may be achieved through, for example, a reduction in the building footprint area, and/or the realignment of buildings within the site to reduce constrictions to overland flow paths. This is discussed further in Section 6.4.2\(^{22}\);

2. All proposed future development within Zone 3a High Probability will require a detailed Flood Risk Assessment (FRA);

3. Floor levels must be situated above the 1% (100 year) maximum flood level plus climate change, incorporating an allowance for freeboard, calculated assuming a breach failure of the River Thames flood defences;

4. 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 D. 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;

5. 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;

6. 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 and/or compensatory flood storage is provided within the site (or upstream);

7. A minimum 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. The minimum buffer width is 8m, however this may be increased to 16m in areas adjoining tidally influenced rivers, and therefore consultation with the Environment Agency is required at an early stage.

6.4.6 Future Development within Zone 2 Medium Probability

Planning Recommendations – Allocation of Land for Future Development

1. In accordance with PPS25, land use within Zone 2 Medium Probability should be limited to the ‘water-compatible’, ‘less vulnerable’ and ‘more vulnerable’ category (including residential development), or essential infrastructure, to satisfy the requirements of the Sequential Test.

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\(^{21}\) Compensatory flood storage must be provided on a ‘level for level’ basis (i.e. the loss of available storage volume at each incremental height above river level must be replaced at an equivalent elevation), and must be hydraulically linked to the floodplain so that floodwaters can recede naturally. The Environment Agency can provide further advice in this regard

\(^{22}\) Refer also Section C of D9 (PPS25)
2. Where non-flood risk related planning matters dictate that ‘highly vulnerable’ development should be considered further, it will be necessary to ensure that the requirements of the Exception Test are satisfied. In planning terms, it must be demonstrated that “the development provides wider sustainability benefits to the community that outweigh flood risk”, and that “the development is on developable previously developed land, or that there are no reasonable alternative sites on previously developed land”.

3. To satisfy the remaining criteria of the Exception Test, all development within Zone 2 Medium Probability should be conditioned in accordance with the development control recommendations below.

Development Control Recommendations – Minimum Requirements

1. A positive reduction in the risk of flooding within the Borough should be demonstrated as an outcome of the proposed development. This may be achieved through, for example, a reduction in the building footprint area, and/or the realignment of buildings within the site to reduce constrictions to overland flow paths. This is discussed further in Section 6.4.2.

2. All proposed future development within Zone 2 Medium Probability will require a Flood Risk Assessment (FRA) that is commensurate with the risk posed to the proposed development;

3. Floor levels must be situated above the 1% (100 year) predicted maximum flood level (or the 0.5% (200 year) tidal flood level, whichever is greater) plus climate change, incorporating an allowance for freeboard;

4. 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 D. 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;

5. 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)

6.4.7 Future Development within Zone 1 Low Probability

Planning Recommendations – Allocation of Land for Future Development

There are generally no flood risk related constraints placed upon future development within Zone 1 Low Probability (in accordance with PPS25), however it is important to recognise that future development within this zone may adversely impact upon the existing flooding regime if not carefully managed. Flooding related issues of a localised nature may also occur within Zone 1 Low Probability. For this reason, all development should be carried out in accordance with the development control recommendation below. Within ‘dry island’ areas that are surrounded by a degree of flood risk, effective emergency planning measures should be in place to ensure that the risk to life is minimised in case of flooding.

Development Control Recommendations – Minimum Requirements

A Surface Water Flood Risk Assessment will be required for all sites greater than 1ha in size, in compliance with PPS25 and current guidance and policy. This will involve the introduction of SUDS techniques 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.

It is necessary to ensure that future development within Zone 1 is aligned in such a way to ensure that buildings do not interfere with existing overland flow routes (refer Figure 4).
6.5 Overview of Flood Risk - Character Areas

185. To provide meaningful recommendations, and for ease of reference, the flood risk within the Borough has been considered on the basis of ‘Character Areas’. These character areas have been delineated largely on the basis of geographical location, and within the SFRA incorporate only those areas in which there is a risk of flooding.

6.5.1 Character Area H1 – Chiswick (Figure 3.1)

Assessment of Flood Risk

The majority of the Chiswick Area is situated within Zone 3a High Probability, affected by flooding from the River Thames. A number of localised ‘high points’ within the floodplain are delineated as Zone 2 Medium Probability. A significant proportion of the Character Area H1 would be affected if the River Thames flood defences fail or are overtopped.

The town of Chiswick is a successful major shopping centre situated partially within Zone 3b Functional Floodplain. This represents a major concern with respect to public safety.

The remainder of the character area is situated within Zone 1 Low Probability.

Overview of Development Pressure

Area H1 is under great pressure for further development since the successful shopping centre is already threatened by competition and additional non-retail uses.

6.5.2 Character Area H2 – Isleworth & Brentford (Figures 3.2 to 3.4)

Assessment of Flood Risk

Part of this area is within Zone 3a High Probability, at risk of flooding from the River Thames and the River Brent. Some of these areas are also within 500m of the flood defence line and could be affected if the River Thames or the River Brent flood defences fail or are overtopped.

There are localised areas of Zone 3b Functional Floodplain along the River Brent corridor, although primarily in uninhabited areas.

There is a stretch of Zone 2 Medium Probability that is primarily as a result of flooding from the Duke of Northumberland River. The remainder of the Character Area H2 is within Zone 1 Low Probability.

Overview of Development Pressure

Due to the social condition of the Character Area H2, pressure for further development is substantial. Regeneration will result in economic enhancement not only to the Borough, but to the wider region.

The Isleworth and Brentford area experiences social problems, with high unemployment, low incomes and has particular community needs. The development plan in this area is tailored to tackle these problems and to achieve the objectives of the regeneration strategy.
6.5.3 Character Area H3 – Central Hounslow (Figure 3)

Assessment of Flood Risk

Character Area H3 is situated between the River Crane and the Duke of Northumberland. The area bounding the River Crane is within Zone 3a High Probability and Zone 2 Medium Probability. The Duke of Northumberland River does place some areas in the eastern perimeter within Zone 2 Medium Probability.

Overview of Development Pressure

Hounslow is one of London’s 10 Metropolitan Centres and covers a high quality shopping centre with good public transportation links. However, it lacks leisure facilities and development is essential for the continuity of its success.

6.5.4 Character Area H4 – Heston & Cranford (Figure 3.5)

Assessment of Flood Risk

Character Area H4 is situated in the north of the Borough with the River Crane as the western boundary. There are properties on the western extremity of Cranford that are within Zone 3b Functional Floodplain. There are also areas of Zone 3a High Probability and Zone 2 Medium Probability.

Overview of Development Pressures

A large proportion of the Character Area H4 falls within the designated Green Belt and there is no pressure for further development in this area within current planning horizons. Some areas may be developed in future years to meet the growing demand for developable land within the broader Borough.

6.5.5 Character Area H5 – West Area (Figure 3.6)

Assessment of Flood Risk

Character Area H5 is located to the west of the River Crane which is the primary source of flood risk. There are areas close to the River Crane within Zone 3b Functional Floodplain, although principally in undeveloped areas. Associated with these are areas of Zone 3a High Probability or Zone 2 Medium Probability derived from the River Crane. The remaining area is Zone 1 Low Probability.

Overview of Development Pressures

Feltham town centre is a mixed area with many prosperous parts, but also deprivation. The area is in desperate need of new investment in order to improve its image, environment, access and the quality of life for local residents.

6.5.6 Brentford Area Action Plan (BAAP)

186. A more detailed assessment of flood risk of potential development sites in the BAAP (February 2007) has been undertaken, presented in Figure 9 and adjoining Appendix B. The risk of flooding posed to (and by) the proposed development, should it be allocated, has been considered. Where possible at this stage, a cross check has been carried out between the proposed land use, and the vulnerability criteria provided by PPS25. This provides an indication of whether or not the Sequential Test must be applied to demonstrate the planning ‘need’ for a proposed site allocation.
187. An assessment of effective flood mitigation measures that will address the risk of flooding in a safe and sustainable manner throughout the lifetime of the development have been identified, to satisfy point (c) of the Exception Test.

6.5.7 Remaining Areas of the Borough

188. 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.

189. There are no specific flood risk related constraints placed upon future development within Zone 1 Low Probability (in accordance with PPS25), however a Surface Water Flood Risk Assessment will be required 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

190. As highlighted in Section 2, the SFRA is a strategic document that provides an overview of flood risk throughout the area. Once the Sequential Test has been applied in accordance with Section 6.1 above 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 for all proposed developments. This should be submitted as an integral part of the planning application.

191. 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 Character Area discussions above 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.

192. Proposed Development within Zone 3a High Probability & 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), 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 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 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.

A demonstration that residual risks of flooding (after existing and proposed flood management and mitigation measures are taken into account) are acceptable. Measures may include flood defences, flood resistant and resilient design, escape/evacuation, effective flood warning and emergency planning.

Details of existing site levels, proposed site levels and proposed ground floor levels. All levels should be stated relevant to Ordnance Datum

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;

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.

It is reiterated that a proportion of the London Borough of Hounslow is delineated as Zone 3a High Probability, however the presence of raised defences provides a degree of protection against flooding. It is broadly accepted that these defences reduce the actual risk to properties within lower lying areas of the district, however recent history has demonstrated the potentially catastrophic consequence of a breach failure, often resulting in widespread flooding.

It is essential that developers situated within close proximity of a raised flood defence thoroughly review the existing and future structural integrity of the defences (i.e. over the lifetime of the development), and ensure that emergency planning measures are in place to minimise risk to life in the unlikely event of a defence failure.

193. Proposed Development within Zone 2 Medium Probability

For all sites within Zone 2 Medium Probability, a high level FRA 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.

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;

194. Proposed Development within Zone 2 Medium Probability and Zone 1 Low Probability

For all sites greater than 1ha in area, a Surface Water 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.

The specific requirement for a detailed analysis of defence failure to be carried out should be determined in conjunction with the Council and the Environment Agency at the FRA scoping stage. It is recommended that all proposed developments situated within 1000m of the defence line confirm the need (or otherwise) to carry out this assessment prior to commencement.
195. The SFRA provides specific recommendations with respect to the provision of sustainable flood risk mitigation opportunities that will address both the risk to life and the residual risk of flooding to development within particular ‘zones’ of the area. These recommendations should form the basis for the site-based FRA.

6.6.2 Raised Floor Levels & Basements (Freeboard)

196. 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.

197. Wherever possible, 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.

198. 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.

6.6.3 Sustainable Drainage Systems (SUDS)

199. 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.

200. SUDS may improve the sustainable management of water for a site by25:

- 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.

201. 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 of a number of sites could be significant.

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25 Interim Code of Practice for Sustainable Drainage Systems National SUDS Working Group, 2004
202. 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 table\textsuperscript{26}. 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). Careful consideration of the site characteristics must be assured to ensure the future sustainability of the adopted drainage system.

<table>
<thead>
<tr>
<th>Pervious surfaces</th>
<th>Surfaces that allow inflow of rainwater into the underlying construction or soil.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green roofs</td>
<td>Vegetated roofs that reduce the volume and rate of runoff and remove pollution.</td>
</tr>
<tr>
<td>Filter drain</td>
<td>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.</td>
</tr>
<tr>
<td>Filter strips</td>
<td>Vegetated areas of gently sloping ground designed to drain water evenly off impermeable areas and to filter out silt and other particulates.</td>
</tr>
<tr>
<td>Swales</td>
<td>Shallow vegetated channels that conduct and retain water, and may also permit infiltration; the vegetation filters particulate matter.</td>
</tr>
<tr>
<td>Basins, Ponds and Wetlands</td>
<td>Areas that may be utilised for surface runoff storage.</td>
</tr>
<tr>
<td>Infiltration Devices</td>
<td>Sub-surface structures to promote the infiltration of surface water to ground. They can be trenches, basins or soakaways.</td>
</tr>
<tr>
<td>Bioretention areas</td>
<td>Vegetated areas designed to collect and treat water before discharge via a piped system or infiltration to the ground</td>
</tr>
</tbody>
</table>

203. 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
- www.ciria.org.uk/SUDS/

\textsuperscript{26} Interim Code of Practice for Sustainable Drainage Systems National SUDS Working Group, 2004
204. Furthermore, the Environment Agency (Thames Region) has issued best practice guidance for Sustainable Drainage Systems (October 2006), available from the Environment Agency development control teams. This provides a clear hierarchy for SUDS, reflecting the degree of sustainability offered by the SUDS application as captured in the table below.

<table>
<thead>
<tr>
<th>SUDS technique</th>
<th>Flood Reduction</th>
<th>Water Quality Improvement</th>
<th>Landscape &amp; Wildlife Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living roofs</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Basins and ponds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Constructed wetlands</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>- Balancing ponds</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>- Detention basins</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>- Retention ponds</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Filter strips and swales</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Infiltration devices</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>- soakaways</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>- infiltration trenches and basins</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Permeable surfaces and filter drains</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>- gravelled areas</td>
<td></td>
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6.7 Local Community Actions to Reduce Flood Damage

205. It is estimated that several hundred homes 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.

206. 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.

6.7.1 Flood Proofing

207. 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.
6.8 Emergency Planning

208. 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 are27:

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

209. The SFRA provides a concise summary of the possible sources of flooding within the Borough, and may be used to inform the assessment of flood risk in response to the requirements of the Act.

210. The Environment Agency monitors river levels within the main rivers affecting the Borough. Based upon weather predictions provided by The Met Office, 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 areas28, 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. Within the Brent catchment, the onset of flooding can be very rapid with little warning, for most less than 3 hours. However, as Hounslow is situated in the lower reach of the catchment, then the warning should be longer. Flood Warning and the Automated Voice Messaging Service is being reviewed as part of the Brent FRM Strategy.

211. As water levels rise and begin to pose a risk to life and/or livelihood, it is the responsibility of the Council to coordinate the evacuation of residents. This evacuation will be supported and facilitated by the emergency services. 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.

212. Figure 4 shows the natural route that surface water will take across Borough, the changes in gradient and low lying areas 0.5m below the surrounding land within a given contour. Emergency Planners can use this map to identify where surface water flooding may flow or pond in events where the surface water drainage system is exceeded. The changes in gradient can indicate where the drainage system is expected to surcharge and cause surface water flooding. The low-lying areas may represent a hazard where flood water draining from the surrounding area may drain at depth and high velocity. Figure 8 depicts the locations of vulnerable sites and emergency services.

27 Civil Contingencies Act 2004
28 Restricted to those urban areas situated within Environment Agency flood warning zones
213. Coordination with the emergency services and the Environment Agency is imperative to ensure the safety of residents in time of flood. Areas within the Borough that are at risk of river flooding (as indicated by the shaded PPS25 flood risk zones in the adjoining maps) are typically susceptible to relatively long duration rainfall events, and considerable forewarning will generally be provided to encourage preparation in an effort to minimise property damage and risk to life.

214. In contrast, 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 district 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.

215. 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.

216. It is recommended that the Council’s Emergency Response Plan is reviewed in light of the findings and recommendations of the SFRA to ensure that safe access can be provided during a major flooding event.

6.9 Insurance

217. 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.

218. The precise outcome of this review remains somewhat unclear. However it is broadly understood that those property owners who are situated above the 1.33% AEP (75 year) flood level will be able to secure insurance policies that will protect them against damages sustained in case of flooding.

219. There is a lack of clarity where properties are situated below this level, though it is understood that property owners will generally be protected against damages caused by a failure of the urban drainage system (i.e. drainage and/or sewer flooding). Insurance against river flooding may be provided in some areas, however premiums are likely to be considerable. Further information in this respect is available from the Association of British Insurers (ABI).

29 That is, the event that has a 1.33% probability of occurring in any one year. In other words, the event that will occur on average (or be exceeded) once every 75 years.
7 Conclusion & Recommendations

220. A number of properties within the Borough of Hounslow are 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 and sewer flooding.

221. 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.

222. 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 urban centres within the Borough (refer Section 6.5).

223. 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 meet the Exception Test. These should be applied as development control conditions for all future development (refer Section 6.5).

224. Council policy is essential to ensure that the recommended development control conditions 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 supplementary planning guidance is developed to build upon emerging Council policy, in light of the suggested development control conditions presented by the Hounslow Borough SFRA (refer Section 6.5).

225. Emergency planning is imperative to minimise the risk to life posed by flooding within the Borough. It is recommended that the Council review their adopted flood risk response plan in light of the findings and recommendations of the SFRA.

226. The core data used to underpin the development of the SFRA will be superseded over time as the Environment Agency provides further investment in detailed modelling of the River Thames and its tributaries, reviewing its Flood Zone Maps on a quarterly basis. It is recommended that the Environment Agency Flood Zone Maps are retained as the ‘first pass’ filter at the development application stage, triggering (or otherwise) the need for a more detailed site-based investigation.

227. The SFRA should be retained as a ‘living’ document, reviewed on a regular basis in light of better flood risk information and emerging policy guidance.
APPENDIX A

Hounslow Borough SFRA
User Guide
APPENDIX B

Review of PPS25 Constraints
Brentford Area Action Plan (BAAP)
Overview

In accordance with PPS25, it is necessary for a local authority to adopt a sequential approach when allocating sites for future development. This is outlined in Section 6.4.1 of the SFRA, however in simple terms it must be demonstrated 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.

The SFRA does not endeavour to address this aspect of the Sequential Test. It can however review emerging allocations, and in light of the delineated PPS25 flood zones, provide clear recommendations for permissible land uses (as defined by PPS25).

The Adopted Approach

A review of emerging proposal sites has been undertaken as part of the SFRA process. Emerging sites as identified by the Council (Brentford Area Action Plan (BAAP) June 2007 – refer Figure 9) were overlaid onto the adopted PPS25 flood zones. The attached table, and summary sheets for those sites affected by flooding, (M3, M8 and RR1) summarises:

- the locality of each nominated site;
- the flood zone within which that site falls; and
- the restrictions that flood risk places upon the future development of the site.

It is highlighted that the SFRA has been developed in parallel to the ‘live’ planning process. Therefore, at the time of writing, the Council was able to provide emerging decisions taken with respect to specific sites that will influence the status of the allocation (e.g. exclusion and/or land use change on flood risk grounds).

Interpretation of Proposal Sites Review (attached table)

The attached table has adopted a ‘traffic light’ system to mirror the decision matrix provided within PPS25 (Appendix D). The table should be interpreted in accordance with the following legend.

- Development type is permissible under PPS25. A site based FRA is required in accordance with Section 6.5 of the SFRA.
- Development type is permissible under PPS25, only if the Exception Test is passed. It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk. A site based FRA is required in accordance with Section 6.5 of the SFRA. All future development must be designed in accordance with the minimum requirements set out in Section 6.4 of the SFRA.
- Development type is not permitted by PPS25.

NOTE: Where a site is only partially affected by flooding, the ‘worst’ (most constrained) flood zone has been highlighted in the matrix. Future development should be restricted to the area within the site that is least affected by flooding.

It is highlighted that, in some instances, sites are only partially affected by flooding. In these instances, the ‘traffic lights’ within the attached matrix reflect the most significant risk of flooding within the site. At these locations, future development may be permitted to proceed, however this should be restricted to the lowest risk areas of the site if at all possible.
APPENDIX C

Thames CFMP
Key Messages – Lower Brent & Crane
(Environment Agency, January 2007)
Key characteristics of the Lower Brent
- The Brent is a fluvial river system until its confluence with the Thames at Brentford where there is a risk from tidal flooding or a combination of both tidal and fluvial flooding.
- Downstream of the A40 the Brent floodplain is wide with fewer properties at risk than in the area upstream.
- Multiple sources, climate change and growth pressure could all result in greater frequency and severity of flooding.
- Extensive developed floodplain, with commercial/industrial development alongside river corridor is prevalent in this catchment.
- Existing flood defences are maintained.

Key characteristics of the River Crane and Duke of Northumberland
- Highly developed floodplain, with development along the river corridor.
- Near Heathrow some natural floodplain and river corridor remains.
- River banks are fluvial and have been typically straightened and river bank erosion prevented through toe boarding.
- In the Lower Crane near its confluence with the Thames the river has become encased in concrete to convey flood waters faster. The Lower Crane is protected from tidal flooding by a gate system, there is a residual risk associated with this gate’s failure to operate.
- The Duke of Northumberland river is man made and is designed to convey a fixed flow. Due to climate change there may be a residual flood risk associated with this river.

Types of flood risk in the Lower Brent and Crane
- Overtopping of river banks and flood defences.
- Residual flood risk in tidal areas.
- Damage to flood defence walls.
- Overflow of surface water drains.
- Rapid surface water runoff from urban areas.
- In-channel blockages and constrictions.
- Possible Groundwater flood risk.

What is being done to manage flood risk at present in the Lower Brent and Crane
- We (the Environment Agency) currently manage the risk of fluvial flooding by transferring the water in modified channels and conveying it out of the catchment. More than 25% of the rivers are maintained for this purpose. The average residual life of our flood risk management assets in the Brent catchment is 11 to 20 years.
- The majority of the Crane catchment is undefended except in the Tidal section where a concrete lined channel, high flood defence walls and the Tidal gate provide some flood defence protection.

What can be done to manage flood risk in the future in the Lower Brent and Crane
The general approach across the Brent and Crane catchment needs a clear vision and bold decision making. We need to maximise the remaining life of the conveyance system. This will provide some management of the probability of fluvial events. During this time we need to reduce the consequences of flooding. This will involve a spectrum of activity, from spatial planning policies at a Borough level, through to flood resilience at the individual property level. The aim of this is to enable sustainable development throughout the catchment that is increasingly resilient to flooding, regardless of the water source.

The Environment Agency is not likely to be taking any action to further reduce the probability of flooding within the Lower Brent and Crane catchment in the foreseeable future. In the long-term the consequences of flooding can be reduced through the application of PPS25. We should focus on protecting what remains of the undeveloped floodplain from future development.
In order to manage flood risk in the future we would like the following issues identified in the SFRA, and would recommend that these issues are brought forward from the SFRA into the LDF as policies to influence/shape future development:

Seek risk reduction:
- Use the Sequential Test to locate new development in least risky areas, giving highest priority to Flood Zone 1.
- If an Sequential Test is undertaken and a site in a floodplain is identified as only site for development, after application of Exception Test use sequential approach to site design and seek opportunities to reduce risk (e.g. change to a less vulnerable land use, reduce footprint, replace existing building with a development on stilts, make space for water).
- Build resilience into a site’s design (e.g. flood-proofing, raised floor levels).
- Ensure that redevelopment behind defences reduces residual flood risk.
- Ensure development is ‘Safe’. For residential developments to be classed as ‘safe’ dry access without crossing through the floodplain will be required. The SFRA should define the meaning of ‘Safe’.

Riverside developments:
- Set development back from rivers, seeking an 8 metre wide undeveloped buffer strip in fluvial areas, and up to a 16 metre wide buffer strip in Tidal areas. This will make space for water and additional capacity to accommodate climate change.
- Look at opportunities for river restoration/enhancement as part of a development to make space for water and to reduce the legacy costs associated with the maintenance of hard engineering structure.
- Assess condition of existing assets (e.g. bridges, culverts, river walls) and renew so that its lifetime is commensurate with lifetime of the development. Enhancement opportunities should be sought when renewing assets e.g. deculverting, bioengineered river walls, raising bridge soffits to take into account climate change. More sustainable solutions to flood risk management will be easier and less costly to maintain and ultimately less expensive to replace.
- Presumption against further culverting and building over of culverts. All new developments with culverts running through their site should seek to deculvert rivers for flood risk management and conservation benefit.

Drainage:
- SUDS required on all new development.
- All sites greater than 1 ha in size require the following:
  - SUDS,
  - Greenfield discharge rates,
  - 1 in 100 year on-site attenuation taking into account climate change.
  - On land allocations in the SFRA space shall be set-aside for SUDS.

Flood Alleviation Schemes:
- Define the functional floodplain, protect Greenfield functional floodplain from future development. Develop appropriate flood risk management policies for the Brownfield functional floodplain, focusing on risk reduction.
- Remaining greenfield floodplain is our greatest flood risk management asset, protect remaining greenfield floodplain from future development.
- Identify sites where developer contributions could be used to fund future flood risk management schemes.
- Look at opportunities to make space for water to accommodate climate change.

Emergency planning:
- Use SFRA to inform emergency planning process.
- Use SFRA to educate local people to improve flood awareness.
Long-term planning:
A longer-term approach to managing flood risk in the Lower Brent is needed. Insufficient space is available for future flood alleviation schemes, to manage flood risk in the future long-term land use planning will need to consider the following:

- Undertake land swaps to remove vulnerable development from the floodplain and free up land for flood storage.
- Change the vulnerability classification of existing developments in areas at risk of flooding.
APPENDIX D

Safe Access & Egress Design Requirements
( Environment Agency, June 2007)
‘Safe’ access and egress is to be designed to meet the following strict criteria:

Developments within Zone 3a High Probability and Zone 2 Medium Probability, and are **NOT** offered protection from flood defences (refer Figure 5):

- Dry escape, above the 100 year flood level taking into account climate change, should be provided for all ‘more vulnerable’ (including residential) and ‘highly vulnerable’ development;
- ‘Safe’ should preferably be dry\(^{30}\) for all other uses such as educational establishments, hotels and ‘less vulnerable’ land use classifications.

Developments within Zone 3a High Probability and Zone 2 Medium Probability, and **ARE** offered protection from flood defences (refer Figure 5):

- ‘Safe’ access should preferably be dry\(^{23}\) for ‘highly vulnerable’ uses;
- ‘Safe’ access should incorporate the ability to escape to levels above the breach water level\(^{31}\).

**In all instances, it will be necessary to ensure that the Hounslow Borough Council Emergency Planning Team, and the emergency services (consulted via the Emergency Planning Team), accept the proposals.**

For **major ‘highly vulnerable’ development**, ‘safety’ will also need to be ensured through the development of a robust evacuation plan. This should clearly define routes to dry (i.e. ‘unflooded’) land. This may include routes through flood waters, providing the depth and speed of flow across the evacuation route are below the risk defined by the “some” threshold in ‘Flood Risk to People’ (Defra, FD2320)\(^{32}\).

For **infrastructure development**, ‘safety’ will also need to be ensured through the development of a robust evacuation plan. This should clearly define dry escape routes (above the 100 year plus climate change flood level) to dry (i.e. ‘unflooded’) land.

In exceptional circumstances, dry access (above the 100 year plus climate change flood level) for ‘more vulnerable’ and/or ‘highly vulnerable’ development may not be achievable. In these exceptional circumstances, liaison must be sought with the Environment Agency and the Hounslow Borough Council Emergency Planning Team to ensure that the safety of site tenants can be satisfactorily resolved.

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\(^{30}\) Above the 100 year, plus climate change, flood level  
\(^{31}\) Defined assuming the full hydrostatic loading of the flood defence upon collapse (as a worst case scenario)  
\(^{32}\) Refer Defra Research Paper FD2320 ‘Flood Risks to People’
FIGURES
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