

Spelthorne Borough Council Strategic Flood Risk Assessment (SFRA)

December 2006



Spelthorne Borough Council
Knowle Green
Staines
TW18 1XB

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EXECUTIVE SUMMARY

Introduction

1. The Borough of Spelthorne extends from Thames Water's Wraysbury Reservoir in the west to the Stain Hill Reservoirs in Sunbury to the east, while the River Thames forms its southern boundary. The Borough includes numerous watercourses including the Lower Colne system and the River Ash. Several other Thames Water water supply reservoirs are also located within Spelthorne. Its main towns are Staines, Stanwell, Ashford, Shepperton and Sunbury.
2. The Council is currently preparing a Local Development Framework (LDF) in accordance with the Planning and Compulsory Purchase Act 2004. The Spelthorne Borough Council Local Plan (adopted 2001) sets out the Council's current proposals for the development and use of land in the Borough. This will be replaced by the Local Development Framework. Much of the housing within the Borough was constructed during the inter war period, and therefore little regeneration of existing housing stock is anticipated. Some intensification of residential development is envisaged within the existing urban areas, however additional employment and commercial development will be largely focussed in and around Staines.
3. The River Thames and its tributaries is a dominant feature of the Borough of Spelthorne. A significant amount of existing development is situated adjacent to, or near, the river and/or its tributaries. Flooding from the River Thames has occurred a number of times within the last 100 years, most recently in 2003 in which many homes and businesses were affected. It is estimated that over 5,500 properties are at 'significant' risk of flooding within the Borough, encompassing almost 20% of the existing urbanised area.

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, where possible steering it away from areas that are most at risk from flooding, and ensuring that it does not exacerbate existing known flooding problems.
5. Draft *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 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 forward planning and development control decisions are made.
7. PPS25 was released for consultation by the Department of Community and Local Government (DCLG) in December 2005. PPS25, though in draft form, is used by the Environment Agency in conjunction with the earlier Planning Policy Guidance (PPG) 25, as the basis for guiding planning decisions within flood affected areas. The final release of PPS25 is currently planned for January 2007.

What is a Strategic Flood Risk Assessment (SFRA)?

8. The Spelthorne Borough Council Strategic Flood Risk Assessment (SFRA) has been carried out to meet the following key objectives:
- To collate all known sources of flooding, including river, surface water (local drainage), sewers and groundwater, that may affect existing and/or future development within the Borough;
 - To delineate areas of 'low', 'medium' and 'high' flood risk within the Borough, in accordance with Planning Policy Statement 25 (PPS25), and to map these:
 - Areas of 'high' flood risk are assessed as having a 1 in 100 or greater chance of river flooding (>1%) in any year, and are referred to as High Probability Zone 3;
 - Areas of 'medium' flood risk are assessed as having between a 1 in 100 and 1 in 1000 chance of river flooding (1% to 0.1%) in any year, and are referred to as Medium Probability Zone 2;
 - Areas of 'low' flood risk are assessed as having a less than 1 in 1000 chance of flooding (<0.1%) in any year, and are referred to as Low Probability Zone 1.
 - Within flood affected areas, recommend appropriate land uses (in accordance with the PPS25 *Sequential Test*) that will not unduly place people or property at risk of flooding.
9. 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

10. The primary objective of PPS25 is to steer vulnerable development towards areas of lowest flood risk. The Sequential Test provides clear guidance as to how this should be achieved. In simple terms, the Sequential Test requires that the district is delineated into areas of 'low', 'medium' and 'high' risk (as outlined above). It then provides a list of suitable types of land use that should be permitted within each zone, depending upon the perceived vulnerability of the community that will be present day to day within that development.

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.
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. The Exception Test requires that:

- *“The development makes a positive contribution to sustainable communities, and to sustainable development objectives;*
- *The development is on developable brownfield land or where there are no reasonable alternative options on developable brownfield land;*
- *A flood risk assessment demonstrates that the residual risks of flooding to people and property (including the likely affects of climate change) are acceptable and can be satisfactorily managed; and*
- *The development makes a positive contribution to reducing or managing flood risk.”*

Outcomes of the Spelthorne Borough SFRA

14. The Borough of Spelthorne has been delineated into zones of low, medium and high flood risk, based upon existing available information provided by the Environment Agency. Detailed flood risk mapping has been made available for the River Thames, the River Ash and the River Colne. The EA Flood Maps (September 2006) have been adopted as the basis for the SFRA for other watercourses.
15. Many of the key population centres within the Borough are situated close to the River Thames or in its extensive floodplain, and not surprisingly a considerable proportion of the Borough is affected by flooding. Indeed it is estimated that some 5,500 properties are at ‘significant’ risk of flooding (i.e. at risk of flooding on average once in every 100 years). Investment has been made over the past 50-70 years in an endeavour to reduce the risk of flooding, improving the standard of protection provided to properties within the Borough. A considerable proportion of the Borough remains at risk of flooding however. It is estimated that approximately 14%¹ of the urbanised area of the Borough is situated within the 1% (100 year) flood extent. Almost 50% of the urbanised area of the Borough will be affected by the 0.1% (1000 year) flood, which closely mirrors the 1% (100 year) flood in 2056 (i.e. incorporating the anticipated impacts of climate change).
16. Areas of ‘functional floodplain’ (i.e. Functional Floodplain Zone 3b) have been identified. These areas are generally open space areas that flood relatively frequently, and are subject to fast flowing and/or deep water. Development should not be permitted within these areas.
17. Areas subject to flooding up to (and including) once in every 100 years on average (i.e. High Probability Zone 3a) have been identified. Residential development should be avoided in these areas wherever possible.

The SFRA has outlined specific development control conditions that should be placed upon development within High Probability Zone 3a to minimise both the damage to property, and the risk to life in case of flooding. 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.

18. 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. Medium Probability Zone 2) have been identified. Essential community services, including hospitals and 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).

¹ This figure excludes urban areas that are situated on ‘dry islands’ within the flood affected area. These areas will be isolated during periods of flooding, and therefore should also be considered as being at risk.

19. There are no restrictions placed on development within Low Probability Zone 1 (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 further downstream. It is necessary therefore to ensure that developers carry out a Drainage Impact 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.

The Way Forward

20. A considerable proportion of the Borough of Spelthorne is at risk of flooding. The risk of flooding posed to properties within the Borough arises from a number of sources including river flooding, surface water flooding and groundwater flooding.
21. A spatial planning solution to flood risk management should be sought wherever possible. It is necessary for the Council to consider not only how to steer vulnerable development away from areas affected by flooding in accordance with the PPS25 Sequential Test, but also how it will reflect other relevant strategies and studies in seeking to reduce flooding to those already at risk within the Borough. Specific planning recommendations have been provided.
22. Where other planning considerations must guide the allocation of sites and the Sequential Test cannot be satisfied, specific recommendations have been provided to assist the Council and developers to meet the Exception Test.
23. Effective development control policy is essential to assist the Council to manage flood risk, and to ensure a consistent approach 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 a supporting Supplementary Planning Document (SPD) is developed in light of the Spelthorne Borough SFRA, providing a full explanation of Council and Environment Agency requirements for development within flood affected areas.
24. 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

25. The Spelthorne Borough SFRA has been developed in accordance with draft PPS25. The policy guidance is in draft form at the time of writing, and revisions are due to be released in January 2007. Discussions with the Environment Agency and DCLG suggest that the revisions will not markedly influence the outcomes of the current study. However, a cursory review of the SFRA should be carried out on the release of PPS25 and/or any other supporting documentation. In particular, attention should be given to any potential changes in definitions and interpretations. It is strongly recommended that such changes be addressed in the Council's proposed SFRA Part II document.
26. Furthermore, 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 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 over time, and may marginally alter predicted flood extents within the Borough. This may therefore influence future development control decisions within these areas.

27. 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.

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Glossary

AEP	Annual Exceedance Probability e.g. 1% AEP is equivalent to 1% probability of occurring in any one year (or, on average, once in every 100 years)
Core Strategy	The Development Plan Document within the Council's Local Development Framework which sets the long-term vision and objectives for the area. It contains a set of strategic policies that are required to deliver the vision including the broad approach to development.
DCLG	Department of Community and Local Government
Defra	Department of Environment, Food and Rural Affairs
Development	The carrying out of building, engineering, mining or other operations, in, on, over or under land, or the making of any material change in the use of a building or other land.
Development Plan Document (DPD)	A spatial planning document within the Council's Local Development Framework which set out policies for development and the use of land. Together with the Regional Spatial Strategy they form the development plan for the area. They are subject to independent examination.
DPD	Development Planning Document
EA	Environment Agency
Flood Map	Nationally consistent delineation of 'high' and 'medium' flood risk, published on a quarterly basis by the Environment Agency
Formal Flood Defence	A structure built and maintained specifically for flood defence purposes
Functional Floodplain	PPS25 Flood Zone, defined as areas at risk of flooding in the 5% AEP (20 year) design event
Habitable Room	A room used as living accommodation within a dwelling but excludes bathrooms, toilets, halls, landings or rooms that are only capable of being used for storage. All other rooms, such as kitchens, living rooms, bedrooms, utility rooms and studies are counted.
High Probability Zone 3a	PPS25 Flood Zone, defined as areas at risk of flooding in the 1% AEP (100 year) design event
Informal Flood Defence	A structure that provides a flood defence function, however has not been built and/or maintained for this purpose (e.g. boundary wall)
LiDAR	Light Detection and Ranging (LiDAR) is an airborne terrain mapping technique which uses a laser to measure the distance between the aircraft and the ground
Local Development Framework (LDF)	Consists of a number of documents which together form the spatial strategy for development and the use of land
Low Probability Zone 1	PPS25 Flood Zone, defined as areas outside of Medium Risk Zone 2

Medium Probability Zone 2	PPS25 Flood Zone, defined as areas at risk of flooding in events that are greater than the 1% AEP (100 year), and less than the 0.1% AEP (1000 year) design event
Planning Policy Guidance (PPG)	A series of notes issued by the Government, setting out policy guidance on different aspects of planning. They will be replaced by Planning Policy Statements.
Planning Policy Statement (PPS)	A series of statements issues by the Government, setting out policy guidance on different aspects of planning. They will replace Planning Policy Guidance Notes
PPG25	Planning Policy Guidance 25: Development and Flood Risk Office of the Deputy Prime Minister (ODPM), 2001
PPS25	Planning Policy Statement 25: Development and Flood Risk Department of Community & Local Government, Draft 2005
Previously Developed (Brownfield) Land	Land which is or was occupied by a building (excluding those used for agriculture and forestry). It also includes land within the curtilage of the building, for example a house and its garden would be considered to be previously developed land.
Residual Risk	A measure of the outstanding flood risks and uncertainties that have not been explicitly quantified and/or accounted for as part of the review process
SEA	Strategic Environmental Assessment
SuDS	Sustainable Drainage System
Supplementary Planning Document (SPD)	Provides supplementary guidance to policies and proposals contained within Development Plan Documents. They do not form part of the development plan, nor are they subject to independent examination.
Sustainability Appraisal (SA)	Appraisal of plans, strategies and proposals to test them against broad sustainability objectives.
Sustainable Development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (The World Commission on Environment and Development, 1987).

1 Introduction

1.1 Context and Purpose

1. Many of the major towns and villages within the Borough of Spelthorne are situated adjacent to rivers. It is estimated that over 5,500 properties are at 'significant' risk of flooding² within the Borough. Flooding represents a risk to both property and life. It is essential therefore that planning decisions about future policies and development proposals are informed, and take due consideration of flood risk.
2. From the outset, it is important to emphasise that the primary flooding event used as the 'threshold' for assessments under PPS25 occurs, on average, once every 100 years. That is to say, the SFRA (and indeed the planning process) must consider very seriously the risk posed to property and life in any areas of the Borough that are affected by flooding in any event up to (i.e. more frequently) and including the 100 year flood event.
3. The 1% (100 year) event has a 1% probability of happening in any one year. This is clearly a relatively rare event. The last such event within Spelthorne was in 1894, and no residents will have witnessed a flood of this magnitude locally. As a result, a degree of apathy towards the risk posed to the community by an event of this scale is inevitable. Many landowners and prospective developers will simply not be aware of the impact that such an event may have upon the Borough.
4. Draft Planning Policy Statement (PPS) 25: Development and Flood Risk requires that local planning authorities prepare a SFRA in consultation with the Environment Agency. The primary purpose of the SFRA is to determine the variations in flood risk across the Borough to inform and support the Council's revised flooding policies in its emerging Local Development Framework (LDF). Jacobs was commissioned by Spelthorne Borough Council in July 2006 to prepare a Strategic Flood Risk Assessment (SFRA).
5. Draft PPS25 was released for consultation in December 2005, replacing Planning Policy Guidance (PPG) 25. The Spelthorne SFRA has been developed in accordance with draft PPS25. It is anticipated that the policy statement will be issued in its final form in January 2007, and recent discussions with the Department of Community and Local Government (DCLG) have suggested that a change in the classification of land use vulnerability (Appendix D, Table D2) should be anticipated. It is important therefore that a cursory review of the SFRA be carried out on the release of PPS25 and/or any other supporting documentation. It is strongly recommended that all changes, including changes in definitions and interpretations, be addressed in the Council's proposed SFRA Part II document. Furthermore, the SFRA should be adopted as a 'living' document and should be reviewed regularly in light of emerging policy directives and an improved understanding of flood risk.
6. This SFRA for the Borough is being developed in tandem with the emerging development of the Council's Local Development Framework (LDF). This SFRA forms part of the Council's evidence base for its LDF. This SFRA will inform planning policy, the allocation of land for housing and employment, and development control decision making within the Borough, assisting the Council to reduce the risk of flooding.

² i.e. at risk of flooding, on average, once in every 100 years

7. It is important to recognise that the SFRA is a strategic investigation that is intended to provide an overview of flood risk throughout the Borough, providing the framework within which future planning decisions (including development applications) are to be reviewed. A detailed site based Flood Risk Assessment (FRA) will be required for all proposed developments within the district affected by flooding, and this must be carried out at the planning application stage and submitted with all relevant planning applications.
8. This report sets out our findings in relation to flood risk for the Borough. The SFRA builds heavily upon existing knowledge of flood risk within the Borough, sourced through consultation with the Environment Agency (EA), the Council and Thames Water.

1.2 Study Area

9. Spelthorne Borough is situated west of London just south of London Heathrow Airport. The Borough extends from Thames Water's Wraysbury Reservoir in the west to the Stain Hill Reservoirs in Sunbury to the east, while the River Thames forms its southern boundary. The Borough includes numerous watercourses including the Lower Colne system and the River Ash. Several other Thames Water water supply reservoirs are also located within Spelthorne. Its main towns are Staines, Stanwell, Ashford, Shepperton and Sunbury as indicated in Figure 1.1.
10. The earliest settlements within the Borough were situated on relatively high ground, and generally not susceptible to flooding. Urban expansion however, particularly during the inter war period, saw housing developments extending into adjacent lower lying areas. These 'newer' areas have experienced flooding, not primarily from the River Thames, but from surface water flooding and groundwater flooding. Flooding represents a risk to both property and life. It is essential therefore that planning decisions are informed, and take due consideration of the risk posed to (and by) future development by flooding.
11. Future development pressure within the Borough of Spelthorne is relatively limited. Approximately 65% of the Borough is situated within protected greenbelt areas. Within the urban centres, much of the housing was constructed in the inter war period, the population increasing from 26,964 in 1921 to 83,275 in 1961. Much of the existing housing stock is therefore in a relatively good condition, and the need for regeneration is limited. Some intensification of residential areas is anticipated to meet current regional housing targets for the Borough, focussing upon existing urban centres. Staines has been identified as the primary centre for future commercial development within the Borough, and little growth is proposed within Ashford, Sunbury and Shepperton.

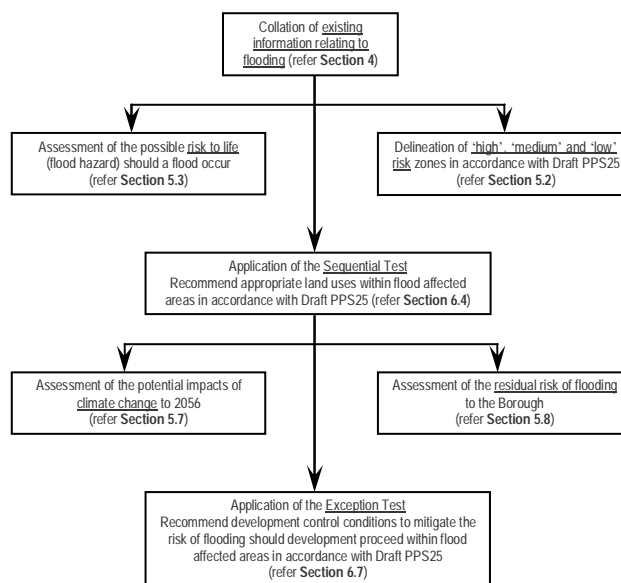
2 SFRA Approach

12. The primary objective of the Spelthorne 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:
 - Help to identify and implement strategic solutions to flood risk, providing the basis for possible future flood attenuation works;
 - 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;
 - Support and inform the Council's emergency planning response to flooding.

13. 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. Reference has also been made to emerging guidance provided by the Environment Agency in November 2006³.

14. 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 Spelthorne Borough SFRA has built heavily upon this existing knowledge, underpinning the delineation of the Borough into 'high', 'medium' and 'low' probability zones, in accordance with Draft 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.

15. A summary of the adopted SFRA process is provided in the diagram below, outlining the specific tasks undertaken and the corresponding structure of the SFRA report.



³ Strategic Flood Risk Assessments, Interim Guidance, Environment Agency Thames North East, Nov 2006

16. It is important to recognise that all of the rivers that affect the Borough of Spelthorne flow into, or from, adjoining authorities within the Thames Valley. Future development within the Borough, if not carefully managed, can influence the risk of flooding posed to residents within neighbouring areas. Conversely, careless planning decisions within adjacent districts can also impact adversely upon flooding within the Borough.

17. A number of authorities within the Thames Valley are carrying out similar strategic flood risk investigations at the current time. 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 adopted approach and decision making with respect to the effective management of flood risk throughout the Thames system 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

18. This section provides a brief overview of the strategy and policy context relevant to flood risk in the Borough of Spelthorne.
19. 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 to 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 Overview

20. National planning policy is set out through a number of Planning Policy Statements (PPSs) and Planning Policy Guidance Notes (PPGs). The Government is currently reviewing all PPGs with revised advice being set out in a PPS and, where necessary, accompanying best practice guidance.
21. PPSs and PPGs cover a full range of planning issues drawing on the central issue of sustainable development. Central themes include the re-use of previously developed land and the wish to steer inappropriate (or vulnerable) development away from areas at risk of flooding. It is a requirement that the LDF is consistent with Government planning policy.

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

22. Draft Planning Policy Statement 25 (PPS25) was released for consultation in December 2005, and underpins the process with which local planning authorities are to account for flood risk as an integral part of the planning process. The overarching principles set out by PPS25 for the management of flood risk at local planning authority level are broadly encapsulated in Paragraph 5 of the document:

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

- *identifying land at risk and the degree of risk of flooding from river, sea and other sources in their areas;*
- *preparing Regional or Strategic Flood Risk Assessments (RFRA/SFRAs) as appropriate, either as part of the Sustainability Appraisal of their plans or as a freestanding assessment that contributes to that Appraisal;*
- *framing policies for the location of development which avoid flood risk to people and property where possible and manage any residual risk, taking account of the impacts of climate change;*
- *reducing flood risk to and from new development through location, layout and design, including the application of a sustainable approach to drainage;*

- *using opportunities offered by new development to reduce flood risk to communities;*
 - *only permitting development in areas of flood risk when there are no suitable alternative sites in areas of lower flood risk and the benefits of the development outweigh the risks from flooding;*
 - *working effectively with the Environment Agency and other stakeholders to ensure that best use is made of their expertise and information so that decisions on planning applications can be delivered expeditiously; and*
 - *ensuring spatial planning supports flood risk management and emergency planning.”*
23. These broad planning objectives effectively set the scope for the specific outcomes of the SFRA process. The SFRA in turn then informs planning and development control decisions to ensure that the objectives set out above can be achieved.
24. The guidance in draft PPS25 also indicates that Sustainability Appraisals should be informed by the SFRA for their area. Under the Town and Country Planning (Local Development) (England) Regulations 2004, a Sustainability Appraisal (SA) is required for all Local Development Frameworks (LDFs). The purpose of SA is to promote sustainable development through better integration of sustainability considerations in the preparation and adoption of plans. The Regulations stipulate that SA of LDFs should meet the requirements of the SEA Directive.
25. It is important to reiterate that PPS25 is not applied in isolation as part of the planning process. The formulation of Council policy and the allocation of land for future development must also meet the requirements of other planning policy.
26. This may introduce some apparent conflict in national policy direction. For example, PPS6 (Town Centres) encourages future retail premises to be situated within existing centres. Staines town centre is economically the most sustainable location for further retailing. A large proportion of the commercial centre is situated within the 1% (100 year) flood extent however.
27. Clearly a careful balance must be sought in these instances, and the SFRA aims to assist in this process through the provision of a clear and robust evidence base upon which informed decisions can be made.

3.3 Regional Planning Policy

3.3.1 Regional Planning Guidance for the South East (RPG9)

28. Regional planning policies provide the overarching framework for the preparation of a LDF. Regional Planning Guidance for the South East (RPG9) covers the period up to 2016, and sets out the housing requirement for each county within the region.
29. RPG9 acknowledges that climate change is likely to exacerbate the risk of flooding. In relation to river floodplains, the guidance states that in the South East there are many areas, particularly close to the Thames, *“where there is already extensive building in the floodplains.”* In these areas, the guidance indicates that *“it is important that development... takes account of the risk of flooding and that undeveloped and undefended floodplains are protected from inappropriate development.”* Policy INF1 states that *“development should be guided away from areas at risk or likely to be at risk in future from flooding, or where it would increase the risk of flood damage elsewhere. Existing flood defences should be protected where they continue to be relevant.”*

3.3.2 The South East Plan

30. Under the Planning and Compulsory Purchase Act 2004, RPG9 is to be replaced by a new Regional Spatial Strategy, entitled the South East Plan. The South East Plan has been prepared by the South East England Regional Assembly (SEERA) and was submitted to the Government in July 2006. It sets out the vision for the region through to 2026. The examination into the South East Plan is expected to begin in November 2006, with the final plan published in 2008.
31. The South East Plan will set a new housing requirement for each district or Borough. The submitted South East Plan proposes that 3,020 net additional dwellings should be built in the Borough between 2006 and 2026. It is a requirement that the Core Strategy is in general conformity with regional planning policy.
32. Policy NRM3: Sustainable Flood Risk Management, indicates that the sequential approach to development in flood risk areas will be followed. In addition, the policy states that local authorities and developers, with advice from the Environment Agency, should undertake a Strategic Flood Risk Assessment. This should have regard to climate change.

3.4 Local Planning Policy

3.4.1 Spelthorne Borough Local Plan (Adopted 2001)

33. The Spelthorne Borough Local Plan was adopted in 2001 to set out the policies that are used to control future development in the Borough, reflecting national, regional and Structure Plan guidance. The Plan is committed to the principles of sustainable development. The Plan recognises that the implications of sustainability are far reaching, and that there is a limit on the ability of the environment to support human activity. The approach adopted however does not endeavour to call a halt to new development, but seeks to deal with development and change in a way which considers the long term sustainability of the Borough's environment.
34. The adopted Spelthorne Borough Local Plan makes specific reference to development within flood affected areas. Policy BE (Built Environment) 29 stipulates:

“Within the area liable to flood, development, including land raising, will not be permitted unless it can be demonstrated to the satisfaction of the Borough Council that the proposal would not of itself, or cumulatively in conjunction with other development:-

- (a) increase impedance to the flow of flood water, or*
- (b) reduce the site's contribution to the capacity of the flood plain to store water, or*
- (c) increase the number of people or properties at risk from significant adverse effects of flooding;*
- (d) obstruct land adjacent to water courses required for access and/or maintenance purposes;*
- (e) adversely affect flood defence structures or other features with the same role.*

Measures to mitigate any potential adverse effects of a development on the capacity of the flood plain should ideally enhance its capacity.”

3.4.2 Spelthorne Borough Local Development Framework (LDF)

35. Work has commenced on the preparation of the Local Development Framework, which will eventually replace the policies of the Local Plan (anticipated January 2008). The outcomes of the Spelthorne Borough SFRA will inform the development of policies relating to flooding for incorporation into the LDF.

4 Data Collection

4.1 Overview

36. A considerable amount of knowledge exists with respect to flood risk within the Borough of Spelthorne, 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 Map (September 2006);
 - Topography (LiDAR).
37. 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 the 'high', 'medium' and 'low' probability flood zones, 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 Map

38. 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 or AEP) chance of flooding from rivers 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.
39. 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 Spelthorne area is further discussed in Section 4.4. The Environment Agency's Flood Map provides a consistent picture of flood risk for England and Wales.
40. 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.
41. The Flood Map in the Borough of Spelthorne is provided in Figure 4.1, showing a considerable proportion of the area being at risk from river flooding. This is not surprising given the relatively low lying topography of much of the Borough, particularly adjoining the River Thames and its tributaries.

4.3 Historical Flooding

42. The Borough of Spelthorne has a history of flooding with major floods within the last century from the River Thames affecting homes and businesses in 1894, six times from 1900 to 1929, 1947, 1959, 1974, and most recently in 2003. Many residents will recall the more recent events, and therefore it may be helpful to put these floods into context in terms of their magnitude. An overview of flooding statistics within the River Thames (at Staines) is provided in the table below.

River Thames Flood Event	Approx Flood Magnitude	Approx River Thames Flow at Staines (m ³ /s)
November 1894	1 in 100	600
February 1900/04	1 in 20	445
January 1915	1 in 20	440
January 1925	1 in 17	425
January 1928	1 in 15	410
December 1929	1 in 18	430
March 1947	1 in 60	535
January 1959	1 in 6	360
November 1974	1 in 4	350
January 2003	1 in 14	390
For Comparison Purposes		
River Thames 'bank full' flow	-	250
River Thames 'dry weather' (i.e. average daily) flow	-	53
PPS25 'High Risk' Event	1 in 100	-
Association of British Insurers (ABI) 'Threshold' Event (refer Section 6.9)	1 in 75	-

43. It is important to remember however that flood risk within the Borough is not restricted solely to River Thames flooding however, and a number of properties have been affected historically as a result of localised runoff, groundwater flooding and/or failure of the underground sewer system.
44. Detailed discussions have been held with the Council to identify those areas within the Borough that are known to have been exposed to flooding. It is clear that, in some areas, the cause of flooding has been addressed through dedicated investment in improvement works. These improvement works include (for example) the Desborough Cut, a River Thames diversion channel constructed during the 1930s to increase the standard of protection provided to Shepperton.
45. Those areas known to have been susceptible to localised flooding in recent years have been highlighted in the adjoining flood risk maps. It is important to highlight these areas as part of the SFRA as a number of these properties are situated outside of the delineated flood risk zones. These are an important reminder that the risk of flooding is not restricted purely to fluvial (river) flooding. Development control decisions must 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

46. A number of detailed flooding investigations have been carried out by the Environment Agency for watercourses within the Spelthorne Borough. 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.
47. Detailed hydraulic modelling has been undertaken for the Lower Thames River from Hurley to Teddington, which includes levels and extents for the 5% (20 year), 1% (100 year) and 1 % (100 year) + 20% (i.e. climate change) flood events. One of the detailed hydraulic models developed for the Lower Thames River consists of a TuFlow (2D) hydraulic model representation between Windsor and Sunbury, which includes the Borough of Spelthorne. This model currently includes a representation of the lower reaches of the Lower Colne system, the River Ash and its offtake from the River Colne. A separate detailed ISIS (1D) hydraulic model also exists for the Lower Colne system.
48. It should be noted that the maps derived from water levels predicted using detailed hydraulic models are based on existing catchment conditions. 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), or the condition of the river channels and structures is allowed to deteriorate.
49. The maps derived from detailed hydraulic models are generally considered to be more refined and more accurate than the existing EA Flood Map. Detailed modelling is also able to provide flood extents for a range of flood events of varying magnitude (refer to Figure 4.2), highlighting those areas that are subject to more frequent flooding, and/or areas that may be at risk in future years due to the possible effects of climate change. For this reason, where available, the detailed modelling outputs have been used instead of the EA Flood Map for SFRA purposes.

4.5 Flood Defences

50. 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 is maintained by its respective owner, regardless of whether it is owned by the Environment Agency. An 'informal' flood defence is a structure that has often not been specifically built to retain floodwater, and is not maintained for this specific purpose. Boundary walls and industrial buildings situated immediately adjacent to rivers often act as informal flood defences.
51. Formal raised flood defences have been identified in consultation with the Environment Agency. The defences identified are located mainly on the lower reaches of the Lower Colne system, north of Staines. The main formal raised defences are as follows:
 - Raised banks along the Colne Brook – west of Wraysbury Reservoir;
 - Raised defence (referred to as Cambridge kennels defence) along the Wraysbury River;
 - Raised defences on the Wraysbury River between Pound Mill and Hale Street Bridge;
 - Raised defences along both sides of the Staines Bypass Channel linking the Wraysbury River with County Ditch/River Thames;
 - Raised defence south of the A30 along Thames Water aqueduct;

- Raised defences at the River Ash offtake from the River Colne;
 - Raised defences along the River Colne between the A30 and the railway line, through to the Two Rivers Retail Park.
52. Although these raised defences may be formally maintained, it is important to reiterate that the risk of flooding can never be fully removed. There will always be a residual risk of flooding, due to (for example) a more extreme event, changing climatic conditions, 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.
53. No informal raised flood defences in the form of boundary walls and/or existing buildings, providing protection from flooding, have been identified in the Spelthorne Borough. It is recognised however that infrastructure, including for example road and/or rail embankments, may alter the flow of floodwater throughout the Borough. For the purposes of the SFRA process, these have not been assessed as 'informal' defences. This is because the height and breadth of the embankments are such that the likelihood of a sudden catastrophic failure of the structure (i.e. potentially posing a risk to life) is virtually negligible.

4.6 Consultation

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

Spelthorne Borough Council

Planning

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

Drainage

Consulted to identify areas potentially at risk from river flooding and/or urban drainage

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. The Environment Agency was also consulted during the development of the project brief, and agreed to the scope of the investigation prior to commissioning.

Thames Water

Thames Water is responsible for the management of urban drainage (surface water) and sewerage within Spelthorne Borough. The underground drainage systems in many towns and cities of England are being progressively upgraded from the Victorian sewers. However, they often remain under capacity and subject to relatively frequent 'overload' (i.e. resulting in flooding on the surface).

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 post code. It is not possible therefore to pinpoint known capacity problems and/or infrastructure at risk of structural failure.

However, issues associated with failures of the underground drainage/sewer systems are generally relatively localised, resulting in flooding to properties. Issues of this nature should not preclude development. It is important however to ensure that future development does not exacerbate known existing problems.

Thames Water also manages the water supply reservoirs and large underground conduits providing water to the region, and as such the emergency planning and response in case of a system failure is the responsibility of the organisation. A catastrophic failure of this infrastructure may result in flooding to the Borough of Spelthorne.

4.7 Topography

55. Within a large proportion of the area, detailed flood risk mapping has been carried out, providing a robust means of delineating zones of 'high' risk (i.e. 1% (100 year) design flood extents. Dependence must be placed upon the Environment Agency Flood 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 'sensitivity' 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 outline is generally representative of anticipated flooding conditions.
56. In simple terms, topography provides the basis for a common sense assessment of predicted flood zone extents. Indeed it is important to ensure that the Environment Agency Flood 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.
57. Topography also provides a common sense indicator of the likely risk to property as a result of flooding. Spelthorne is a very flat Borough. The highest point is at Oaks Road, Stanwell at 23.8 mAOD. In contrast, the lowest point is at Lower Sunbury at 7.5 mAOD. The distance between these points is approximately four miles, representing a typical maximum surface slope within the Borough of no more than 1 in 400. This emphasises the likely susceptibility of many areas of the Borough to flood risk, due both to river and surface water flooding.

5 Flood Risk in Spelthorne

5.1 Overview

58. The southern boundary of the Borough of Spelthorne is delineated by the River Thames. Many of the key population centres within the Borough are situated along the length of the river corridor, and not surprisingly a considerable proportion of the Borough is affected by flooding. Indeed it is estimated that some 5,500 properties are at 'significant' risk of flooding (i.e. at risk of flooding on average at least once in every 100 years).
59. River Thames flooding has affected the Borough a number of times within recorded history, most recently in 2003. Investment has been made over the past 50-70 years in an endeavour to reduce the risk of flooding, improving the standard of protection provided to properties within the Borough. A considerable proportion of the Borough remains at risk of flooding however. It is estimated that approximately 14%⁴ of the urbanised area of the Borough is situated within the 1% (100 year) flood extent. Almost 50% of the urbanised area of the Borough will be affected by the 0.1% (1000 year) flood, which broadly resembles the 1% (100 year) flood in 2056 (i.e. incorporating the anticipated impacts of climate change).
60. Localised flooding as a result of surface water flooding is also a known risk to properties. Surface water flooding may occur as a result of (for example) culvert and/or gully blockage, surcharging of the underground drainage (or sewer) system, and heavy rainfall falling on paved areas and/or saturated ground. Surface water flooding is exacerbated in Spelthorne due to the relatively flat topography of the Borough. Water is not able to drain away quickly.
61. It is also important to recognise that there is a risk to properties as a result of groundwater flooding. A large proportion of the Borough overlays a soil layer commonly referred to as the 'Thames Gravels'. These gravels allow the infiltration of local catchment runoff into the ground, reducing the risk of surface water flooding. Thames Gravels also allow the free flow of groundwater from the river however. When water levels in the river are high, localised groundwater flooding can occur in low lying areas in the floodplain. Flooding may be experienced some distance away from the river long before river levels overtop the riverbanks. The construction of reservoirs, and the backfilling of gravel extraction pits over time has altered the flow of groundwater within the Borough.
62. A risk of flooding has been identified in association with the Colne system and the River Ash. These rivers affect fewer properties within the Borough than the River Thames. They are far more susceptible to flash flooding as a result of localised intense rainfall however, and 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 that development is planned accordingly so that future sustainability can be assured.
63. Finally a number of key water supply reservoirs are situated within, or immediately adjoining, the Borough of Spelthorne. These reservoirs are situated aboveground, and a sudden failure of the embankments retaining the stored water would have a catastrophic affect on properties situated in the path of the resulting flood wave. The reservoirs are very stringently managed and monitored by Thames Water, and the potential risk of failure is considered very small⁵.

⁴ This figure excludes urban areas that are situated on 'dry islands' within the flood affected area. These areas will be isolated during periods of flooding, and therefore should also be considered as being at risk.

⁵ Estimated by Defra to be in the order of 2×10^{-5} % per year (1 in 50,000)

64. The possible failure of the underground pipe system is also a risk, as experienced recently within the adjoining Borough of Windsor and Maidenhead in which a pipe failure resulted in the flooding of a number of properties. These were structural failures however, and it is notoriously difficult to measure in real terms the potential risk of a failure of this nature occurring at any given point.
65. The overloading of the sewer system due to inflows exceeding the underground system capacity (i.e. resulting in surcharging) is also a known problem in some areas.
66. In summary, there are a number of potential sources of flood risk affecting properties within the Borough of Spelthorne. In addition to the 5,500 properties identified as being at 'significant' risk of river flooding, many more are potentially at risk of surface water and/or groundwater flooding. Flooding can affect lives and livelihoods, and it is absolutely essential that future development (particularly residential development) is not placed within areas of the Borough within which the safety of residents cannot be assured in times of flood.

5.2 Fluvial Flooding - Delineation of the PPS25 Flood Risk Zones

67. A key outcome of the SFRA process is the establishment of the Sequential Test in accordance with Appendix D (Table D1) of PPS25. To inform the planning process, and indeed the assessment (and management) of flood risk within existing areas of the Borough, it is necessary to review flood risk across the area. This involves categorising the area in terms of the likelihood (or probability) that flooding will occur.
68. The Borough of Spelthorne has been delineated into the flood zones summarised below.

High Probability Zone 3a

Areas susceptible to flooding from river flooding during a flood that is of a magnitude up to (and including) the 1% Annual Exceedance Probability (AEP)⁶ (100 year) event

Functional Floodplain Zone 3b

Areas susceptible to flooding within which "*water has to flow or be stored in times of flood*" (PPS25). Emerging Environment Agency guidance indicates that the functional floodplain should broadly encompass those areas affected by flooding, on average, once in every 20 years

Medium Probability Zone 2

Areas susceptible to flooding during a flood that is greater in magnitude than a 1% AEP (100 year) fluvial, and up to (and including) the 0.1% Annual Exceedance Probability (AEP) (1000 year) event

Low Probability Zone 1

Areas susceptible to flooding during a flood that is greater in magnitude than a 0.1% AEP (1000 year) event

69. The delineation of the PPS25 flood zones is discussed below, and presented in the adjoining Flood Risk Maps.

⁶ The 1% AEP event is the flood that has a 1% probability of occurring, or being exceeded, in any one year

5.2.1 Delineation of High Probability Zone 3a

70. High Probability Zone 3a is defined as those areas of the Borough that are situated below (or within) the 1% AEP (100 year) fluvial flood extent.
71. For planning purposes, the Environment Agency has issued a series of Flood Maps as depicted on the Environment Agency's website (www.environment-agency.gov.uk). As outlined in Section 4, for the Lower Thames system, the River Ash and the River Colne, these maps are based on detailed modelling that has been carried out by the Environment Agency.
72. In those areas for which detailed flood mapping is not available, the Environment Agency's Flood Map based on the relatively coarse national generalised computer model has been adopted to underpin the SFRA process.

5.2.2 Delineation of Functional Floodplain Zone 3b

73. Functional Floodplain Zone 3b 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, however for the purposes of the Spelthorne SFRA, Zone 3b has been defined as land which meets all of the following three criteria:
 - land subject to flooding in the 5% AEP (20 year) flood event (i.e. relatively frequent inundation expected, on average once every 20 years);
 - 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).
74. Within the Borough of Spelthorne, this encompasses primarily those low lying areas immediately adjoining the River Thames. Any development within these areas is likely to measurably impact upon the existing flooding regime, increasing the severity and frequency of flooding elsewhere.
75. It is noted that, within some areas of the Borough, pockets of existing urban development are affected by flooding in the 5% AEP (20 year) event. In some instances, flooding within these areas is relatively localised and shallow, possibly subject to groundwater flooding as a result of elevated river levels and/or localised ponding.
76. It may be reasonable to argue therefore that these areas are not functional floodplain under the adopted PPS25 definition, and therefore not subject to the strict planning constraints posed by the policy guidance. Instead, the site would be subject to the planning constraints posed by sites situated within the 'high' risk zone, albeit subject to more frequent flooding than the surrounding area.
77. Further consideration should be given to these issues once PPS25 and any supporting documentation are released, particularly in the light of any potential changes in definitions and interpretations. It is strongly recommended that such changes be addressed in the Council's proposed SFRA Part II document.

5.2.3 Delineation of Medium Probability Zone 2

78. Medium Probability Zone 2 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.
79. The Environment Agency's Flood Map includes a 0.1% AEP (1000 year) flood outline. It is noted that this outline broadly resembles the modelled 1% (100 year) + 20% (climate change) flood outline for the Lower Thames system, i.e. providing an indication of the anticipated 1% (100 year) flood extents in the year 2056. For this reason, it is proposed that the more extreme of the two outlines be adopted as the basis for delineation of Medium Probability Zone 2.

5.2.4 Delineation of Low Probability Zone 1

80. Low Probability Zone 1 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)

5.3.1 Definition of Flood Hazard

81. 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.
82. 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'.
83. 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.
84. In summary, research has determined that if the product of flow depth (m) x flow velocity (m/s) is greater than or equal to $0.4 \text{ m}^2/\text{s}$, then an average adult is likely to be knocked off their feet. If the product of depth x velocity is greater than or equal to $0.6 \text{ m}^2/\text{s}$, then the average car will be washed away. These ratios have been determined through rigorous physical testing, and are widely accepted as reasonable threshold values above which it is deemed that there is a very real risk to life.

85. It is highlighted however that these figures do relate to an average healthy adult. Young children and the elderly will clearly be more vulnerable, and may be at risk in shallower and/or lower energy flow. It is also essential to emphasise that this in no way is intended to suggest that a depth x velocity ratio that is less than $0.4 \text{ m}^2/\text{s}$ should be adopted as the sole measure of public safety during flooding conditions. Submerged hazards including, for example, exposed manholes and tripping obstacles pose an obvious risk. Flood water is typically both poor quality and low temperature, and these too pose obvious risks to public health.
86. Defra and the Environment Agency have recently collaborated to develop a document entitled 'Flood Risk to People'. 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.

5.3.2 Flood Hazard due to River Thames Flooding

87. The speed and depth with which the River Thames floods the Borough of Spelthorne is an important consideration. Deep, fast flowing water may potentially pose risk to life. This must be considered when planning future development.
88. The results of the existing detailed two dimensional hydraulic analysis of the River Thames system have been examined to identify areas where floodwaters could pose a risk to life. These results have been used as the basis for delineating the approximate 'high flood hazard zone' for planning purposes.
89. It has been assumed that the 'high flood hazard zone' is defined as those areas in which the depth x velocity of the flow exceeds $0.4 \text{ m}^2/\text{s}$. The affected areas of Spelthorne Borough are delineated in Figure 5.1, and it is broadly suggested that development is steered away from these areas wherever possible. The 'high flood hazard zone' areas are particularly evident where floodwaters bypass natural meanders in the River Thames channel, resulting in either deep water and/or high velocities. It should be noted that these zones are determined from the two dimensional modelling results which are based on a 50 m grid and therefore could be worse locally.
90. In summary, the likelihood of a rapid river level rise within the River Thames and possible rapid inundation of urban areas within Spelthorne Borough posing a risk to life is considered to be minimal. This is primarily due to the large River Thames system and its substantial upper contributing catchment area which allows the Environment Agency, with its current flood warning system, to provide forewarning of two (2) days of a pending flood event.

5.3.3 Flood Hazard due to Flood Defence Failure

91. The presence of formal raised defences within the Borough of Spelthorne provides localised protection against fluvial flooding. There is always a residual risk that formal raised defences may fail however, as a result of 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.

92. A two dimensional hydraulic analysis of potential breach failure scenarios was carried out at a selected location along Colne Brook (refer to Figure 5.2). This location was selected largely on the basis of perceived risk to life should a catastrophic failure of a formal raised flood defence occur, i.e. focussing on urbanised areas situated immediately behind raised flood defences. Within other less populated areas, a qualitative approach was adopted using the topography and the response of the detailed analyses as the basis for considering the approximate 'high hazard zone' for planning purposes.
93. The breach modelling assumes that the water level in the river is close to overtopping at the point of defence failure. Upon catastrophic failure of the defence, the model then progressively inundates the land behind the defence based upon the topography of the area (defined by LiDAR). The depth and speed (velocity) of the flow is calculated as the floodwaters progress inland, providing the basis for determining the hazard posed to the community.
94. It is highlighted that the breach modelling has not taken into consideration the structural integrity of the defences. It is important to note that the probability of defence failure is directly proportional to the nature (construction) of the flood defence. Earthen embankments are susceptible to possible piping and/or slip failure. 'Hard' defences (e.g. sheet pile walls) are less likely to fail in this manner. A residual risk of overtopping and rotational failure remains however.
95. In summary, a large proportion of Spelthorne Borough is relatively low lying, and in many areas floodwaters can disperse quickly following a breach failure. The results of the detailed breach analysis undertaken on the Colne Brook did not seem to pose a hazard to the community within the Borough of Spelthorne. This is due to the relatively low height of the formal raised flood defences which do not allow a significant build up of water (and therefore energy) behind the defences. Following a qualitative approach to the other formal raised flood defences within the Borough it was concluded that similar results would be obtained at these locations. On this basis no further detailed breach analyses were undertaken.

5.4 Local Drainage (Surface Water Flooding) Issues

96. As discussed earlier, consultation has been carried out with the Environment Agency and the Council to identify known and/or perceived problem areas. These drainage problems are generally attributed to surface water flooding, including (for example) inundation from floodwaters from open drains and watercourses due to overland flow during exceptionally wet weather. In some instances these problems may be due to poor maintenance, associated with (for example) culvert blockages.
97. A summary of surface water flood issues that are known to the Council has been provided. These are outlined in a report included as Appendix A. The report identifies the capacity of the Thames gravels in absorbing water and the typical surface water drainage system in the Borough being based on soakaways. However, the limited gradient in the Borough topography limits the flow of both groundwater and surface water in ditches. After prolonged periods of rainfall and/or ground saturation surface water flooding can occur. Particular known problem areas are highlighted on the adjoining flood risk maps.
98. 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. Input has been sought from Thames Water to pinpoint known and/or perceived problem areas, however the information provided is very general.

99. Surface water flooding issues of this nature are generally localised problems that can be addressed as part of the design process, for example through a condition placed upon planning approval that infrastructure shall be upgraded before the development can proceed. They should therefore not influence the allocation of land for future development.
100. It is essential 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).
101. The Environment Agency strongly advocates the use of Sustainable Drainage Systems (SuDS). A wide variety of SuDS techniques are available (refer Section 6.8.3), potentially providing both water quality and water quantity improvement benefits on a site by site basis throughout the Borough. Wherever possible within brownfield areas, the developer should seek to reduce the rate of runoff from the site to greenfield runoff rates (i.e. the rate of runoff generated from the site assuming an open grassed area). Collectively, the effective application of SuDS as part of all future development will assist in reducing the risk of flooding to the Borough.

5.5 Groundwater Issues

102. Groundwater flooding has been observed at a number of locations within Spelthorne Borough, in the towns of Staines, Shepperton and Sunbury. It is possible that previous development within the area has altered the natural groundwater drainage. The construction of reservoirs, and backfilling of gravel pits with materials of different permeability to those present originally, could have altered groundwater storage and flow paths.
103. Equally, where flood defences have been constructed to mitigate the risk of fluvial flooding, a residual risk of groundwater flooding may remain. Groundwater could move through the Floodplain Gravels, driven by high water levels in the river, flooding land behind the river defences. Fluvial defences could also impede the natural flow of groundwater into the river, thus resulting in a backing up of groundwater behind the defences, potentially exacerbating the risk of groundwater flooding, and resulting in flooding within floodplain areas well before the banks of the River Thames are over topped.
104. The risk of groundwater flooding is highly variable and heavily dependant upon local conditions at any particular time. Groundwater flooding within Spelthorne Borough should once again therefore not normally preclude development. Notwithstanding this however, it is recognised that the risks associated with groundwater flooding are not well understood, and it is important to ensure that future development is not placed at unnecessary risk.
105. In accordance with draft PPS25, all future development will require an appropriate Flood Risk Assessment (FRA) at the planning application stage. It is important that the risk of groundwater flooding is thoroughly examined on a site scale by the developer as part of the detailed FRA process, and appropriate design measures should be adopted accordingly.

5.6 Water Supply Infrastructure Failure

106. Thames Water is responsible for water supply infrastructure located within the Spelthorne Borough which could cause flooding should any of the infrastructure fail. This infrastructure includes large water supply reservoirs⁷ and several deep large diameter pipes.
107. Thames Water was consulted to discuss the risk of flooding associated with the failure of the above mentioned water supply infrastructure, in particular the breaching of the water supply reservoirs. It is understood that the risk of flooding associated with the failure of such reservoirs has been determined under a study sponsored by Defra. Unfortunately, the water supply reservoirs are part of the national critical infrastructure and therefore due to security reasons no specific information could be provided.
108. Thames Water provided assurance that the water supply reservoirs are actively managed and that all required safety standards are met. Thames Water confirmed that there is a Reservoir Surveillance Management Process that is externally accredited via the ISO 9000 accreditation. This includes the appointment of a Supervising Panel Engineer and regular inspections of all reservoirs to the requirements of the Reservoirs Act by suitably qualified engineers. In addition to the statutory requirement, Thames Water state that it undertakes inspections of the reservoirs by trained individuals at a frequency agreed by the Supervising Panel Engineer. On this basis the possible risk of failure of these reservoirs is considered to be minimal.
109. However, issues associated with failures of large diameter underground pipe systems could result in flooding to localised areas. Unfortunately no information on the risk of flooding associated with the failure of such systems was forthcoming within the timeframes of the current investigation. It is important to emphasise however that issues of this nature should not preclude development. Effective emergency response is an acceptable means of reducing the potential risk to life in the unlikely case of infrastructure failure. For this reason, these considerations do not affect the outcomes and/or recommendations of the SFRA process.

5.7 Climate Change

110. 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.
111. In the absence of a definitive answer, PPS25 provides guidance that states that a 20% increase in the 1% AEP (100 year) river flow can be expected within the next 50 years, increasing to a 30% increase in the 1% AEP (100 year) river flow can be expected within the next 100 years.
112. The detailed modelling of the Lower Thames has considered the potential impact of climate change over the next 50 years. The anticipated extent of the 1% AEP (100 year) flood affected area in 2056, as presented in the adjoining figures, broadly resembles the current 0.1% AEP (1000 year) flood outline. This indicates a considerable increase in the number of properties at risk of flooding. It has been estimated that flood depths within the current High Probability Flood Zone 3a may increase by up to 300 mm as a result of climate change over the next 50 years.

⁷ Water supply reservoirs include the Wraysbury, King George VI, Staines North and South, Queen Mary and Kempton. A reservoir aqueduct linking the Thames at Wraysbury to the Kempton Treatment Works is also managed by Thames Water.

113. 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 over the lifetime of the development should be assessed proportionally to the guidance provided by PPS25 as outlined above. For example, if the proposed lifetime of the development is approximately 50 years, then the impact of a 20% increase in the 1% AEP (100 year) fluvial flow should be considered.
114. 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 Drainage Impact 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

115. 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.
116. 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 have been designed;
 - the structural deterioration of flood defence structures (including informal structures acting as a flood defence) over time; and/or
 - general uncertainties inherent in the prediction of flooding.
117. The SFRA process has carried out a review of flood risk within the Borough of Spelthorne in accordance with the PPS25 Sequential Test, identifying a number of areas that fall within High Probability Zone 3a. 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 variable quality. For this reason, there are inherent uncertainties in the prediction of flood levels used in the assessment and management of flood risk.
118. It is difficult to quantify uncertainty. The adopted flood zones underpinning the Spelthorne SFRA are based upon the detailed flood mapping within the area adjoining the River Thames. 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.
119. Taking a conservative approach for planning purposes, it is understood that the Environment Agency (Thames Region) generally adopt a 300 mm 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.
120. 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

121. 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.
122. 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.
123. 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

124. 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.
125. The Regional Assembly should consider flood risk when reviewing strategic planning decisions including (for example) the provision of future housing and transport infrastructure.
126. The Environment Agency has a statutory responsibility for 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.
127. 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 planning policy, the allocation of land for future development, detailed development control policies and sustainability appraisals. Local Planning Authorities have a responsibility to consult with the Environment Agency when making planning decisions relating to policy making and planning applications.

128. Landowners & Developers⁸ 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.

6.3 Strategic Flood Risk Management - The Environment Agency

6.3.1 Overview

129. 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, appropriate measures were put into place to mitigate the risk of inundation to developing areas. Needless to say, the construction of these measures only provided alleviation to localised areas, and by their nature presented a risk of inadvertently increasing the risk of flooding elsewhere, through the redistribution of floodwater.
130. 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.
131. A number of flood risk management strategies are underway within the Thames region, encompassing many of the large river systems that influence flood risk within the Borough of Spelthorne. A brief overview of these investigations is provided below.

6.3.2 Catchment Flood Management Plan (CFMP)

132. *"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.*
133. *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.*
134. *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.*⁹

⁸ Referred to also as 'landowners' within PPS25

⁹ Catchment Flood Management Plans – Volume 1 (Guidance), Version 1.0, July 2004

135. The flood risk regime within the Borough of Spelthorne is heavily influenced by the River Thames. The Thames system is under careful consideration by the Environment Agency, and resources are currently being targeted at a strategic level to ensuring that the nature and severity of flood risk throughout the wider greater London area is broadly understood. This will enable the Environment Agency, responsible for the future management of flood risk within the area, to target future activities in a cost effective and sustainable manner.
136. A CFMP is being developed for the River Thames catchment. A summary document has recently been provided outlining the main messages from the CFMP (September 2006). Four key messages have been highlighted by the CFMP, relating to the effective management of flood risk within the catchment:
- 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.
137. These succinctly reinforce the over-arching objectives of PPS25, i.e. it is important that Local Authorities seek to restrict development within flood affected areas, protecting the natural floodplain wherever possible.

6.3.3 Lower Thames Strategy

138. The Lower Thames Strategy is being carried out by Halcrow and Jacobs on behalf of the Environment Agency, triggered as an outcome of the widespread flooding experienced within the catchment in 2003. The initial phase of the investigation was completed in 2005, considering the management of flood risk from the River Thames between Datchet and Walton Bridge. A subsequent phase has since been considered, reviewing the reach extending from Walton Bridge to Teddington.
139. The Strategy has investigated a number of large-scale engineering solutions, community based measures and non-structural options to mitigate the risk to urban areas as a result of flooding from the River Thames. The engineering solutions considered included flood walls, flood storage, channel improvements (i.e. widening and/or deepening of the river channel), and the construction of new flood relief channels.
140. It has been concluded that there are number of technical, environmental and economic constraints that will dictate the viability of these engineering works, and these are currently under investigation.
141. Phase 3 of the study is due to be concluded by January 2007. The final stage of the study will be to prepare a final strategy document recommending the preferred options to manage flood risk in the study area.
142. The intention of the study is not to reduce flood risk in order to make way for future development, but to improve the standard of protection provided to existing properties at risk of flooding (including some of the 5,500 homes at significant risk of flooding within the Borough of Spelthorne). It is also unlikely that the physical management measures identified will be in operation within foreseeable planning timeframes.
143. For this reason, the SFRA has not taken the potential flood risk reduction measures in account in this instance. Within future planning horizons however, the revision of the SFRA should review the status of schemes recommended as an outcome of the Lower Thames Strategy, and consider the potential impact that these may have upon flood risk within the Borough.

6.4 Planning & Development Control – Spelthorne Borough Council

6.4.1 Planning Solutions to Flood Risk Management

144. 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.
145. The ideal solution to effective and sustainable flood risk management is to remove urban development from areas that are susceptible to flooding and/or to find appropriate measures that will reduce the likelihood of flooding. Within Spelthorne, the relocation of existing development into lower risk areas is simply not feasible, restricted both by the considerable extent of flood affected land within the Borough, and high land value. For this reason, a combination of planning and intervention measures will be required to proactively reduce the risk of flooding over time.
146. An important part of a comprehensive approach to flood risk management is ensuring that new development is appropriately sited. PPS25 stipulates permissible development types, taking due consideration of the degree of flood risk posed. Wherever possible, the Council should restrict development to those land uses summarised in PPS25 Appendix D (Table D2)¹⁰.
147. In addition to planned development however, it is recognised that the progressive development and/or regeneration of the area is also likely to involve the (re)development of windfall sites. To ensure that the SFRA is able to provide meaningful recommendations in both instances therefore, the Borough has been considered on the basis of 'Character Areas'. These character areas have been delineated largely on the basis of geographical location in this instance, and within the SFRA incorporate only those areas in which there is a perceived risk of flooding.
148. It is recognised that relatively substantial areas of the Borough of Spelthorne are situated within High Probability Zone 3a. Open areas outside of urban settlements are designated Green Belt, and therefore development within these areas is precluded by strict planning policy. Within urban areas however, there is a relatively dense pattern of development, and limiting future development and/or regeneration is likely to have a detrimental impact upon the economic and social welfare of the existing community. Within these areas, the Council and potential future developers are required to work through the Exception Test (PPS25 Appendix D) to demonstrate that:
- *“The development makes a positive contribution to sustainable communities, and to sustainable development objectives;*
 - *The development is on developable brownfield land or where there are no reasonable alternative options on developable brownfield land;*
 - *A flood risk assessment demonstrates that the residual risks of flooding to people and property (including the likely affects of climate change) are acceptable and can be satisfactorily managed; and*
 - *The development makes a positive contribution to reducing or managing flood risk.”*

¹⁰ It is reiterated that a change in the classification of land use vulnerability (Appendix D, Table D2) should be anticipated in the final release of PPS25.

149. 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. Low Probability Zone 1 or Medium Probability Zone 2) wherever feasible.
150. Within the Borough of Spelthorne however, it is not feasible to allocate land within the River Thames floodplain only to commercial and/or industrial land uses in order to relocate all 5,500 properties at risk into the lower risk flood zones. This would compromise the future viability of the communities, and would involve a scale of public expenditure which could never feasibly be secured. A more pragmatic approach must therefore be taken. A sustainable solution to flood risk management (for the lifetime of the proposed development) must be achievable, however, addressing the latter two points of the Exception Test.
151. The ease with which it is feasible to manage the risk of flooding within a site can be generally related to the severity and frequency with which flooding is expected to occur. In areas that flood more regularly, it follows that the severity of flooding in a more extreme event is likely to be greater than in areas that are flooded less frequently (i.e. areas that are typically at a higher level and situated further away from the river).
152. To assist the planning process therefore, a further breakdown of High Probability Zone 3a has been provided, highlighting those areas within the 1% AEP (100 year) predicted flood extent that are expected to flood on a relatively frequent basis. For the purposes of the Spelthorne SFRA, High Probability Zone 3a has been broken down in the following manner:
 - **High Probability Zone 3a(i)** - depicted as areas of existing urban development that have a flood hazard (depth x velocity) less than 0.4 m²/s and are affected by flooding in the 5% AEP (20 year) event. As outlined earlier, in some instances flooding within these areas is relatively localised and shallow, possibly subject to groundwater flooding as a result of elevated river levels and/or localised ponding. It may be reasonable to argue that these areas are not functional floodplain, and therefore not subject to the strict planning constraints imposed on property within Functional Floodplain Zone 3b. Instead the site would be subject to the planning constraints posed by sites situated within the 'high' risk zone, albeit subject to more frequent flooding than the surrounding area. **Further consideration should be given to these issues once PPS25 and any supporting documentation are released, particularly in the light of any potential changes in definitions and interpretations. It is strongly recommended that such changes be addressed in the Council's proposed SFRA Part II document.**
 - **High Probability Zone 3a(ii)** - depicted as all remaining areas within the 1% AEP (100 year) flood outline.
153. Where development is to be allocated within High Probability Zone 3a on planning grounds, wherever feasible this should be guided towards areas within High Probability Zone 3a(ii) in preference to High Probability Zone 3a(i). High Probability Zone 3a(i) encompasses areas that are subject to relatively frequent flooding, and it is expected that mitigation measures to ensure public safety in case of flooding may be difficult to implement effectively. It will be the responsibility of the developer (in all instances within High Probability Zone 3a) to develop a detailed Flood Risk Assessment that can demonstrate that the risk of flooding has been adequately addressed in accordance with PPS25.

154. The SFRA has been developed in close liaison with the Council and the Environment Agency to work through the requirements of the Sequential Test (and, where necessary, the Exception Test) within the Borough of Spelthorne.
155. 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.
156. It is important to recognise that the PPS25 Exception Test is to be applied at all stages of the planning process. It should be applied to both the establishment of the Local Development Framework (i.e. the documentation of planning policy and the allocation of land for future development), and the design and approval of development at the planning application stage.
157. The Exception Test seeks to ensure future sustainability throughout the lifetime of a proposed development. It also seeks, wherever feasible, a positive contribution to reducing or managing flood risk within the Borough. This objective should be embraced in the development of planning and development control policy.

6.5 Borough Character Areas – Assessment of Flood Risk

158. A detailed review of flood risk across the Borough has been carried out, delineating areas of 'high', 'medium' and 'low' risk. The overview of flood risk is provided in Appendix B and adjoining Figures 6.0 to 6.14.

6.6 Spelthorne Borough Council – Planning Policy

159. The extent of flooding faced by the Borough requires a comprehensive approach to sustainable flood risk management. In developing an appropriate policy approach, regard will need to be taken to PPS25 guidance. This guidance advocates the following:

Future Development within Low Probability Zone 1:

1. There are no flood risk related constraints placed upon future development within Low Probability Zone 1 (in accordance with PPS25). Aside from this, all development should be carried out in accordance with the recommendation below.
2. Following discussion with the Council and the Environment Agency, it has been agreed that all 'dry islands' (i.e. Low Probability Zone 1 areas surrounded by Medium Probability Zone 2) be considered as part of Medium Probability Zone 2.

Future Development within Medium Probability Zone 2:

1. In accordance with PPS25, land use within Medium Probability Zone 2 should be restricted to the 'water-compatible', 'less vulnerable' and 'more vulnerable' category (refer Appendix D1 of PPS25) to satisfy the requirements of the Sequential Test.

2. Where non-flood risk related planning constraints dictate that 'highly vulnerable' land uses should proceed, it is necessary to ensure that the requirements of the Exception Test are satisfied. In planning terms, it must be demonstrated that "*the development makes a positive contribution to sustainable communities and to sustainable development objectives*", and that "*the development is on developable brownfield land, or where there are no reasonable alternative options on developable brownfield land*".
3. To satisfy the remaining criteria of the Exception Test, all development within Medium Probability Zone 2 should be conditioned in accordance with the recommendations below.

Future Development within High Probability Zone 3a:

1. In accordance with PPS25, land use within High Probability Zone 3a should be restricted to the 'less vulnerable' category (refer Appendix D1 of PPG25) to satisfy the requirements of the Sequential Test.
2. Development should be guided towards High Probability Zone 3a(ii) in preference to High Probability Zone 3a(i).
3. For 'more vulnerable' land uses (including residential), it is necessary to ensure that the requirements of the Exception Test are satisfied. In planning terms, it must be demonstrated that "*the development makes a positive contribution to sustainable communities and to sustainable development objectives*", and that "*the development is on developable brownfield land, or where there are no reasonable alternative options on developable brownfield land*".
4. To satisfy the remaining criteria of the Exception Test, all development within High Probability Zone 3a should be conditioned in accordance with the recommendations below.

Future Development within Functional Floodplain Zone 3b should be restricted to 'water-compatible uses' and 'essential infrastructure' that has to be there (in accordance with PPS25). All 'essential infrastructure' in the Functional Floodplain Zone 3b must be designed and constructed to remain operational in times of flood and not impede water flows.

6.7 Spelthorne Borough Council – Development Control Decisions

160. For the purposes of development control, detailed flood risk management measures will need to be set out for developers, included within the emerging Supplementary Planning Document. The following reflects the minimum requirements stipulated by the Environment Agency in response to PPS25:

Future Developments within Low Probability Zone 1:

A Drainage Impact Assessment will be required to demonstrate that runoff from the site (post development) is not increased. This will involve the introduction of SuDS techniques. The geology in this area is characterised by Alluvium, Brickearth, Taplow Gravels and Flood-plain Gravels, and therefore infiltration techniques should be feasible. Any SuDS design must take due account of groundwater and geological conditions.

Future Developments within Medium Probability Zone 2:

1. All proposed future development within these zones will require a detailed Flood Risk Assessment (FRA).
2. Floor levels should be situated above the 1% (100 year) plus climate change¹¹ predicted maximum flood level plus freeboard.
3. Seek to provide dry access (above 1% (100 year) flood level) to enable the safe evacuation of residents and/or employees in case of flooding.
4. Implement SuDS to ensure that runoff from the site (post redevelopment) is not increased. The geology in this area is characterised by Alluvium, Brickearth, Taplow Gravels and Floodplain Gravels, and therefore infiltration techniques should be feasible. Any SuDS design must take due account of groundwater and geological conditions, and consider how the system will perform when there is extensive inundation of the floodplain during a major fluvial event.

Future Developments within High Probability Zone 3a:

1. All proposed future development within these zones will require a detailed Flood Risk Assessment (FRA). Properties situated within the close proximity to formal raised defences will require a detailed breach assessment to ensure that the potential risk to life (i.e. in case of a defence failure) can be safely managed throughout the lifetime of the development.
2. Floor levels should be situated above the 1% (100 year) plus climate change predicted maximum flood level plus freeboard¹². Within defended areas, the 1% (100 year) peak design flood level will be determined assuming a potential breach failure of the raised defence.
3. Seek to provide dry access (above 1% (100 year) flood level) to enable the safe evacuation of residents and/or employees in case of flooding. Within industrial and commercial complexes, a site-based emergency plan should be implemented to ensure the safety of employees and customers in case of flooding.
4. 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 predicted peak design flood level (refer to minimum floor level).
5. Implement SuDS to ensure that runoff from the site (post redevelopment) is not increased. The geology in this area is characterised by Alluvium, Brickearth, Taplow Gravels and Floodplain Gravels, and therefore infiltration techniques should be feasible. Any SuDS design must take due account of groundwater and geological conditions.

¹¹ Modelled as a 20% increase in the 1% (100 year) flow over a 50 year period

¹² It is appreciated that the raising of new development within existing urban areas may result in a substantial difference in floor levels that may introduce unacceptable visual and/or building access impacts. In these instances, alternative strategies to ensure the effective management of residual flood risk should be discussed with the Environment Agency. It is highlighted that flood proofing is likely to be acceptable in commercial or industrial areas only.

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). Where applicable, the proposed development should also not have an adverse impact on the integrity and effectiveness of flood defence structures.
7. The proposed development should, where applicable, maintain appropriate access for the maintenance of watercourses.

6.8 Detailed Flood Risk Assessment (FRA) – The Developer

6.8.1 Scope of the Detailed Flood Risk Assessment

161. As highlighted in Section 2, the SFRA is a strategic document that provides an overview of flood risk throughout the area. It is imperative that a site-based Flood Risk Assessment (FRA) is carried out by the developer for all proposed developments, and this should be submitted as an integral part of the planning application. It is now a government directive that planning applications seeking approval for development within flood affected areas can be regarded as invalid if not supported by a detailed Flood Risk Assessment. The following reflects best practice on what should be addressed within a detailed FRA.
162. 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. Low Probability Zone 1), 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. the River Thames). 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.

163. Proposed Development within High Probability Zone 3a

All FRAs supporting proposed development within High Probability Zone 3a should assess the proposed development against all elements of the Council's flood policy, and 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.

164. It is noted that a proportion of the Borough of Spelthorne is delineated as High Probability Zone 3a, however the presence of localised raised defences provides a degree of protection against flooding. It is broadly accepted that these defences reduce the actual risk to properties, however recent world history has demonstrated the potentially catastrophic consequence of a breach failure, often resulting in widespread flooding.

165. It is essential that developers thoroughly review the existing and future structural integrity of the defences upon which the development will rely (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.

166. Proposed Development within Medium Probability Zone 2

For all sites within Medium Probability Zone 2, a high level FRA should be prepared based upon readily available existing flooding information, sourced from the Environment Agency. 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 6.8.2) and the provision of a planned evacuation route and/or safe haven.

It is highlighted that many of those areas currently situated within Medium Probability Zone 2 are also affected by the 1% (100 year) plus 20% climate change scenario (refer Section 5.2). This is an important correlation. In real terms, this means that **properties that are today (2006) at relatively low risk will, in 50 years (2056), be within High Probability Zone 3a**. It is imperative therefore that planning and development control decisions take due consideration of the potential risk of flooding in future years.

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

Within all areas of the Borough, 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.

168. 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.

6.8.2 Raised Floor Levels & Basements (Freeboard)

169. 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 50 years.
170. Wherever possible, floor levels should be situated a minimum of 300 mm above the 1% AEP (100 year) plus climate change flood level, determined as an outcome of the site based FRA, or 600 mm above the 1% AEP (100 year) flood level 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.
171. 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 300 mm 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.

6.8.3 Sustainable Drainage Systems (SuDS)

172. 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 (as described in Section 5.4) is one of the most effective ways of reducing and managing flood risk within the Borough.
173. SuDS may improve the sustainable management of water for a site by¹³:
- 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.
174. 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 sites could be significant.
175. 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 table¹⁴. 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.

¹³ Interim Code of Practice for Sustainable Drainage Systems National SUDS Working Group, 2004

¹⁴ Interim Code of Practice for Sustainable Drainage Systems National SUDS Working Group, 2004

Pervious surfaces	Surfaces that allow inflow of rainwater into the underlying construction or soil.
Green roofs	Vegetated roofs that reduce the volume and rate of runoff and remove pollution.
Filter drain	Linear drains consisting of trenches filled with a permeable material, often with a perforated pipe in the base of the trench to assist drainage, to store and conduct water; they may also permit infiltration.
Filter strips	Vegetated areas of gently sloping ground designed to drain water evenly off impermeable areas and to filter out silt and other particulates.
Swales	Shallow vegetated channels that conduct and retain water, and may also permit infiltration; the vegetation filters particulate matter.
Basins, Ponds and Wetlands	Areas that may be utilised for surface runoff storage.
Infiltration Devices	Sub-surface structures to promote the infiltration of surface water to ground. They can be trenches, basins or soakaways.
Bioretention areas	Vegetated areas designed to collect and treat water before discharge via a piped system or infiltration to the ground
Pipes and accessories	A series of conduits and their accessories normally laid underground that convey surface water to a suitable location for treatment and/or disposal. (Although sustainable, these techniques should be considered where other SUDS techniques are not practicable).

176. 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
- Draft Planning Policy Statement 25, Annex F, Office of the Deputy Prime Minister, 2005
- www.ciria.org.uk/suds/

177. Furthermore, the Environment Agency (Thames Region) has issued best practice guidance for Sustainable Drainage Systems, providing a clear hierarchy for SuDS requirements at the planning application stage. This is available upon request from the Environment Agency development control teams.

6.9 Local Community Actions to Reduce Flood Damage

178. It is estimated that over 5,500 homes within the Borough are at 'significant' risk of flooding (i.e. affected by flooding in events up to and including the 1% AEP (100 year) event). 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.

179. 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.

6.9.1 Flood Proofing

180. 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 damages sustained.

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.

6.10 Emergency Planning

181. Emergency planning is an absolutely critical aspect of flood risk management. Some 5,500 properties have been identified as susceptible to significant flooding within the Borough. Logistically, this could mean the evacuation of up to 15,000 residents to safety for the duration of an extreme flooding event. 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.

182. Potential evacuation routes have been identified in adjoining Figures 7.1 to 7.3, highlighting those locations in which the raising of the road would enable 'dry' evacuation if feasible. All road raising must ensure that existing flood flow paths are not affected, resulting in flooding elsewhere.

183. In the short term, it is recommended that the road crest levels are reviewed in light of predicted peak design flood levels, and the feasibility of future road raising considered further for possible programming. In some areas, it is appreciated that the raising of roads to provide dry evacuation routes may not be feasible in the short to medium term. In these locations it is imperative that people can be moved to safe areas with access to medical attention, food, water and warmth during extended periods of flooding.

184. 'Dry' access (i.e. above flood level) should be sought wherever possible to ensure that all residents can be safely evacuated in times of flood. Whilst flooding of the smaller watercourses will result in the inundation of urban areas for a short period of time, it must be appreciated that flooding due to the River Thames will result in standing water for significant periods, typically in excess of a week. This can be seen in adjoining Figures 7.4 to 7.8, which indicate the simulated flood progression with time for the 1%AEP (100 year) + 20% (i.e. climate change) flood event for the Lower Thames.
185. The progressive inundation plan provided for the River Thames in Figures 7.4 to 7.8 should also assist in the development of the emergency plan. This indicates the areas that will be affected by flooding first, the progressive inundation of the area (including possible access/egress routes) and an indication of the associated flood hazard.
186. The reader's attention is drawn to the period of inundation anticipated in many areas of the Borough as a result of River Thames flooding. It is expected that, in an extreme (100 year) flood event, areas of the Borough may be under water for in excess of 300 hours, or 12 days. During this period, residents stranded within flood affected areas will have no access to food or medical attention. It is likely that the flooding will have affected water and electricity supplies, and it is also a high probability that the flooding will occur during the winter period. These factors will substantially increase the potential risk to life.
187. As discussed earlier, coordination with the emergency services and Environment Agency is imperative to ensure the safety of residents in time of flood. 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.
188. Widespread flooding throughout the region is a recognised risk associated with rising water levels within the River Thames. This event will occur due to long duration rainfall depressions situated over Southern England, and considerable forewarning will be provided to encourage preparation in an effort to minimise property damage and risk to life. Residents situated within the 'functional floodplain' areas are likely to be the most vulnerable as water levels rise. These areas will flood more frequently than other areas of the Borough, and are likely to be the first cut off from safe evacuation routes.
189. Other areas within the Borough of Spelthorne, adjacent to the River Ash and Colne Brook, are susceptible to 'flashier' flooding. This will often be 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 can not be sensibly forewarned.
190. All urbanised areas are potentially at some degree risk of localised surface water 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 exacerbate surface water flooding that can only realistically be addressed by regular maintenance.
191. 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.

6.11 Insurance

192. 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.
193. 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)¹⁵ flood level will be able to secure insurance policies that will protect them against damages sustained in case of flooding.
194. There is a lack of clarity from the insurance industry 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).

¹⁵ 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

195. A considerable proportion of the Borough of Spelthorne is at risk of flooding with approximately 14% of the urban area and 5,500 properties affected by the 1% (100 year) flood event. The risk of flooding posed to properties within the Borough arises from a number of sources including river flooding, surface water flooding and groundwater flooding.
196. A collation of potential sources of flood risk has been carried out in accordance with Draft 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 in accordance with Draft PPS25, providing the basis for the application of the PPS25 Sequential Test.
197. A comprehensive approach to flood risk management should be sought. Where other planning considerations must guide the allocation of sites and the Sequential Test cannot be satisfied, specific recommendations have been provided to assist the Council and the developer to meet the Exception Test in PPS25.
198. 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. The current Council policy should be reviewed in light of emerging policy guidance (PPS25) with respect to flood risk. This should seek to address the following core considerations that will assist the Council to reduce flood risk within the Borough:
 - supporting appropriate flood alleviation measures under consideration by the Environment Agency;
 - promoting the application of sustainable drainage techniques for all development within the Borough;
 - maintaining the effectiveness of the existing available floodplain by not permitting future development within existing open areas;
 - seeking to steer vulnerable development away from flood affected areas;
 - seeking a measurable reduction in the likelihood of flooding through redevelopment within existing urban areas, for example, through the provision of flood storage and/or the reduced impedance of flood flow routes; and
 - ensuring flood resilient construction within flood affected areas.
199. For the purpose of clarity, a Supplementary Planning Document should also be developed in light of the suggested development control conditions presented by the Spelthorne Borough SFRA, outlining the minimum requirements of the Environment Agency in response to PPS25.
200. 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.

201. 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 Map on a quarterly basis. Until superseded by improved level of detail or accuracy of the Environment Agency Flood Map, the SFRA maps (to be updated as the results of further detailed modelling becomes available) should be referenced as the first step in the detailed FRA process, clarifying the scale of flood risk posed to the proposed development site. In some areas (e.g. where detailed modelling of the Lower Thames has confirmed that the site is not affected by flooding in the 1% (100 year) design event with climate change) this may preclude the need for any further analysis.
202. PPS25 is in draft form at the time of writing, and is due for final release in January 2007. It is important therefore that a cursory review of the SFRA be carried out on the release of PPS25 and/or any supporting documentation. It is strongly recommended that all changes, including changes in definitions and interpretations, be addressed in the Council's proposed SFRA Part II document. The SFRA should also be retained as a 'living' document, reviewed on a regular basis in light of better flood risk information (e.g. the availability of improved level of detail or accuracy of the Environment Agency's Flood Map) and emerging policy guidance.

Appendix A

Surface Water Condition Borough of Spelthorne

SURFACE WATER CONDITIONS
BOROUGH OF SPELTHORNE
(Dave Horton 25/10/2006)

Introduction

1. The brief of this report was to identify the areas of Spelthorne prone to flooding by reasons other than those caused by the rivers passing through it. The intention was therefore to gather information from archived files that would give information regarding specific locations with dates when they occurred and the effects. Unfortunately in recent times all written records have been discarded. Though some mapping has been located the information gleaned is very limited. The consequence being that the report is primarily based on personal memories and for this reason dates are unclear and the report by no means comprehensive.
2. As a member of the Highways and Drainage Department of Spelthorne Borough Council for around thirty years I was heavily involved in most of the flooding events that occurred within that time to a lesser or greater degree but it should be noted that in the main these events were ones that affected the public highway. However, they should give an indication of the prevailing conditions in the areas surrounding the locations identified especially as for the most part complaints received would invariably blame highway drainage, or the lack of, for the problem whereas the problem could equally be run off from the private property being the cause.

Background

3. For the first twenty five years or so of my involvement there was very little change in circumstances with regard to the cyclic behavior of groundwater levels. Generally it was found that water table levels rarely fell beneath about 2.0m below ground level. The lowest period was during the summer months rising during the autumn to a peak during the winter before falling during the spring. Thus even during the long 'drought' of 1977 deeper excavations would require dewatering systems to be employed.
4. Generally the further from the River Thames the higher the water table. Therefore, in Poyle, once the most northern part of Spelthorne but now within the Borough of Slough, often at its highest the water table would virtually be at ground level. Any rain at that time would often lead to localised flooding with a long delay before dispersal. This led to the Poyle Road carriageway and footway level being raised to reduce the incidents of flooding. Further south the areas of Stanwell and Stanwell Moor though not as seriously affected as Poyle would still have very high water table during the winter months being only just below ground level. Although not as serious as Poyle, heavy rainfall would lead to localised flooding with levels falling relatively slowly.
5. The situation appeared to be compounded at times by the mechanical discharge of surface water to the surrounding area from Heathrow Airport. Though not conclusively proved it was suspected that clearing of surface water from the airport occurred at times contributing to flooding conditions.
6. As stated the further north from the river Thames the higher the underlying water table seems to be. Therefore Ashford, Staines and Shepperton on the whole are generally not noticeably affected by high water tables apart from in pockets. The affect a high water table does have is to increase the time laying water following storms takes to disperse.
7. What should be an obvious impact on drainage to the borough is the numerous gravel extraction areas that have occurred in the past and at present being undertaken in the Shepperton area with further operations likely in Sunbury. Many if not all of the older gravel pits are now filled in and were done so when control of the fill material was not

so controlled as it is now. However, from a personal point of view I am unaware of any correlation between recurring flooding incidents and the presence of old or existing pits. Equally the presence of reservoirs is not an issue I am aware of as a cause or factor with regard to flooding except with the intense rainfall over short periods that appears to happen more and more frequently. This rainfall falling on the large areas of steep banks quickly flows to the toe and depending on the reservoir's location contributes to flooding. This may be that as the construction of the reservoirs and the filling of most of the old gravel pits occurred before I became involved and therefore unaware of the prevailing conditions prior to this time.

History

8. On the whole the disposal of roof drainage has always been by means of soakaways. The major exception to this are the properties built close to or abutting the highway. In these instances rainwater down pipes either discharge directly on to footways or by means of channels onto the carriageway. By either means the rainwater is added to the burden on the highway drainage system. Town centres have a large number of buildings with drainage such as this presumably due to the necessity of locating the shops close to the highway, though there are similar instances widespread across the borough. In all the cases I am aware of they are the older type of property. There is very little evidence of properties discharging roof drainage to the foul sewer system. What examples that came to light were usually unauthorized connections made at a time when the property had major alterations carried out and the person(s) responsible were unaware that such practice was not acceptable.
9. Highway drainage in the main up to the 1950/60s was predominantly piped systems discharging eventually to a local watercourse. This changed to a greater dependence on soakaways, even in cases where a piped system existed and localized flooding occurred the likely solution to the problem would be to construct a soakaway(s) in the immediate area. Presumably this was based on economic reasons set against the cost of maintaining/repairing the existing system or reprofiling the road.
10. A major exception to this is the Elmsleigh Centre and the roads and car parks surrounding it. In this area a piped system exists that falls to a pumping station in Riverside Car Park. Collected water is then pumped into the Thames. One of the few surface water drainage systems in the borough that is the responsibility of TWU.

Watercourses

11. The larger rivers, The Thames, Colne and Wrybury obviously are main receivers of direct connections from highway drains as well as the smaller River Ash. There are also lesser watercourses that play a major part in conducting drainage to the major rivers. They are:

The Stanwell Brook, Stanwell Ditches & West Bedfont Ditches. (Stanwell & Ashford)

12. Classed as main river both start in the north of Stanwell, one to the east and one to the west. The Eastern leg starts close to Long Lane, travels beneath that road turning west at London Road to the junction at Stanwell Road. The Western leg starts near Stanwell Village runs virtually south to Town Lane near its junction with Clare Road. It then travels under Town Lane joining with the eastern leg at London Road before continuing along Stanwell Road turning into Salcombe Road then continuing south under the railway line and running behind the properties in Woodthorpe Road and Adelaide Road before discharging to the River Ash. Almost the entire length has been piped. Though classed as main river the brooks have been maintained as part of the highway system.

Sweeps Ditch (Staines)

13. Before construction of the Two Rivers Shopping Area pipe work still existed that one time fed water to the ditch from the Colne. Now the head of the ditch is at the junction of High Street and South Street. Sweeps ditch runs across the Elmsleigh Car Park under

the railway and behind Drakes Avenue and towards Knowle Green. It then travels across Staines Recreation Ground before crossing Commercial Road and running alongside Knightsbridge Crescent and Baden Close. After it crosses Laleham Road it continues across fields before joining the River Thames near The Ryde. The major length of the ditch is open after crossing under the railway near Drakes Avenue. It is maintained as a land drain by Spelthorne Borough Council up to Laleham Road at which point it is classed as main river. Though there is generally a flow in the ditch this is artificially maintained by pumping water into it from the River Thames.

Unnamed ditch leading to the Feltham Hill Brook/Portlane Brook. (Ashford & Sunbury)

14. The ditch starts near the junction of Rosary Gardens and Feltham Hill Road and travels in a southerly direction crossing Feltham Hill Road turning East at the end of Southfields Avenue. It continues east till Alexandra Road where it follows the boundary of the open space wher it turns north. The ditch continues north through the grounds of the BP offices in Chertsey Road before crossing Cadbury Road and joining the Portlane Brook. Apart from its early stages the ditch is generally piped in the built up area through to the Portlane Brook. The Brook is generally dry.

Unnamed ditch leading to The Markway Ditch. (Sunbury)

15. The ditch starts just north of Charlton Road junction with Hetherington Road and travels east behind Ashford Water Treatment Works towards the M3. It continues along Nursery Road crossing Green street and eastwards across The Avenue, along Batavia Road before turning southeast along Staines Road East then south along Markway then joining the Markway Ditch. The Markway Ditch runs southward to the River Thames. The ditch is generally piped through built up areas and the remainder open. Water from the storage lagoon at the water treatment works is often discharged into it.
16. These four watercourses form a network that is accessible by much of the surface water drainage not draining directly to the main rivers.

Site Specific Examples of Flooding

Stanwell Moor

17. The area around Hithermoor Road has been subjected to flooding on a number of occasions over the years, the most recent I believe in the winter 2001/2002. There are probably a number of reasons for this area being prone to flooding and certainly the number of ditches present in the immediate and surrounding areas suggest that historically this has always been so. On one occasion, around ten years ago, the major contributory factor to the flooding incident was an old mattress that had been dumped in one of the ditches behind houses therefore not easily seen. The mattress had effectively dammed the ditch and once removed the situation reverted to an acceptable level. The incident in 2001/2002 was primarily caused by flooding by the Colne. An added complication was the adding of foul sewage to the flood waters by a pumping station in the north in Poyle. The system normally pumps to another station located in Haws Lane. Unfortunately the pumps in Haws Lane could not cope with the volume resulting in much of the pumped sewage from the northern station overflowing into the flood waters.
18. Following one occurrence of flooding an investigation was undertaken to see if the ditch along Haws Lane could be brought up to a condition to relieve the situation. However, it was thought possible that this would simply cause further problems at Shortwood Pond, the eventual discharge point. (See example under that title).
19. There is some thought that the pumping from Heathrow Airport into local watercourses may have contributed to flooding in the area in the past.

Moor Lane, Staines

20. Moor Lane has suffered from flooding in various locations along its length from near to the M25 through to its junction with Wraysbury Road. The most recent occasion following heavy rain was at the southern end. Like the Stanwell Moor area the land adjoining Moor Lane is served by a number of ditches but on the eastern side the ditch in that location does not appear to have a discharge point. It does appear that the ditch at one time did fall to the Wraysbury River but possibly at the time of the construction of the railway link from Colnbrook to Staines the ditch was cut though no trace of it could be found when the land was redeveloped for housing (Wraysbury Gardens).

Shortwood Pond

21. Approximately six years ago the office block was affected by rising water from the adjacent pond in Shortwood Common. Investigation was carried out and it appeared that there had been at one time an outfall from the pond that led to the River Ash. The line could be followed but had silted up to only a depression in the ground. At that time discussion took place to carry out works funded by the owners of the offices but nothing came to fruition.

Acacia Road, Petersfield Road, Staines

22. In 1993 the River Ash overflowed in this area causing widespread flooding of back gardens and the common. Further flooding occurred along the Ash right down to Shepperton. The Ash at its start is from the Colne where it is controlled by a sluice gate.
23. From recollection the Colne at that time was in flood and the sluice gate was opened wider to relieve some pressure. More recently flooding on the common area resulted in complaints from residents not so much by the flooding but the time it took for the water to disperse. At that time an attempt was made to reform a ditch in the area but due to the presence of trees along its length it was difficult to achieve much more than a scrape as a greater dig would have caused major damage to the tree's roots. However, some improvement was achieved.

Long Lane, Stanwell

24. Possibly due to the poor condition of the piped watercourse along Long Lane the road has flooded on a number of occasions. Again, like Stanwell Moor, there is a possibility that water pumped from Heathrow Airport may have contributed to the problem in the past.

Bedfont Road, Stanwell

25. Similar situation to Long Lane but more dependant on soakaways.

Station Crescent, Ashford

26. The piped ditch from Stanwell runs through Salcombe Road crossing Station Crescent to an open section of ditch just before passing under the railway. A possible restriction at this point may be the cause of the problem.

Beechwood Avenue, Sunbury

27. Generally confined to the junction with Ashridge Way. Although soakaways are present it is thought that they are part of a linked system with an outfall to the Feltham Hill Brook.

Laytons Lane, Sunbury

28. Similar to Beechwood Avenue but with no outfall. Could be dealt with by connecting to the piped ditch on the northern side of Nursery Road.

Charlton Road, Shepperton

29. Charlton falls within a triangle of land bounded by the Thames Water aqueduct to the north, the Queen Mary reservoir to the west and the M3 motorway to the south-east. It appears that with the building of the M3 Charlton's natural sub soil drainage was cut off with only the River Ash acting as an outlet. Run off from The Queen Mary reservoir's steep banks contribute to the amount of water the natural drainage has to deal with. There is a ditch at the base of the reservoir's banks but there does not appear to be an outlet though there is some evidence one did exist in the past crossing New Road and south across fields to the Ash.

Ashford Road, Ashford Common

30. Running along the side of the Queen Mary reservoir much of the road's drainage runs to the ditch at the base of the reservoir's banks. At times of heavy rain the ditch cannot cope with the volume of surface water run off.

Watersplash Road, Shepperton

31. Near the junction with Ford Close. No apparent reason.

Chertsey Road Ashford

32. Near the junction with Dennis Close. No apparent reason.

Appendix B

Borough Character Areas – Assessment of Flood Risk

Borough Character Areas – Assessment of Flood Risk

1. The non-fluvial flooding information shown on the adjoining figures is the best digital data currently available from the Environment Agency. By its very nature, this information is less comprehensive and reliable than fluvial data where the latter has been derived from detailed modelling. The non-fluvial flooding information shown on the figures should therefore be treated with caution, particularly where any queries arise in specific locations.

Character Area SB1 – Staines: Sheet 1 of 3 (refer to Figure 6.1)

2. This area is situated north west of the Staines urban centre and includes the Thames Water Wraysbury Reservoir. With the exception of the small areas, along the County Ditch, Wraysbury and Colne rivers, which are situated within the Functional Floodplain Zone 3b and/or the High Probability Zone 3a(ii), the majority of the area is situated within Medium Probability Zone 2.
3. The area to the south west of the Wraysbury Reservoir is defended against fluvial flooding from the Colne Brook by a system of formal raised flood defences. The future sustainability of the area south west of the Wraysbury Reservoir is dependent upon the continued structural integrity of these flood defences.
4. The hazard posed to the public by a sudden failure of the formal raised flood defences has been considered. The results of the detailed breach analysis did not seem to pose a hazard to the community. This is due to the relatively low height of the formal raised flood defences which do not allow a significant build up of water (and therefore energy) behind the defences.
5. The risk that flooding as a result of a reservoir breach may pose to public safety has not been considered. Thames Water was consulted for flood plans, however, for security reasons no specific details could be provided. Thames Water provided assurance that the water supply reservoirs are actively managed and that all required safety standards are met. On this basis the possible risk of failure of these reservoirs is considered to be minimal.
6. Some drainage issues have been identified in this area, however, these are very localised in nature and in some instances are possibly maintenance related. No specific groundwater flooding issues have been identified in this area. These issues should not preclude development within this area.

Character Area SB2 – Staines: Sheet 2 of 3 (refer to Figure 6.2)

7. This area covers the northern part of the Staines urban extent, from south of the Thames Water Wraysbury Reservoir to the Spelthorne Borough Council offices in Knowle Green. This area is immediately south of the Thames Water King George VI and Staines Reservoirs.
8. With the exception of the Functional Floodplain Zone 3b and/or the High Probability Zone 3a(i) and (ii) areas, along the Lower Thames, County Ditch, Wraysbury and Ash Rivers, the majority of the area is situated within Medium Probability Zone 2. However, there are small areas situated within Low Probability Zone 1. There are a few areas which are defended against fluvial flooding from the Wraysbury River by a system of formal raised flood defences. The future sustainability of the areas in the vicinity of these defences is dependent upon the continued structural integrity of these flood defences. Equally there are formal raised flood defences on the River Colne system at the Thames Water aqueduct and the River Ash offtake which control the amount of water which could potentially flow down the Thames Water aqueduct and the River Ash. The future sustainability of the areas further downstream of these defences is dependent upon the continued structural integrity of these flood defences.

9. The hazard posed to the public by a sudden failure of the formal raised flood defences has been considered. Following a qualitative approach to the formal raised flood defences in this area it was concluded that a breach of these defences would not pose a hazard to the community. This is due to the relatively low height of the formal raised flood defences which do not allow a significant build up of water (and therefore energy) behind the defences.
10. The risk that flooding as a result of a reservoir breach may pose to public safety has not been considered. Thames Water was consulted for flood plans however, for security reasons no specific details could be provided. Thames Water provided assurance that the water supply reservoirs are actively managed and that all required safety standards are met. On this basis the possible risk of failure of these reservoirs is considered to be minimal.
11. Some drainage issues have been identified in this area, however, these are very localised in nature and in some instances are possibly maintenance related. Some groundwater flooding issues have also been identified in this area. These issues should not preclude development within this area.

Character Area SB3 – Staines: Sheet 3 of 3 (refer to Figure 6.3)

12. This area covers the southern part of the Staines urban extent, from the Spelthorne Borough Council offices in Knowle Green down to and including Penton Hook Island. This area does not include any Thames Water reservoirs, however, there are reservoirs to the north and east of the area.
13. With the exception of the Functional Floodplain Zone 3b and/or the High Probability Zone 3a(i) and (ii) areas, along the Lower Thames and Sweeps Ditch, the majority of the area is situated within Medium Probability Zone 2. However, there are small pockets situated within Low Probability Zone 1. These small pockets “dry islands” are generally surrounded by Medium Probability Zone 2 and therefore should be considered as part of Medium Probability Zone 2. There are designated formal raised flood defences indicated in this area along the Thames Water aqueduct by the Environment Agency. However, after discussions with the Environment Agency, it is understood that these are not generally recognised as formal raised flood defences.
14. The hazard posed to the public by a sudden failure of these raised flood defences has been considered. Following a qualitative approach to the raised flood defences in this area it was concluded that a breach of these defences would not pose a hazard to the community. This is due to the relatively low height of the raised flood defences which do not allow a significant build up of water (and therefore energy) behind the defences. However, failure of these defences may allow the Thames Water aqueduct to become an alternative flood route.
15. The risk that flooding as a result of a reservoir breach may pose to public safety has not been considered. Thames Water was consulted for flood plans however, for security reasons no specific details could be provided. Thames Water provided assurance that the water supply reservoirs are actively managed and that all required safety standards are met. On this basis the possible risk of failure of these reservoirs is considered to be minimal.
16. Some drainage issues have been identified in this area, however, these are very localised in nature and in some instances are possibly maintenance related. No specific groundwater flooding issues have been identified in this area. These issues should not preclude development within this area.

Character Area SB4 – Stanwell: Sheet 1 of 2 (refer to Figure 6.4)

17. This area includes Stanwell Moor which is a village to the west of Stanwell town. This area is just north of the Thames Water King George VI and Staines reservoirs.
18. With the exception of the Functional Floodplain Zone 3b and/or the High Probability Zone 3a(ii) areas, along the Stanwell Moor Ditch, Wraysbury and Colne Rivers, a significant portion of the area is situated within Medium Probability Zone 2. Equally there is a significant portion of the area situated within Low Probability Zone 1. There are no formal raised flood defences within this area.
19. The risk that flooding as a result of a reservoir breach may pose to public safety has not been considered. Thames Water was consulted for flood plans however, for security reasons no specific details could be provided. Thames Water provided assurance that the water supply reservoirs are actively managed and that all required safety standards are met. On this basis the possible risk of failure of these reservoirs is considered to be minimal.
20. Some drainage issues have been identified in this area, however, these are very localised in nature and are possibly caused by ponding due to the flat topography in the area following prolonged periods of rainfall. In some instances these problems could be maintenance related, associated with (for example) blockages. No specific groundwater flooding issues have been identified in this area. These issues should not preclude development within this area.

Character Area SB5 – Stanwell: Sheet 2 of 2 (refer to Figure 6.5)

21. This area includes the town of Stanwell which is situated east of the Staines Reservoirs and south east of Heathrow Airport. This entire area is situated within Low Probability Zone 1. Although it should be noted that no detailed modelling of the Stanwell and West Bedfont ditch catchments, which include culverted sections, has been undertaken.
22. The risk that flooding as a result of a reservoir breach may pose to public safety has not been considered. Thames Water was consulted for flood plans however, for security reasons no specific details could be provided. Thames Water provided assurance that the water supply reservoirs are actively managed and that all required safety standards are met. On this basis the possible risk of failure of these reservoirs is considered to be minimal.
23. Some drainage issues have been identified in this area, however, these are very localised in nature and are possibly caused by ponding due to the flat topography in the area following prolonged periods of rainfall. In some instances these problems could be maintenance related, associated with (for example) blockages. No specific groundwater flooding issues have been identified in this area. These issues should not preclude development within this area.

Character Area SB6 – Ashford: Sheet 1 of 2 (refer to Figure 6.6)

24. This area covers the western urban extent of Ashford which is situated to the east of Staines and south of Stanwell. This area is situated south east of the Thames Water Staines Reservoirs and north of the Thames Water Queen Mary Reservoir. With the exception of the small areas, along the River Ash, which are situated within the Functional Floodplain Zone 3b and/or the High Probability Zone 3a(ii), only part of this area is situated within Medium Probability Zone 2. The majority of the area is situated within Low Probability Zone 1.

25. There are no flood defences within this area, however, the failure of raised flood defences further upstream could result in an increase in flow in the Thames Water aqueduct and the River Ash. The hazard posed to the public by a sudden failure of the formal raised flood defences has been considered. Following a qualitative approach to the formal raised flood defences upstream of this area it was concluded that a breach of these defences would not pose a hazard to the community. This is due to the relatively low height of the formal raised flood defences which do not allow a significant build up of water (and therefore energy) behind the defences.
26. The risk that flooding as a result of a reservoir breach may pose to public safety has not been considered. Thames Water was consulted for flood plans however, for security reasons no specific details could be provided. Thames Water provided assurance that the water supply reservoirs are actively managed and that all required safety standards are met. On this basis the possible risk of failure of these reservoirs is considered to be minimal.
27. Some drainage issues have been identified in this area, however, these are very localised in nature and in some instances are possibly maintenance related. No groundwater flooding issues have been identified in this area. These issues should not preclude development within this area.

Character Area SB7 – Ashford: Sheet 2 of 2 (refer to Figure 6.7)

28. This area covers the eastern urban extent of Ashford which is situated to the east of Sunbury Common (area of Sunbury north of M3 Motorway) and immediately north of the Thames Water Queen Mary Reservoir. With the exception of the flood risk zones identified for Character Area SB6 above, the remainder of this area is situated within Low Probability Zone 1.
29. There are no flood defences within this area, however, the failure of raised flood defences further upstream could result in an increase in flow in the Thames Water aqueduct and the River Ash. The hazard posed to the public by a sudden failure of the formal raised flood defences has been considered. Following a qualitative approach to the formal raised flood defences upstream of this area it was concluded that a breach of these defences would not pose a hazard to the community. This is due to the relatively low height of the formal raised flood defences which do not allow a significant build up of water (and therefore energy) behind the defences.
30. The risk that flooding as a result of a reservoir breach may pose to public safety has not been considered. Thames Water was consulted for flood plans however, for security reasons no specific details could be provided. Thames Water provided assurance that the water supply reservoirs are actively managed and that all required safety standards are met. On this basis the possible risk of failure of these reservoirs is considered to be minimal.
31. No specific localised and/or groundwater flooding issues have been identified that should preclude development within this area.

Character Area SB8 – Shepperton: Sheet 1 of 4 (refer to Figure 6.8)

32. This area is situated north west of Shepperton town boundary and includes the smaller communities of Laleham and Littleton. This area is situated south west of the Thames Water Queen Mary Reservoir. With the exception of the areas, along the River Ash and the River Thames, which are situated within the Functional Floodplain Zone 3b and/or the High Probability Zone 3a(ii), the majority of the area is situated within either the High Probability Zone 3a(ii) or the Medium Probability Zone 2. There are small areas which are situated within the Low Probability Zone 1.

33. There are designated formal raised flood defences indicated in this area along the Thames Water aqueduct by the Environment Agency. After discussions with the Environment Agency, it is understood that these are not generally recognised as formal raised flood defences. However, the failure of raised flood defences further upstream could result in an increase in flow in the River Ash. The hazard posed to the public by a sudden failure of the formal raised flood defences has been considered. Following a qualitative approach to the formal raised flood defences upstream of this area it was concluded that a breach of these defences would not pose a hazard to the community. This is due to the relatively low height of the formal raised flood defences which do not allow a significant build up of water (and therefore energy) behind the defences.
34. The risk that flooding as a result of a reservoir breach may pose to public safety has not been considered. Thames Water was consulted for flood plans however, for security reasons no specific details could be provided. Thames Water provided assurance that the water supply reservoirs are actively managed and that all required safety standards are met. On this basis the possible risk of failure of these reservoirs is considered to be minimal.
35. Some drainage issues have been identified in this area, however, these are very localised in nature and in some instances are possibly maintenance related. It is understood that some groundwater flooding issues have been identified in this area. These issues should not preclude development within this area.

Character Area SB9 – Shepperton: Sheet 2 of 4 (refer to Figure 6.9)

36. This area is situated north east of the Shepperton town boundary and includes Shepperton and the smaller communities of Upper Halliford and part of Lower Halliford. This area is situated south east of the Thames Water Queen Mary Reservoir. With the exception of the areas, along the River Ash and Pool End Ditch, which are situated within the Functional Floodplain Zone 3b and/or the High Probability Zone 3a(i) and Zone 3a(ii) areas, a significant proportion of the area is situated within either the High Probability Zone 3a(ii) or the Medium Probability Zone 2. There are small pockets which are situated within the Low Probability Zone 1. These small pockets “dry islands” are generally surrounded by Medium Probability Zone 2 and therefore should be considered as part of Medium Probability Zone 2.
37. There is a designated formal raised flood defence indicated by the Environment Agency in this area along the River Ash at Catlin Crescent. After discussions with the Environment Agency, it is understood that this flood defence does not generally act as a raised flood defence. However, the failure of raised flood defences further upstream could result in an increase in flow in the River Ash. The hazard posed to the public by a sudden failure of the formal raised flood defences has been considered. Following a qualitative approach to the formal raised flood defences upstream of this area it was concluded that a breach of these defences would not pose a hazard to the community. This is due to the relatively low height of the formal raised flood defences which do not allow a significant build up of water (and therefore energy) behind the defences.
38. The risk that flooding as a result of a reservoir breach may pose to public safety has not been considered. Thames Water was consulted for flood plans however, for security reasons no specific details could be provided. Thames Water provided assurance that the water supply reservoirs are actively managed and that all required safety standards are met. On this basis the possible risk of failure of these reservoirs is considered to be minimal.
39. Some drainage issues have been identified in this area, however, these are very localised in nature and in some instances are possibly maintenance related. It is understood that some groundwater flooding issues have been identified in this area. These issues should not preclude development within this area.

Character Area SB10 – Shepperton: Sheet 3 of 4 (refer to Figure 6.10)

40. This area is situated south west of the Shepperton town boundary and includes Shepperton and part of Lower Halliford. This area is situated south of the Thames Water Queen Mary Reservoir. With the exception of the areas, along the River Ash, River Thames and Pool End Ditch, which are situated within the Functional Floodplain Zone 3b and/or the High Probability Zone 3a(i) and Zone 3a(ii) areas, a significant proportion of the area is situated within either the High Probability Zone 3a(ii) or the Medium Probability Zone 2. There are small pockets which are situated within the Low Probability Zone 1. These small pockets “dry islands” are generally surrounded by Medium Probability Zone 2 and therefore should be considered as part of Medium Probability Zone 2.
41. There are no flood defences within this area, however, the failure of raised flood defences further upstream could result in an increase in flow in the River Ash. The hazard posed to the public by a sudden failure of the formal raised flood defences has been considered. Following a qualitative approach to the formal raised flood defences upstream of this area it was concluded that a breach of these defences would not pose a hazard to the community. This is due to the relatively low height of the formal raised flood defences which do not allow a significant build up of water (and therefore energy) behind the defences.
42. The risk that flooding as a result of a reservoir breach may pose to public safety has not been considered. Thames Water was consulted for flood plans however, for security reasons no specific details could be provided. Thames Water provided assurance that the water supply reservoirs are actively managed and that all required safety standards are met. On this basis the possible risk of failure of these reservoirs is considered to be minimal.
43. Some drainage issues have been identified in this area, however, these are very localised in nature and in some instances are possibly maintenance related. It is understood that some groundwater flooding issues have been identified in this area. These issues should not preclude development within this area.

Character Area SB11 – Shepperton: Sheet 4 of 4 (refer to Figure 6.11)

44. This area is situated south east of the Shepperton town boundary and includes Shepperton and the smaller community of Lower Halliford. This area is situated south east of the Thames Water Queen Mary Reservoir. With the exception of the areas, along the River Ash, River Thames and Pool End Ditch, which are situated within the Functional Floodplain Zone 3b and/or the High Probability Zone 3a(i) and 3a(ii) areas, a significant proportion of the area is situated within either the High Probability Zone 3a(ii) or the Medium Probability Zone 2. There are small pockets which are situated within the Low Probability Zone 1. These small pockets “dry islands” are generally surrounded by Medium Probability Zone 2 and therefore should be considered as part of Medium Probability Zone 2.
45. There are no flood defences within this area, however, the failure of raised flood defences further upstream could result in an increase in flow in the River Ash. The hazard posed to the public by a sudden failure of the formal raised flood defences has been considered. Following a qualitative approach to the formal raised flood defences upstream of this area it was concluded that a breach of these defences would not pose a hazard to the community. This is due to the relatively low height of the formal raised flood defences which do not allow a significant build up of water (and therefore energy) behind the defences.
46. The risk that flooding as a result of a reservoir breach may pose to public safety has not been considered. Thames Water was consulted for flood plans however, for security reasons no specific details could be provided. Thames Water provided assurance that the water supply reservoirs are actively managed and that all required safety standards are met. On this basis the possible risk of failure of these reservoirs is considered to be minimal.

47. No specific localised and/or groundwater flooding issues have been identified that should preclude development within this area.

Character Area SB12 – Sunbury: Sheet 1 of 3 (refer to Figure 6.12)

48. This area is situated west of Ashford town and includes the area of Sunbury Common north of the M3 Motorway and part of Lower Sunbury. Part of the area, near the water works is immediately east of the Thames Water Queen Mary Reservoir. With the exception of the areas in the vicinity of the water works, which are situated within the Medium Probability Zone 2, the majority of the area is situated within Low Probability Zone 1. There are no formal raised flood defences within this area.
49. The risk that flooding as a result of a reservoir breach may pose to public safety has not been considered. Thames Water was consulted for flood plans however, for security reasons no specific details could be provided. Thames Water provided assurance that the water supply reservoirs are actively managed and that all required safety standards are met. On this basis the possible risk of failure of these reservoirs is considered to be minimal.
50. Some drainage issues have been identified in this area, however, these are very localised in nature and in some instances are possibly maintenance related. It is understood that some groundwater flooding issues have been identified in this area. These issues should not preclude development within this area.

Character Area SB13 – Sunbury: Sheet 2 of 3 (refer to Figure 6.13)

51. This area is situated west of Shepperton and Ashford towns. It includes part of Sunbury Common north of the M3 Motorway and part of Lower Sunbury. Sunbury Common is east of the Thames Water Queen Mary Reservoir. With the exception of the areas in the vicinity of the River Thames, which are situated within the Functional Floodplain Zone 3b and/or the High Probability Zone 3a(ii), the remainder of the area is situated within either the Medium Probability Zone 2 or the Low Probability Zone 1. There are no formal raised flood defences within this area.
52. The risk that flooding as a result of a reservoir breach may pose to public safety has not been considered. Thames Water was consulted for flood plans however, for security reasons no specific details could be provided. Thames Water provided assurance that the water supply reservoirs are actively managed and that all required safety standards are met. On this basis the possible risk of failure of these reservoirs is considered to be minimal.
53. Some drainage issues have been identified in this area, however, these are very localised in nature and in some instances are possibly maintenance related. It is understood that some groundwater flooding issues have been identified in this area. These issues should not preclude development within this area.

Character Area SB14 – Sunbury: Sheet 3 of 3 (refer to Figure 6.14)

54. This area is situated west of Shepperton town. It includes part of Lower Sunbury south of the M3 Motorway. This area is situated south east of the Thames Water Queen Mary Reservoir. With the exception of the areas in the vicinity of the River Thames, which are situated within the Functional Floodplain Zone 3b and/or the High Probability Zone 3a(ii), the remainder of the area is situated within either the Medium Probability Zone 2 or the Low Probability Zone 1. These small pockets of Low Probability Zone 1 or “dry islands” are generally surrounded by Medium Probability Zone 2 and therefore should be considered as part of Medium Probability Zone 2. There are no formal raised flood defences within this area.

55. The risk that flooding as a result of a reservoir breach may pose to public safety has not been considered. Thames Water was consulted for flood plans however, for security reasons no specific details could be provided. Thames Water provided assurance that the water supply reservoirs are actively managed and that all required safety standards are met. On this basis the possible risk of failure of these reservoirs is considered to be minimal.
56. Some drainage issues have been identified in this area, however, these are very localised in nature and in some instances are possibly maintenance related. No groundwater flooding issues have been identified in this area. These issues should not preclude development within this area.

Remaining Areas of the Borough

57. All remaining areas are situated on higher ground within Low Probability Zone 1, and/or are not subject to any future development pressures (refer Figure 6.0). Some localised drainage and/or groundwater issues may exist, as indicated in the adjoining Figures 6.0 to 6.14), however these should not preclude future development.
58. There are no flood risk related constraints placed upon future development within Low Probability Zone 1 (in accordance with PPS25). Notwithstanding this, a Drainage Impact Assessment will be required in compliance with current guidance and policy. This will involve the introduction of SuDS techniques. Any SuDS design must take due account of groundwater and geological conditions.