

Appendix C: SFRA

London Borough of Southwark Strategic Flood Risk Assessment (SFRA)

February 2008 (Final Rev01)



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EXECUTIVE SUMMARY

Introduction

1. The London Borough of Southwark lies in the centre of London, extending from the River Thames to Dulwich, some 8km to the south. The northern boundary of the borough is bounded by the River Thames for approximately 7km. There are no other main watercourses within the borough, all other drainage catchments having historically been incorporated into the main sewerage system. The borough covers an area of approximately 30 square kilometres and has a population of 244,866 distributed within 105,806 households (2001 Census¹).
2. It is important to recognise that some of those areas that are at risk of flooding in the Borough are under pressure from future development. It is essential therefore that the Council are in a position to take informed decisions, providing a careful balance between the risk of flooding and other unrelated planning constraints that may place pressure upon 'at risk' areas. The Southwark Borough SFRA endeavours to provide specific advice to assist the Council in this regard.
3. **This report (and the supporting mapping) represents the Level 1 SFRA², and should be used by the Council to inform the application of the Sequential Test.** Following the application of the Sequential Test, it may be necessary to develop a Level 2 SFRA³ should it be shown that proposed allocations fall within a flood affected area of the borough. The Level 2 SFRA should consider the risk of flooding in greater detail within a local context to ensure that the site can be developed in a safe and sustainable manner.

Outcomes of the Southwark Borough SFRA

4. The London Borough of Southwark has been delineated into zones of low, medium and high probability of fluvial and tidal flooding, based upon existing available information provided by the Environment Agency. A further assessment of flood hazard within defended areas adjoining the River Thames has also been carried out for planning purposes (refer Section 5). The spatial variation in fluvial (river) flood risk across the borough has been delineated in the following manner:

Zone 3b (Functional Floodplain)

5. Areas subject to flooding in the 5% (20 year) design event have been delineated as Zone 3b Functional Floodplain. The London Borough of Southwark is defended against flooding from the River Thames, and consequently Zone 3b Functional Floodplain is restricted purely to areas situated on the river side of the raised defence line.

Zone 3a High Probability

6. Areas subject to flooding in the 0.5% (1000 year) design event⁴ have been delineated as Zone 3a High Probability. This encompasses the northern areas of the borough, extending from the River Thames to Camberwell. Development within these areas may only be considered following application of the Sequential Test, and 'more vulnerable' development should be avoided wherever possible.

¹ It is highlighted that steady population growth within the borough in the proceeding 6 years will have increased the number of people residing within areas at risk of flooding

² Refer paragraphs 2.32 to 2.35 of the Living Draft of the Practice Guide Companion to PPS25 (February 2007)

³ Refer paragraphs 2.36 to 2.42 of the Living Draft of the Practice Guide Companion to PPS25(February 2007)

⁴ Tidal Flooding

7. The SFRA has outlined specific development control recommendations that should be placed upon development within Zone 3a High Probability to minimise the damage to property, the risk to life in case of flooding, and the need for sustainable drainage techniques (SuDS). It is essential that the developer carries out a detailed Flood Risk Assessment to consider the site-based constraints that flooding may place upon the proposed development.

Zone 2 Medium Probability

8. Areas subject to flooding in events exceeding the 0.5% (1000 year) event⁵, and up to (and including) the 0.1% (1000 year) event have been delineated as Zone 2 Medium Probability. Within the borough of Southwark fall, Zone 2 Medium Probability is restricted purely to the periphery of the River Thames floodplain in Camberwell, and isolated 'islands' (i.e. elevated areas) within the floodplain.
9. 'Highly Vulnerable Development'⁶, for example emergency services, should be avoided in these areas. There are generally no other restrictions placed upon land use in these areas, however it is important to ensure that the developer takes account of possible climate change impacts to avoid a possible increase in the risk of flooding in future years (achieved through completion of a simple Flood Risk Assessment).

Zone 1 Low Probability

10. There are no restrictions placed on land use within Zone 1 Low Probability (i.e. all remaining areas of the borough) by PPS25. It is essential however that consideration is given to the potential risk of flooding from other sources (outlined in 'Localised Flooding Issues' below), ensuring that future development is not inadvertently placed at risk. It is also essential to ensure that future development does not exacerbate the current risk posed to existing homes and businesses.

Localised Flooding Issues

11. Properties and infrastructure within the London Borough of Southwark are also at risk of flooding from other sources. These include surcharging of the underground sewer system, the blockage of culverts and gullies (which results in overland flow), and surface water flooding. Evidence of localised flooding of this nature has been captured through consultation with local authorities, Thames Water and the Environment Agency, and is provided in Figures 2 and 4.
12. PPS25 does not address issues of this nature within its delineation of flood zones and what development is acceptable within them. Incidents of this nature can be often be addressed through the design process, and therefore will not generally affect decision making with respect the allocation (or otherwise) of sites within the borough. The recent flooding throughout England highlights that this is certainly not always the case however, and uncontrolled flooding as a result of particularly heavy rains can create significant damage and disruption.
13. The PPS25 Practice Guide (A Living Draft, February 2007) advocates the application of a sequential approach when allocating land, taking into consideration *all* sources of flooding. From a spatial planning perspective, it is widely considered generally unreasonable to restrict future development within areas that may have suffered a localised flooding incident in years past.

⁵ Tidal Flooding

⁶ Refer Table D2 (Appendix D) of PPS25

14. It is essential however not to overlook the potential risk of localised flooding during the design process. Whilst the incidents that have been identified will typically not result in widespread damage or disruption, a proactive approach to risk reduction through design can mitigate the potential for damage, both to the development itself and elsewhere. Specific development control recommendations have been provided accordingly (refer Section 6.4).
15. As a minimum, the implementation of sustainable drainage systems (SuDS) must be ensured and careful consideration to overland flow routes (and avoidance of their obstruction), as part of the site design, should be encouraged.

A Proactive Approach – Reduction in Flood Risk

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

The Way Forward

18. Planning policy needs to be informed about the risk posed by flooding. A collation of potential sources of flood risk has been carried out in accordance with PPS25, developed in close consultation with both the Council and the Environment Agency. The Borough has been broken down into zones of 'high', 'medium' and 'low' probability of flooding in accordance with PPS25, providing the basis for the application of the PPS25 Sequential Test.
19. A planning solution to flood risk management should be sought wherever possible, steering vulnerable development away from areas affected by flooding in accordance with the PPS25 Sequential Test. Specific planning recommendations have been provided for all urban centres within the borough (refer Section 6.4).
20. 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. These should be applied as development control conditions for all future development (refer Section 6.4.4).
21. Council policy is essential to ensure that the recommended development control conditions can be imposed consistently at the planning application stage. This is essential to achieve future sustainability within the Borough with respect to flood risk management. It is recommended that supplementary planning guidance is developed to build upon emerging Council policy, in light of the suggested development control conditions presented by the Southwark Borough SFRA.
22. Emergency planning is imperative to minimise the risk to life posed by flooding within the Borough. It is recommended that the Council advises the local Resilience Forum of the risks raised in light of the Southwark SFRA, ensuring that the planning for future emergency response can be reviewed accordingly.

A Living Document

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

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Glossary

AEP	Annual Exceedance Probability e.g. 1% AEP is equivalent to 1% probability of flooding occurring in any one year (or, on average, once in every 100 years)
Core Strategy	The Development Plan Document within the Council's Local Development Framework, which sets the long-term vision and objectives for the area. It contains a set of strategic policies that are required to deliver the vision including the broad approach to development.
DCLG	Department of Community and Local Government
Defra	Department of Environment, Food and Rural Affairs
Development	The carrying out of building, engineering, mining or other operations, in, on, over or under land, or the making of any material change in the use of a building or other land.
Development Plan Document (DPD)	A spatial planning document within the Council's Local Development Framework, which set out policies for development and the use of land. Together with the Regional Spatial Strategy, they form the development plan for the area. They are subject to independent examination.
EA	Environment Agency
Flood Zone Map	Nationally consistent delineation of 'high' and 'medium' flood risk, published on a quarterly basis by the Environment Agency
Formal Flood Defence	A structure built and maintained specifically for flood defence purposes
Informal Flood Defence	A structure that provides a flood defence function, however has not been built and/or maintained for this purpose (e.g. boundary wall)
Local Development Framework (LDF)	Consists of a number of documents which together form the spatial strategy for development and the use of land
Zone 1 Low Probability	PPS25 Flood Zone, defined as areas outside of Zone 2 Medium Probability
Zone 2 Medium Probability	PPS25 Flood Zone, defined as areas at risk of flooding in events that are greater than the 1% AEP (1 in 100) for rivers or the 0.5% AEP (1 in 200) design event from the sea, and less than the 0.1% AEP (1 in 1000) design event
Zone 3a High Probability	PPS25 Flood Zone, defined as areas at risk of flooding in the 1% AEP (1 in 100) design event from rivers, or the 0.5% AEP (1 in 200) design event from the sea
Zone 3b Functional Floodplain	PPS25 Flood Zone, defined as areas at risk of flooding in the 5% AEP (1 in 20 chance) design event
Planning Policy Statement (PPS)	A series of statements issues by the Government, setting out policy guidance on different aspects of planning. They replace Planning Policy Guidance Notes

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.
PPS25	Planning Policy Statement 25: Development and Flood Risk Department of Community & Local Government, 2006
Previously Developed (Brownfield) Land	Land which is or was occupied by a building (excluding those used for agriculture and forestry). It also includes land within the curtilage of the building, for example, a house and its garden would be considered to be previously developed land.
Residual Risk	A measure of the outstanding flood risks and uncertainties that have not been explicitly quantified and/or accounted for as part of the review process
SEA	Strategic Environmental Assessment
SUDS	Sustainable Drainage System
Supplementary Planning Document (SPD)	Provides supplementary guidance to policies and proposals contained within Development Plan Documents. They do not form part of the development plan, nor are they subject to independent examination.
Sustainability Appraisal (SA)	Appraisal of plans, strategies and proposals to test them against broad sustainability objectives.
Sustainable Development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (The World Commission on Environment and Development, 1987).

1 Introduction

1.1 Overview

25. The London Borough of Southwark lies in the centre of London, extending from the River Thames to Dulwich, some 8km to the south. The northern boundary of the borough is bounded by the River Thames for approximately 7km. There are no other main watercourses within the borough, all other drainage catchments having historically been incorporated into the main sewerage system.
26. The borough covers an area of approximately 30 square kilometres and has a population of 244,866 distributed within 105,806 households (2001 Census⁷).
27. Half of the area of land within the borough is in the floodplain. 178,000 people (an average of 119 people per hectare) live in this area, which is the second highest population living within the floodplain of local authorities in England and Wales. However, because the National Flood Risk Assessment (NaFRA), from which these statistics are taken, takes into account the condition of flood defences, all of the land area is defined as having a low chance of flooding because of the flood defences along the River Thames.⁸
28. The numbers of properties falling within the Environment Agency's current Flood Zone mapping is shown in the following table

Table 1.1 Flood Zone properties statistics for the London Borough of Southwark⁹ (refer Figure 2A)

Flood Zone	Total properties at risk (residential & non residential)	Percentage of borough's properties
Flood Zone 2 - Medium Probability areas at risk of flooding in events that are greater than the 0.5% AEP (1 in 200) event from tidal flooding, and less than the 0.1% AEP (1 in 1000) event	1132	0.4
Flood Zone 3 – High Probability areas at risk of flooding in the 0.5% AEP (1 in 200) event from tidal flooding	176695	66.4

29. The River Thames has posed a risk of flooding to London for millennia, and as the city grew, the river became more and more constrained by urban development. The natural floodplain of the River Thames within London is now almost fully developed, and boroughs such as Southwark are heavily dependant upon manmade flood defences to protect against the risk of flooding. Substantial investment has been committed to the protection of London, both now and into the future, as set out by the TE2100 Strategy (Environment Agency).

⁷ It is highlighted that steady population growth within the borough in the proceeding 6 years will have increased the number of people residing within areas at risk of flooding

⁸ Environment Agency Flood Risk Data Report (March 2007 - based on information from April 2006)

⁹ Data supplied by the Environment Agency June 2007

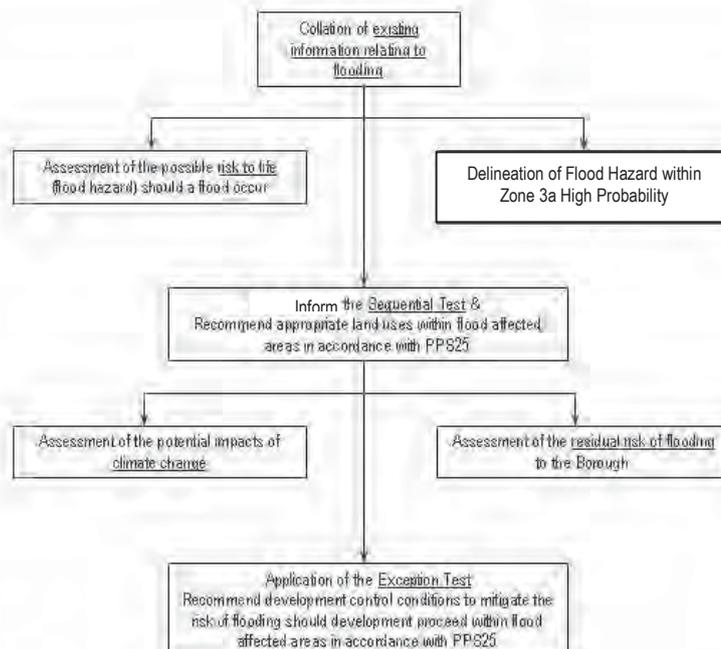
30. The River Thames Tidal Defences (TTD) are critical to the future sustainability of Southwark, comprising a series of raised defences along the river frontage, and the operation of the Thames Barrier to prevent the incursion of surge tides. These are manmade defences however, and when considering development that will still be servicing the local population some 100 years from now, it is essential to take planning decisions with a clear understanding of the potential risks posed should this investment in flood defence be withdrawn in future years.
31. **The Environment Agency wholly support the underlying principles of PPS25, and a clear and consistent policy message resounds through all strategic plans established for the management of flood risk within the River Thames corridor, including both the Thames CFMP and the TE2100 Strategy. This is one of *risk reduction* through the planning process.** It is widely recognised that funding for flood defence is finite, and engineered structures will always have a residual risk of failure, as demonstrated in New Orleans in 2005. Consequently planning decisions must not simply presume that flood defence will be provided into the future, but should seek to mitigate this risk through the planning process (through allocation, and then design). The Southwark SFRA has been developed accordingly.
32. Jacobs was commissioned to develop the Southwark borough Strategic Flood Risk Assessment (SFRA) in May 2007. The London Borough of Southwark is currently reviewing its planning framework, and this SFRA supplements the evidence base that informs this review process. The SFRA is a technical document that will be submitted to the Secretary of State with the submission Core Strategy and supporting Development Planning Document (DPD). This SFRA will be developed and refined over time and will feed into the Council's emerging 'preferred options' for site allocation.

1.2 Future Development in Southwark Borough

33. Southwark is the largest housing landlord in London and the sixth largest in the country with 40,000 homes. These homes are concentrated in the north of the borough, primarily on very large estates. They include the Heygate Estate at the Elephant and Castle, the Aylesbury estate, the north Peckham estates, the Neckinger Estate in Bermondsey, The Tustin Estate on the Old Kent Road and the Canada Estate in Rotherhithe. Most of these estates are within areas of deprivation, measured against a range of indicators including quality of the environment, pollution and health. Council projects to regenerate and improve these estates are therefore vital
34. A key objective of Southwark's Sustainable Community Strategy and Corporate Plan are to regenerate these areas and provide more and better quality homes, improved access to employment and public services and improved quality of the environment. All local authority and housing association housing needs to be brought up to decent home standard, either through refurbishment or rebuilding. New development is needed to provide the investment that will drive much of this regeneration
35. Southwark needs to help accommodate London's continued growth within its urban boundaries without encroaching on open spaces. This includes providing at least 16,300 extra homes between 2007/8 and 2016/7 and accommodating more business floor space. More community facilities, shops and services will be needed to serve a growing population. Much of this development needs to occur in the north of the borough where major centres and transfer infrastructure is located. The north of the borough contains development areas of London-wide importance, as identified in the London Plan. These include the Elephant and Castle and London Bridge Opportunity Areas, part of the Central Activities Zone. Further alterations to the London Plan also extend the London Bridge Opportunity Area westwards to cover Borough and Bankside and designates Canada Water and Surrey Quays as an Area for Intensification.

2 SFRA Approach

36. The primary objective of the SFRA is to inform the revision of flooding policies, including the allocation of land for future development, within the emerging Local Development Framework (LDF). The SFRA has a broader purpose however, and in providing a robust depiction of flood risk across the borough, it can:
- Inform the development of Council policy that will underpin decision making within the borough, particularly within areas that are affected by (and/or may adversely impact upon) flooding;
 - Assist the development control process by providing a more informed response to development proposals affected by flooding, influencing the design of future development within the borough;
 - Help to identify and implement strategic solutions to flood risk, providing the basis for possible future flood attenuation works;
 - Support and inform the Council's emergency planning response to flooding.
37. 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.
38. 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 SFRA has built upon this existing knowledge, underpinning the delineation of the borough into zones of flood hazard (or risk to life). These zones have then been used to provide a robust and transparent evidence base to inform flooding related policy, and the allocation of sites for future housing and employment uses.
39. It is important to recognise that the risk of flooding is assessed within the SFRA assuming *the absence of flood defences*. This is important when considering the risk of flooding over the long term, as indeed future investment in flood defence cannot be guaranteed. Planning decisions must be taken with due recognition of the residual risk to property and life should defences fail in years to come.
40. A summary of the adopted SFRA process is provided in the figure below, outlining the specific tasks undertaken and the corresponding structure of the SFRA report.



41. The River Thames catchment encompasses a large number of boroughs within the Greater London area, and future development within the region could severely influence the risk of flooding posed to neighbouring areas if not carefully managed. It is imperative that all local authorities clearly understand the core issues that flood risk raises within their respective boroughs, and adapt their decision making accordingly. They must be aware of the impact that their planning decisions may have, not only locally, but upon adjoining boroughs along the River Thames.
42. A number of authorities across Greater London are beginning to carry out similar strategic flood risk investigations. These will help provide the evidence base for the Core Strategies and Site Specific development allocations that will form part of the Local Development Frameworks that all local planning authorities must now produce. Whilst the delivery teams and programmes underpinning these studies vary from one district to the next, all are being developed in close liaison with the Environment Agency. Consistency in the adopted approach and decision making with respect to the effective management of flood risk throughout the sub region is imperative. Regular discussions with the Environment Agency have been carried out throughout the SFRA process to this end, seeking clarity and consistency where needed.

3 Policy Framework

3.1 Introduction

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

3.2 National Policy

3.2.1 Introduction

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

3.2.2 Planning Policy Statement 25: Development and Flood Risk¹⁰

46. Planning Policy Statement 25 (PPS25) was published in December 2006 and sets out the planning objectives for flood risk management. It states that all forms of flooding and their impacts are material planning considerations, which gives much weight to the issue of flooding. The aim of PPS25 is to ensure that flood risk is taken into account at all stages of the planning process in order to prevent inappropriate development in 'at risk' areas.
47. The key objectives for planning are appraising, managing and reducing flood risk. To *appraise* the risk it is stated that flood risk areas need to be identified, and that the level of risk needs to be identified. To facilitate this, PPS25 indicates that Regional Flood Risk Appraisals and Strategic Flood Risk Assessments should be prepared.
48. To *manage* the risk, Local Planning Authorities (LPAs) need to develop policies which "avoid flood risk to people and property where possible, and manage any residual risk, taking account of the impacts of climate change". LPAs should also only permit development in flood risk areas if there are no feasible alternatives located in areas of lower flood risk.
49. To *reduce* the risk, PPS25 indicates that land needed for current or future flood management should be safeguarded; new development should have an appropriate location, layout and design and incorporate sustainable drainage systems (SUDS); and new development should be seen as an opportunity to reduce the causes and impacts of flooding by measures such as provision of flood storage, use of SUDS, and re-creating the functional flood plain.
50. A partnership approach is stressed in PPS25 to ensure that LPAs work with partners such as the Environment Agency. The Environment Agency can provide both information and advice relating to flood risk, and should always be consulted when preparing policy or making decisions which will have an impact on flood risk.

¹⁰ Communities and Local Government (2006) Planning Policy Statement 25: Development and Flood Risk

51. The future impacts of climate change are highlighted in PPS25, as climate change will lead to increased flood risk in many places in the years ahead. When developing planning policy, LPAs need to consider if it is necessary to encourage the relocation of existing development to locations at less of a risk from flooding in order to prevent future impacts of flooding.
52. PPS25 also gives specific advice for determining planning applications, which needs to be considered when developing policy. LPAs should ensure that flood risk assessments (FRAs) are submitted with planning applications where this is appropriate; they should apply the sequential approach (defined in the PPS) which ensures that lower risk areas are considered preferable to higher risk areas; priority should be given to the use of SUDS; and new development should be designed to be resilient to flooding as appropriate.
53. The Practice Guide Companion to PPS25 was released in draft form for consultation by the Department for Communities and Local Government in February 2007, providing additional guidance on the principles set out in PPS25.

3.2.3 Planning Policy Statement: Planning and Climate Change

54. The planning policy statement 'Planning and Climate Change' was released in December 2007, and provides supplementary guidance for PPS1: Delivering Sustainable Development. The document highlights the issue of climate change, and sets out ways planning should prepare for its effects, which includes managing flood risk. Little detail is given about flooding in this document as PPS25 already does this.

3.3 Regional Planning Policy

3.3.1 The London Plan¹¹

55. The London Plan is the adopted regional spatial strategy relevant to Southwark. This document includes a number of policies relevant to flood risk in the London area within which Southwark is situated. The three key policies relate to flood plains; flood defences; and sustainable drainage.
56. The London Plan identifies that the management of flood risk is extremely pertinent to London. Consequently the Plan seeks to ensure that all future development minimises the risk of flooding within the Capital.
57. Further Alterations to the London Plan were published on 19 February 2008 and make changes to the key flooding policies in the adopted London Plan. The changes reinforce the importance of considering flood risk at *all* stages of the planning process. Paragraphs 4.37 and 4.38 state:

"Reduction in flood risk can be achieved through appropriate location, design and construction of development and the sustainable management of surface water run-off. Boroughs, either individually or collectively, will produce Strategic Flood Risk Assessments. Developers should determine, in consultation with the Environment Agency or the relevant borough, whether their proposed development site is at flood risk. Developers seeking to develop a site at flood risk should undertake an appropriate flood risk assessment. All flood risk management proposals should avoid increasing flood risk to neighbouring areas.

London is prone to flooding from five sources: tidal, fluvial, groundwater, surface and sewer flooding. Climate Change will increase the probability of flooding from all these sources except perhaps groundwater. The management of flood risk is critical to London's future. Our understanding of flood risk is increasing.

¹¹ Mayor of London (2004) The London Plan: Spatial Development Strategy for Greater London

The Mayor is undertaking a Regional Flood Risk Appraisal and the Environment Agency is undertaking the Thames Estuary 2100 project and the Thames Catchment Flood Management Plan. These will all be important tools in managing flood risk and will need to be reflected in future spatial planning documents and decisions.

Creating additional areas for flood storage will be an important flood risk management tool and the Environment Agency, Mayor and boroughs should work together to identify and safeguard such areas. These areas may have multiple uses."

58. Policy 4A.12 (Flooding) is particularly relevant stating that boroughs in reviewing their Development Plans should carry out strategic flood risk assessments to identify locations suitable for development and those required for flood risk management. Within these areas the assessment of development proposals should be carried out in line with PPS25. This SFRA document identifies the areas at risk from flooding within the London Borough of Southwark following the principles set out in PPS25.

59. New policy 4A.13 (Flood Risk Management) replaces former policy 4C.7 (Flood Defences):

"Where development in areas at risk from flooding is permitted (taking into account the provisions of PPS25), the Mayor will and the boroughs and other agencies should manage the existing risk of flooding, and the future increased risk and consequences of flooding as a result of Climate Change, by:

- *protecting the integrity of the existing flood defences;*
- *setting permanent built development back from existing flood defences to allow for the management, maintenance and upgrading of those defences to be undertaken in a sustainable and cost effective way;*
- *incorporating flood resilient design; and*
- *establishing flood warning and emergency procedures.*

Opportunities should be taken to identify and utilise areas for flood risk management, including the creation of new floodplain or the restoration of all or part of the natural floodplain to its original function, as well as using open space in the flood plain for the attenuation of flood water.

The Mayor will, and boroughs and other agencies should, take fully into account the emerging findings of the Thames Estuary 2100 Study, the Regional Flood Risk Appraisal and the Thames Catchment Flood Management Plan."

60. This is an issue for Southwark as the borough is defended from flooding by the Thames Tidal Defences. The London Borough of Southwark will need to ensure that any new development near to the defences is set back from them, and that any new development does not undermine the defences.

61. The revised policy 4A.14 (Sustainable Drainage) seeks to ensure that surface water run-off is managed close to its source and presents a hierarchy approach to sustainable drainage:

"The Mayor will, and boroughs should, seek to ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy:

- *store rainwater for later use*
- *use infiltration techniques, such as porous surfaces in non-clay areas*
- *attenuate rainwater in ponds or open water features for gradual release to a watercourse*
- *attenuate rainwater by storing in tanks or sealed water features for gradual release to a watercourse*
- *discharge rainwater direct to a watercourse*
- *discharge rainwater to a surface water drain*
- *discharge rainwater to the combined sewer.*

The use of sustainable urban drainage systems should be promoted for development unless there are practical reasons for not doing so. Such reasons may include the local ground conditions or density of development. In such cases, the developer should seek to manage as much run-off as possible on site and explore sustainable methods of managing the remainder as close as possible to the site.

The Mayor will encourage multi agency collaboration (GLA Group, Environment Agency, Thames Water) to identify sustainable solutions to strategic surface water and combined sewer drainage flooding/overflows.

Developers should aim to achieve greenfield run off from their site through incorporating rainwater harvesting and sustainable drainage. Boroughs should encourage the retention of soft landscaping in front gardens and other means of reducing, or at least not increasing, the amount of hard standing associated with existing homes."

62. Changes have been made to policy on ground water (now policy 4A.15) to reflect the current position of the GLA that the recent issue of rising ground water is now under control with a range of abstractions maintaining groundwater levels a sustainable levels. The issue will however be kept under review in case of any further fluctuations of groundwater levels. In considering major planning applications in areas where rising groundwater is an existing or potential problem steps should be taken to abstract and use that groundwater for cooling or watering purposes or even for use within the development or by a water supply company.
63. The Region's housing targets over the plan period are given in policy 3A.1 "Increasing London's Supply of Housing" and subsequent table SA.1. The London Plan sets Southwark a housing target of at least 16,300 extra homes between 2007/8 and 2016/17.
64. The policies mentioned above will need to be considered when the borough is considering how to allocate land, in particular, in order to meet development pressures such as the need for additional housing.

3.3.2 Draft Regional Flood Risk Appraisal

65. The Draft Regional Flood Risk Appraisal (RFRA) for London was published for informal consultation on 21 June 2007. It has been produced for the London Plan and is part of the Draft London Plan Implementation Report. It examines the nature and implication of flood risk in London and how the risk should be managed. The recommendations of specific relevance to the London Borough of Southwark are outlined below:
 - Recommendation No. 2 - All Thames-side planning authorities should put in place policies to promote the setting back of development from the river edge to enable sustainable and cost effective upgrade of river walls/embankments, in line with London Plan Policy 4C.6 (FALP policy 4A.5vi);
 - Recommendation No. 6 - Developments all across London should implement the Drainage Hierarchy set out in Policy 4A.5vii of the FALP (refer Section 6.6);
 - Recommendation No. 10 – Organisations responsible for development with large roof areas should investigate providing additional surface water runoff storage;
 - Further strategic recommendations are provided for key development types throughout the region including (for example) schools, hospitals and emergency services. These recommendations focus heavily upon ensuring that the risk of flooding is minimised through the design process.

3.3.3 Supplementary Planning Guidance – Sustainable Design & Construction¹²

66. Clause 2.4.4 of the SPG (Water Pollution and Flooding) sets out a series of standards that are to be sought through local planning policy. These form the framework within which the development control recommendations established within the Southwark SFRA have been developed (in consultation with the Council and the Environment Agency). The 'Essential Standards' sought through the SPG are:
- *use of SUDS measures wherever practical; and*
 - *achieve a 50% attenuation of the undeveloped site's surface water runoff at peak times*
67. Furthermore, the 'Mayor's Preferred Standard' is:
- *achieve a 100% attenuation of the undeveloped site's surface water runoff at peak times*
68. Specific guidance is provided to assist boroughs in the achievement of these desired standards, and these are outlined as following:
- *Incorporating Sustainable Drainage Systems (SuDS) - as an alternative to traditional approaches to managing runoff from buildings and hardstanding. SuDS reduce the total amount, flow and rate of surface water that runs directly to rivers through stormwater systems which is a contributory factor in flooding incidents and affects the biological quality of waterways. It may not be possible to achieve the preferred standard in situations where a proposed development is of high density, particularly in central London or town centres or where there are high levels of contamination in ground conditions.*
 - *Identifying potential sources of flooding and assessing their possible impacts both now and in the future - any development proposed needs to consider flood risk from a variety of possible sources, such as watercourses, groundwater, foul and surface water sewer and overland flow. The Environment Agency publishes flood maps showing tidal and non tidal river flood plains. Other sources will need to be considered on a more localized basis. All development must conform to the sequential test set out in PPG25 (now further developed in consultation on PPS25) and supported by the London Plan (Policy 4C.6). This makes it clear that development in functional floodplains or inappropriately defended floodplains should be wholly exceptional. Development should incorporate safe access routes above the flood levels likely during the design life of the development.*
 - *Adopt principles of flood resistant design - The Environment Agency is opposed to unsustainable land uses within areas of flood risk. It is working to influence development patterns to minimize risk, primarily by developing land outside flood plains first, followed by land at lowest risk in defended areas. Some forms of development need to be beside rivers, for example, boat clubs. These should be designed so that they can be flooded without causing any undue damage. In other areas development can be designed to be flood resistant. For example putting living accommodation on the first floor or building on stilts. Roof drainage can also be designed to cope with the higher levels of rainfall and increased occurrence of storms expected from climate change.*

3.3.4 Mayor's Draft Water Strategy (March 2007)

69. *"Most people in London expect to turn on the tap and get water without having to think about where it comes from. Equally, people want to be able to pull out the plug and let water run away without having to worry about what happens to it afterwards. However, changes are going on around us that mean that Londoners will have to pay more attention to where water comes from and goes to. London is a dynamic, growing city and, like other world cities, is facing the effects of a changing climate. Together these pressures will aggravate the stress on existing systems by placing:*

¹² Mayor of London (May 2006)

- *A greater demand for water from the mains network, and therefore from the environment;*
- *An increased flow to, and discharges from, the sewage treatment works*
- *A greater risk of surface flooding as rainwater runs off new houses, driveways and roads;*
- *An increase in storm and tidal surge;*
- *All in all, this means we will need increasingly to plan and co-ordinate all aspects of water management than in the past."*

70. To address these issues, the Draft Water Strategy sets out specific proposals for future management of water and wastewater within Greater London. These are outlined below.

"Chapter 7 – Disposal of Wastewater in London (Proposal 11)

As part of the next periodic review, the sewerage undertaker with the support of the London Boroughs should seek to establish a firm programme to remove those properties and areas in London from the risk register that are at risk of flooding from overloaded sewers."

"Chapter 8 – Flood Risk in London (Hierarchy 5)

The Mayor proposes the following hierarchy for managing floods in London:

- *Avoid types of development that are vulnerable to flooding in flood risk areas*
- *Where this is avoidable, reduce the vulnerability through design and construction techniques by providing space for rivers and tidal processes to occur. Also, by increasing the resilience of buildings to floods through design and construction techniques such as raising electrical services*
- *Alleviate the risk of flooding through flood defences."*

"Chapter 8 – Flood Risk in London (Proposal 13)

Developers should determine, in consultation with the Environment Agency, the sewerage undertaker, Transport for London and the relevant London Borough, whether their proposed development site is at risk from flooding. Developers seeking to develop a site at risk from flooding should undertake an appropriate flood risk assessment. All flood risk management proposals should avoid increasing flood risk to neighbouring areas."

3.4 Local Planning Policy

3.4.1 The Southwark Plan (UDP) 2007

71. The Southwark Plan (UDP) 2007 sets out the local planning strategy and policies for the borough.
72. Policy SP16 'River Thames' is concerned with developments within the area of the River Thames. It states: *"Developments should protect and enhance the river Thames and its environs. And where appropriate incorporate measures to protect against flooding."*
73. Policy 3.9 is concerned with surface run-off, stating that: *"New developments should not result in an increase in surface run-off, which could result in increased flood risk and pollution. Problems arising from surface run-off can be significantly reduced in the first instance through the careful design of developments. The LPA will require Major Developments to incorporate sustainable methods of drainage, unless it can be demonstrated that this is not practical."*
74. Policy 3.31 on Flood Defences adds further guidance stating that: *"Planning permission will not be granted for development sited adjacent to the River Thames unless it is set back at a suitable distance from the river wall to allow for the replacement/repair of flood defences and for any future raising to be undertaken in a sustainable and cost effective manner. Nor will permission be granted for any scheme that would undermine or breach flood defences in any way."*

75. These policies were drafted before the publication of PPS25. The policy wording in the borough's development plan will need to be updated to reflect PPS25 when the strategic policies for the LDF are drafted.

3.4.2 Southwark Local Development Framework

76. The Southwark Plan policies will be saved for three years (to 2010) before commencement with the Core Strategy. This SFRA will be used to supplement the evidence base of the Core Strategy in line with the principles set out in PPS25.
77. The emerging policy broadly set out in this chapter should be in keeping with the key underlying principles set out in PPS25. It is recommended that a Development Control Policies DPD, or a Supplementary Planning Document, be considered to set out the specific recommendations for future development within flood affected areas (as described in this document). These recommendations have been identified and agreed in close consultation with the Environment Agency and the Council. They represent the minimum design criteria that will be expected by the Environment Agency should development be permitted to proceed.
78. As part of the Southwark Local Development Framework three area action plans are being prepared for the Aylesbury Estate, Peckham and Rotherhithe areas of the borough. These documents will provide a framework that sets out how these areas will be developed over the coming years to ensure they become high quality sustainable communities. The area action plans will need to be developed having regard to flood risk issues in these areas.

4 Data Collection

4.1 Overview

79. A considerable amount of knowledge has been collated to inform the analysis (and delineation) of flood risk throughout the borough, including (but not limited to):
- Historical river flooding information;
 - Information relating to localised flooding issues (surface water, groundwater and/or sewer related), collated in consultation with the Council and the Environment Agency;
 - Locality and condition of raised flood defences;
 - Environment Agency Flood Zone Maps;
 - Topography (LiDAR).
80. This data has been sourced from key stakeholders, as highlighted below. The interpretation of this data to inform the delineation of zones of 'high', 'medium' and 'low' probability of flooding (to meet the requirements of PPS25) is outlined in Section 5. The formulation of planning and development control recommendations is provided in Section 6.

4.2 Consultation

81. Consultation has formed a key part of the data collation phase for the Southwark borough SFRA. The following key stakeholders have been consulted to inform the current investigation:

London Borough of Southwark

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

Environment and Leisure: Consulted to identify historical flooding and areas potentially at risk from river flooding and/or surface water drainage.

*Emergency Planning*¹³: Consulted to discuss the borough's existing emergency response to flooding and links with the Environment Agency.

Environment Agency

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

Thames Water

Thames Water is responsible for the management of urban drainage (surface water) and sewerage within the borough. Thames Water was consulted to discuss the risk of localised flooding associated with the existing drainage/sewer system.

¹³ Note that the Council has consulted the London Fire Brigade however no further data relating to historical flooding was forthcoming

82. A summary of data received from consulted stakeholders is provided in the table below.

Organisation	Data Received
London Borough of Southwark ⁷⁴	<ul style="list-style-type: none"> ➤ Localised flooding incidents (provided by Transport for London) in 2006 (see Section 5.6) ➤ Description of historical flooding within the Borough (see Section 5.2) ➤ Ordnance Survey (OS) mapping ➤ Current spatial planning documents (see Section 3.4)
Environment Agency	<ul style="list-style-type: none"> ➤ Historical flood outlines (River Thames) (see Figure 4) ➤ Groundwater flooding incidents (see Figures 2B and 4) ➤ Location and condition of raised flood defences (see Figure 2A) ➤ NaFRA data (number of properties at risk of flooding) (see Section 1) ➤ EA Flood Zone Maps (see Figure 2B) ➤ LiDAR (topography) – northern proportion of borough only (see Figure A) ➤ Areas covered by Environment Agency flood warnings (see Section 6.8)
Thames Water	<ul style="list-style-type: none"> ➤ Extract from DG5 Register (number of properties flooded by sewers within postcode area) (see Figure 4)

4.3 Environment Agency Flood Zone Maps

83. The Environment Agency's Flood Map shows the natural floodplain, ignoring the presence of defences, and therefore areas potentially at risk of flooding from rivers or the sea. The Flood Map shows the area that is susceptible to a 1 in 100 (1% annual exceedance probability (AEP)) chance of flooding from rivers, and a 1 in 200 (0.5% AEP) chance of tidal flooding, in any one year. It also indicates the area that has a 1 in 1000 (0.1% AEP) chance of flooding from rivers and/or the sea in any given year. This is also known as the Extreme Flood Outline.

84. 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. Within the tidal reaches of the River Thames (including the London Borough of Southwark) the Flood Map has been developed on the basis of detailed two dimensional modelling. The Environment Agency's Flood Map provides a consistent picture of flood risk for England and Wales.

85. 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 where more accurate information is available.

4.4 Historical Flooding

86. Discussions have been held with the Council to identify those areas within the borough that are known to have been exposed to flooding in recent years. These are summarised in Section 6 below.

87. It is important to recognise that the incidents listed are events in which areas have been affected not only by flooding from the River Thames, but also from surcharging of the underground sewer system, blockage of culverts and gullies, and/or surface water runoff or groundwater.

¹⁴ Note that the Council's Emergency Planning team has consulted the London Fire Brigade for information relating to historical incidents of localised flooding. No further data information was provided for SFRA purposes.

88. It is important to recognise that often the *cause* of observed flooding is difficult to ascertain, particularly after the floodwaters have passed. Finally, whilst prescriptive information relating to the precise location and depth of flooding is not always available, anecdotal information highlights the importance of careful and informed decision making when locating future development within a borough.

4.5 Flood Defences

89. Flood defences are typically raised structures that alter natural flow patterns and prevent floodwater from entering property in times of flooding. They are generally categorised as either 'formal' or 'informal' defences. A 'formal' flood defence is a structure that was built specifically for the purpose of flood defence, and is maintained by its respective owner, which could be the Environment Agency, Local Authority, or an individual. An 'informal' flood defence is a structure that has not been specifically built to retain floodwater, and is not maintained for this specific purpose, but may afford some protection against flooding. These can include boundary walls, industrial buildings, railway embankments and road embankments situated immediately adjacent to rivers. Within the context of the London Borough of Southwark, protection is also provided by the River Thames Barrier.
90. Formal raised flood defences within the borough have been identified in consultation with the Environment Agency, providing protection against tidal and fluvial flooding from the River Thames. These are indicated in Figure 2. The height of these defence walls is set by an Act of Parliament¹⁵. These were raised in the mid 1970s as interim protection measures in conjunction with the construction of the Thames Barrier. With completion of the barrier, the walls at their original heights provide a standard of defence against a combined fluvial and tidal event of 0.1% (1 in 1000) chance of occurring in any year. The condition of these defences is also shown in Figure 2 and falls within the range Grade 1 or 3 (very good to moderate).
91. No particular informal *raised* flood defences providing protection from flooding have been identified in Southwark as part of the SFRA process. It is important to recognise however that local roads and/or rail lines that have been constructed on raised embankments may alter overland flow routes, and as such may have a localised effect upon the risk of flooding. This should be carefully reviewed in a local context as part of the detailed site based Flood Risk Assessment.

4.6 Topography & Geology

92. Detailed topographic information has been provided by the Environment Agency (2007) for the northern portion of the borough (i.e. that area affected by flooding from the River Thames) in the form of LiDAR. LiDAR enables a detailed Digital Elevation Model (DEM) to be developed that, in simple terms, provides a three dimensional representation of the borough. Topographic information has been sought from OS mapping for the remainder (southern portion) of the borough.
93. Geological information has been retrieved from the British Geological Society (BGS), providing an overview of soils and substrate.

¹⁵ Thames River Prevention of Floods Acts (1879 – 1962)

5 Flood Risk in the London Borough of Southwark

5.1 Overview

94. The London Borough of Southwark is bounded to the north by the River Thames. Whilst the Thames poses a potential risk of flooding to properties within Southwark, all property within the borough is currently protected from combined tidal and fluvial flooding by the River Thames Tidal Defences (TTD) up to the 1 in 1000 year event.
95. This degree of protection is effective provided that the River Thames Barrier is operated to protect against storm surges from the North Sea and that there is a sufficient storage pool behind the barrier to accommodate the River Thames when it is shut during extreme fluvial events at high tides. The TTD are currently being reviewed (as part of the TE2100 Strategy) to protect against climate change beyond 2030.
96. Aside from the River Thames, there are no other watercourses within the borough that may pose a potential risk of flooding to properties within the borough.
97. A potential risk of flooding from other (non river related) sources exists throughout the borough, including possible sewer surcharging, and surface water flooding as a result heavy rainfall and/or blocked gullies. With changing climate patterns, it is expected that intense storms of this nature will become increasingly common. It is vitally important therefore that planning decisions recognise the potential risk that increased runoff poses to property and plan development accordingly so that future sustainability can be assured.
98. The overloading of the sewer system due to inflows exceeding the underground system capacity (i.e. resulting in surcharging) is a known problem in some areas (e.g East Dulwich). Note that surface water networks are typically designed to cater for events up to a 1 in 30 year. Surface water flooding will occur when the sewer system is overloaded and/or a system blockage occurs.
99. The potential sources of flood risk within the borough are explained more fully below.

5.2 Flood Risk from the River Thames

5.2.1 Historical Flooding from the River Thames

100. Severe flooding affected the borough of Southwark on 6th January 1928 when the defences along the River Thames were breached (refer Figure 4). Amongst other disaster locations, failure of a 25 metre stretch of embankment near Lambeth Bridge resulted in the death by drowning of fourteen people within basements. Four thousand people were made homeless as a direct result of this flooding event.
101. Minor incidents of flooding have been observed in locations where local moveable defences have not been put into place in a timely manner, resulting in inundation during a particularly high tide. A particular example includes the Mayflower Public House (Rotherhithe Street) in December 2005.

5.2.2 Fluvial Flood Risk

102. The London Borough of Southwark is bounded to the north by the River Thames. The borough is situated within the lowermost reaches of the River Thames system, draining a catchment area of almost 5000 square miles. Historically the River Thames floodplain was substantially wider than it is today, and indeed the dense urban area of Greater London (including Southwark) heavily constrains the passage of the river corridor as it winds its way towards the sea. Not surprisingly therefore, fluvial flooding from the River Thames does pose a risk to areas of London. High river levels within the lower reaches of the Thames are most likely to be evident when prolonged rainfall falls within the upper reaches of the catchment, affecting counties to the west of Greater London, as occurred during the summer of 2007.
103. The River Thames has been heavily modified over time with the growth of London, including the construction of raised defences along much of its length (within London). As a result, the direct risk to the London Borough of Southwark as a result of fluvial flooding alone is virtually negligible. Should a fluvial flooding event within the upper catchment coincide with a particularly high tide in the lower reaches of the River Thames however, the London Borough of Southwark is at risk. This is discussed further in the section below.
104. There are no other watercourses posing a potential risk of fluvial flooding to the London Borough of Southwark.

5.2.3 Tidal Flood Risk

105. The primary risk to property and life from flooding within the London Borough of Southwark is as a result of tidal activity within the River Thames. Considerable investment has been made in the provision of the Thames Tidal Defences (TTD) to protect Greater London (including Southwark) from tidal flooding. It is essential to appreciate however that the flood defences are engineered structures that can only ever protect up to a point, they may malfunction, and they have a finite structural life. There will always therefore be a residual risk of flooding within the borough, and this is explained further in the section below.
106. As highlighted earlier, the London Borough of Southwark is situated in the lower reaches of the River Thames catchment, and the river is tidally influenced at this location. The primary risk of flooding within the London is as a result of a surge tide. A surge occurs when a weather system within the North Sea creates gale force winds that blow in a southerly direction through the narrow stretch of sea between Great Britain and the continent. A 'wedge' of water is created, increasing in depth as it progresses through the narrowing gap between the land masses towards the English Channel. Large tidally influenced river estuaries, particularly within the South East of England (including the River Thames), are susceptible to relatively large and rapid increases in river levels as the wave passes. Should this 'surge' coincide with a particularly high tide and/or fluvial flooding in the upper reaches of the catchment, the River Thames within London becomes in effect a 'basin' with water approaching in both directions.
107. The Thames Tidal Barrier was constructed specifically to prevent the tidal surge passing upstream into the built up areas of London. Not only does this (in conjunction with the raised River Thames flood defences) protect London from unusually high river levels as a result of a surge tide, but it also ensures that there is capacity in the river channel to safely store fluvial floodwaters that are travelling downstream from the upper catchment. It is important to recognise that the frequency of barrier closures is expected to increase in the future as result of climate change. Operational constraints, and the needs of the river and its users, may restrict the use of the barrier in this manner. Consequently other means of reducing the risk of fluvial flooding from the River Thames may have to be sought in future years.
108. The future sustainability of London is clearly dependant to a large degree upon the retention of the River Thames Tidal Defences (TTD) in the longer term. Decisions surrounding investment of this nature in future years cannot be predicted with any certainty, and therefore it is imperative that planning decisions are taken with a clear understanding of the potential risks posed to property and life should things ultimately go wrong. This is the primary purpose of the following sections of the SFRA.

5.2.4 Delineation of the PPS25 Flood Zones (Fluvial & Tidal Flooding)

109. To inform the planning process, it is necessary to review flood risk across the borough, categorising the area in terms of the likelihood (or probability) that flooding will occur.

Delineation of Zone 3b Functional Floodplain

110. Zone 3b Functional Floodplain is defined as those areas in which “*water has to flow or be stored in times of flood*”. The London Borough of Southwark is defended against flooding from the River Thames. Consequently, areas of Zone 3b Functional Floodplain are restricted purely to the river itself (i.e. areas situated on the river side of the raised defence line, as indicated in Figure 2B).

Delineation of Zone 3a High Probability

111. Zone 3a High Probability is defined as those areas of the borough that are situated within the 1% AEP (100 year) fluvial or 0.5% AEP (200 year) tidal (whichever is greater) flood extent for the River Thames.
112. For planning purposes, the Environment Agency has issued a series of Flood Zone Maps and the outlines dated September 2007, and these have been adopted to define Zone 3a High Probability within the London Borough of Southwark SFRA. This encompasses the northern areas of the borough, extending from the River Thames to Camberwell (refer Figure 2B).
113. For planning purposes, this zone has then been sub-delineated into zones of 'hazard' (reviewing the potential risk to life) as a result of a failure of the River Thames defences, as described in Section 5.2.5 below.

Delineation of Zone 2 Medium Probability

114. Zone 2 Medium Probability is defined as those areas of the borough that are situated between the 0.1% AEP (1 in 1000 year) and the 0.5% AEP (1 in 200 year) flood extents. Zone 2 Medium Probability is defined in accordance with the Environment Agency Flood Zone Map, and is depicted in Figure 2B. Very few areas within the borough of Southwark fall into Zone 2 Medium Probability, restricted purely to the periphery of the River Thames floodplain in Camberwell, and isolated 'islands' (i.e. elevated areas) within the northern most areas adjoining the Thames.

Delineation of Zone 1 Low Probability

115. Zone 1 Low Probability is defined as those areas of the borough that are situated above (or outside of) the 0.1% AEP (1000 year) flood extent. For SFRA purposes, this incorporates all land that is outside of the shaded Zone 2 and Zone 3 flood risk areas (as defined above). As is evident in Figure 2B, the borough to the south of Camberwell is characterised entirely by Zone 1 Low Probability. Isolated elevated areas within the River Thames floodplain are also situated above the predicted flood level, and so these too fall within Zone 1 for planning purposes.

5.2.5 Risk to Life – Flooding from the River Thames

Overview

116. The assessment of flood risk has thus far considered the *likelihood* of flooding within the borough, defined by the PPS25 flood zones. Of equal importance however is the *impact (or consequence)* that will occur within the borough should a flood occur. For example, will the flooding result simply in shallow ponding for a short period of time, causing a temporary disruption to traffic? Or will deep fast flowing floodwaters inundate areas of the borough without warning, posing an immediate and very real risk to life?.
117. 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'.
118. 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.

Assessment of Risk to Life (Flood Hazard)

119. Defra and the Environment Agency have recently collaborated to develop a document entitled 'Flood Risk to People' (FD2320). This provides guidance to aid in the review of flood hazard within the UK. The risk to life (as a result of flooding) within the borough of Southwark has been assessed to accordingly inform the allocation of land within the borough for future development. A brief summary of the findings is presented below:

Flood Hazard due to Flood Defence Failure

Flood defences are typically raised structures that alter natural flow patterns and divert floodwater away from areas of habitation in times of flooding. Raised defences exist along the Thames frontage, forming the northern boundary of the borough (refer Figure 2). These provide protection against tidal flooding, as explained earlier.

A failure of the River Thames defences could result in rapid inundation into the borough, posing a potential risk to residents, pedestrians and property that may be in the path of the floodwaters. Deep, fast flowing water may threaten life, and this must be considered when planning future development. The accumulation of standing water as a result of breaching or overtopping also needs consideration. This can lead to flood risks associated with, for example:

- safe access and exit to/from properties through flood water;
- interference with essential services and infrastructure; and/or
- the inundation (without warning) of basement dwellings.

As part of the SFRA, hydraulic modelling was carried out to consider the velocity, depth and path of flood water should a failure of the defences occur (at any point along its length). The time within which flood waters inundate the borough following a breach failure is also a key consideration of the breach modelling. The methodology used in the modelling is described in Appendices E and F. The use of this information in planning terms is outlined below.

Sub-delineation of Zone 3a High Probability for Planning Purposes

A relatively large proportion of the London Borough of Southwark is situated within Zone 3a High Probability, defended against flooding from the River Thames. There remains a residual risk of failure of these defences however, and therefore it is essential that planning decisions are taken with due consideration to the scale (and variability) of this risk.

Two particular 'measures' of flood risk have been adopted to underpin the development of spatial planning and development control recommendations for the borough.

The first is **flood hazard**, considering the potential risk to life should a failure of the flood defences occur. This is a measure of the flood depth and flow velocity, assessed as described in Appendix D. The adopted Flood Hazard zones are presented in Figure D.

The second is **rate of inundation**, considering the time available to warn residents and business owners of a pending flood following a failure of the River Thames defences. Once again, the method of assessment is provided in Appendix D, and the adopted Rate of Inundation zones are presented in Figure C.

For ease of reference, the rate of inundation has been superimposed onto the flood hazard map. This is provided as Figure E.

Structural Integrity of Flood Defences

Finally, it is highlighted that the structural integrity of the existing flood defences is integral to the sustainability of development. It is recognised however that this will vary with time and proximity along the river frontage. Consequently it is essential that the detailed site based Flood Risk Assessment for all potential future development within defended areas of the borough considers both the likelihood and consequence of defence failure near the proposed site. The current Environment Agency condition grades for the River Thames raised defences are presented in Figure 2.

5.3 Flooding from Other Sources

5.3.1 Historical Flooding from Other Sources

120. Relatively few localised flooding incidents have been observed recent years. Anecdotal evidence provided by Transport for London (see Figure 4), the Council and the Environment Agency. Particular incidents are described below:

Surface Water Flooding

- On 27 April 2004, severe rainfall in the south of the borough caused extensive surface water flooding which inflicted considerable damage on residents and their homes, public services and private businesses in the Dulwich area (see Figure 4). Nearly all the flooding occurred south of East Dulwich Road and Lordship Lane. Flooding was attributed to the intensity of the rainstorm (with a reported probability of less than 0.3% (1 in 300) in any year) and the topography of the area, causing runoff to accumulate in a natural valley, and the Thames Water sewer system serving the area to surcharge. Another contributory factor was blockage of the gullies¹⁶. Improved gratings have now been installed by the Council

¹⁶ Report of the Investigation of Sewer Flooding in Dulwich, April 2004, London borough of Southwark Consultation draft November 2004

Surcharging of Surface Water and Combined Sewers

- Thames Water noted that there were a large number (188 occurrences) of properties flooded by combined overloaded sewers in the last ten years in the SE5 9 area. The following quotation was provided by Thames Water in December 2007 *“The properties listed on the database in SE5 9 postcodes are mainly in Lambeth. The risk of flooding at the majority of these properties will be reduced following completion of the Coldharbour Lane project (Ref 0TVF) in the winter of 2008. The scope of this project is significant and includes up-sizing local sewers, storage and diversion of flows.”*
 - Also Thames Water is planning to shortly upgrade the sewers in the SE24 region (Denmark Hill).
121. Some very general information has also been provided by Thames Water, providing a simple overview (per post code area) of the number of properties that have been affected by sewer flooding over the past decade. This is provided in Figure 4.

5.3.2 Localised Drainage Issues

Overview

122. The risk of flooding from other (non river related) sources is an important consideration. The recent flooding that affected England, and particularly the South East, in August 2007 highlighted the potential risk that groundwater, surface water runoff and sewer flooding can have upon an area. Newbury (West Berkshire), Sheffield and Hull all suffered severe flooding from other sources.
123. Information relating to observed incidents within the borough has been provided (see Section 5.3.1 above) however this information only relates to localised problems *once they have occurred*. PPS25 strongly advocates the prediction (where possible) of potential flood risk, seeking an avoidance strategy that guides development away from these areas wherever possible. It is very difficult to predict the potential risk of localised flooding, particularly given that many of these incidents will be as a result of (for example) the collection of leaves over a gully during a rainfall event. Detailed modelling techniques are available for sewered systems only, and rely heavily upon comprehensive survey information relating to the existing drainage system which is often not readily available. Definitive modelling packages to assess the risk of surface water (or flash) flooding are not available, and localised problems (including, for example, the blockage of gullies) can clearly not be predicted
124. More generally, development can fundamentally alter drainage patterns, obstructing overland flow routes, and altering the volume and speed of runoff. The SFRA has therefore captured all readily available information relating to localised flooding in an effort to inform future detailed FRAs. It is essential to highlight however that this should not be considered a comprehensive representation of all localised flood risks as indeed not all observed incidents may have been reported (and the blockage of culverts and gullies can happen anywhere).

Localised Flood Risk within Southwark

125. Given the heavily urbanised character of much of the borough, it is inevitable that localised flooding problems arising from under capacity drainage and/or sewer systems will occur, particularly given the mounting pressure placed upon ageing systems as a result of climate change. Furthermore, sewer systems are generally designed (in accordance with current Government guidance) to cater for the 1 in 30 year storm, and highway soakaways are generally designed for only 1 in 10 year storms. Storms over and above these design events will exceed the drainage system, resulting in overland flow, often in an uncontrolled manner (resulting in localised flooding). Input has been sought from Thames Water to pinpoint known and/or perceived problem areas relating to the sewer system, however the information provided is very general.

126. Given the scale of the potential 'local flood risk' within the borough, it is essential that planning decisions are informed by a more detailed assessment (carried out in a local context). As part of the detailed site based FRA, it will be necessary for the developer to consider the potential risk of localised flooding from groundwater and/or surface water.
127. Incidents of historical flooding have been identified, however any location within the borough may be susceptible to localised flooding, irrespective of whether or not they have flooded in the past. An overview of the geology and topography has been provided in Figures A and B (see Section 6.3.4 below), and these may be used as a tool to consider whether the proposed development site is (for example) situated within a local 'sink' that may be susceptible to localised ponding.
128. Overland flow routes within the northern portion of the borough (covered by LiDAR) are also provided in Figure 3, providing an indication of areas that may be at risk of surface water flooding when the capacity of the underground drainage system is exceeded. For interest, the 1% (100 year) rainfall intensity within Southwark assuming a critical storm duration of 60 minutes is 53.5mm/hr.

5.3.3 Groundwater Flooding

129. A proportion of the borough of Southwark, away from the River Thames, overlays London Clay. This is an impervious layer, and consequently the risk of groundwater flooding will typically be very low. Areas adjoining the River Thames corridor however are characterised by alluvium and 'river terrace deposits'. These are referred to as 'Thames Gravels' and there is evidence within adjoining boroughs of groundwater flooding occurring some distance from the river as a result of water finding a pathway through the gravels during high river levels.
130. Evidence of historical groundwater flooding within the borough is relatively limited (refer Figure 2), and at times incidents of groundwater flooding can be mistaken for flooding from other sources (or vice versa). The risk of groundwater flooding is highly variable and heavily dependent upon local conditions at any particular time, and therefore it is not possible to sensibly develop a strategic map of 'groundwater risk' as part of the SFRA process. It is important to recognise that historical flooding is *not* a robust measure of the risk of flooding in future years.
131. Due to the high degree of variability when considering groundwater flooding, it is important to ensure that the potential risk of groundwater flooding to a property is considered within a local context. This is most appropriate at the development application stage (i.e. as part of the detailed Flood Risk Assessment).

5.3.4 Risk to Life - Flood Hazard due to Reservoir Failure

132. PPS25 requires that the potential risk of overtopping and/or catastrophic failure of water storages within (or near) the borough is considered as part of the spatial planning process. There are very stringent legislative requirements governing the operation and maintenance of water storage facilities within England, and the risk of failure leading to a loss of property or life is generally extremely low. The recently publicised failure of the Ulley Reservoir in Yorkshire (summer 2007) is a timely reminder that these incidents are not entirely unheard of however. For this reason, the potential risk of flooding to the borough associated with reservoirs is outlined below.
133. A number of reservoirs and open water bodies have been identified within the borough, as listed below (see Figure G). Numerous small local ponds and water features are also evident in the OS mapping of the borough (including, for example, Dulwich Village and Upper Sydenham)¹⁷.

¹⁷ It is highlighted that no evidence of large water supply infrastructure (i.e. pipelines) posing a potential risk of collapse and flooding to the borough has been identified in consultation with Thames Water

- Honor Oak Reservoir (covered water supply reservoir);
- Nunhead Reservoir (covered water supply reservoir);
- Canada Water (historical dock)
- Greenland Dock (historical dock); and
- South Dock (historical dock).

134. An overview of risk associated with these various water bodies is provided below. It

Water Reservoirs

135. Specific information relating to Honor Oak and Nunhead Reservoirs was sought from Thames Water for the purposes of the Southwark Borough SFRA. Unfortunately no information has been forthcoming. Notwithstanding this however, the Water Act 2003 amended the Reservoirs Act 1975, requiring the preparation of dedicated Flood Plans for reservoirs, to be prepared by the asset owner (i.e. Thames Water).
136. A Flood Plan is a set of documents that describe the arrangements to be put into operation in response to a sudden large release of water from a reservoir that could pose a threat to property and life downstream. A Flood Plan will include an assessment of the impacts of dam failure, a review of the measures that can be taken by the reservoir operator to prevent the catastrophic failure, and an assessment of the emergency response mechanism required to minimise risk to life and property should a failure occur.
137. Dedicated Flood Plans will be required for all reservoirs that may pose a risk to the borough from spring 2009. For legislative purposes, this includes reservoirs that exceed 25,000m³ in volume and/or pose a risk to the general public should a catastrophic failure occur. In the interim, the asset owner must provide assurance that the water supply reservoirs are actively managed and that all required safety standards are met. 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. On this basis therefore, the possible risk of *structural failure* of these reservoirs is considered to be minimal.
138. No specific risk 'envelope' is available for failure of the two water storage facilities, and the potential risk of flooding as a result of structural failure is certainly much less than the indicative scenarios set out within PPS25 (i.e. 1% likelihood of occurring in any one year). This should not unduly influence the spatial planning process therefore. Notwithstanding this however, it is recommended that the potential risk of reservoir failure is communicated to the Local Resilience Forum by the Council for inclusion on the Community Risk Register. This will ensure that future planning is put into place to enable an effective response in case of a possible emergency.

Historical Docks

139. The historical docks identified are clustered in the north eastern corner of the borough, in relatively close proximity to the River Thames. These are the remnants of a much larger system of docks that were in operation as recently as the 1920s, but that have subsequently been filled in and developed upon.
140. From a planning and/or flood risk perspective, the docks (and/or their surrounds) are not raised above ground level, and there is no potential risk to life as a result of structural failure. A residual risk of overtopping may exist however. Whilst there is no evidence of this occurring in recent history, it is envisaged that local runoff will fall towards these water bodies when the capacity of the dedicated drainage system is exceeded. Following particularly intense local rainfall therefore, there may be a risk that water levels will rise within the docks.

141. A 'freeboard' is evident within the dock system, providing an excess storage capacity before overtopping will occur. Given the relatively large surface area of the docks therefore, it is considered very unlikely that this available storage will be exceeded. Should this occur under extreme conditions however, the topography of the area surrounding Canada Water is such that some localised flooding may occur, with water spilling downhill towards Bermondsey. Greenland Dock and South Dock in contrast are situated in a local 'sag' and any overspill will be directed towards the River Thames.
142. In summary however, the potential risk of overtopping resulting in a risk to property and/or life is considered very small.

Local Water Features

143. A number of small local water features are evident in the OS mapping. These will typically be local ponds that are landscaping features that may or may not form part of the local drainage system. Prolonged intense rainfall may result in the overtopping of these ponds, resulting in localised flooding within the immediate vicinity. For planning and design purposes, it is recommended that these water features are considered in the same manner as risks arising from other elements of the local drainage system, ensuring that exceedance flows (i.e. runoff that will occur once the capacity of the drainage network is exceeded) are dealt with in a controlled manner.

5.3.5 Topography & Geology

Overview

144. The topography and geology of the borough provides a means of identifying those areas within which surface water runoff is likely to cause the most disruption, and potentially damage to property. Areas in which the soils are highly impermeable (reducing the capacity of infiltration into the ground during periods of wet weather) and localised 'sags' in the topography (where ponding is likely to occur) can be considered locations within which the potential risk of localised flooding should be taken into account as part of the design process.
145. The local geology also provides an indication of the likely presence (or otherwise) of a susceptibility to groundwater flooding. For example, areas of highly permeable gravel geology situated near a river may be at risk of groundwater flooding as the local water table rises following a rainfall event. It is worth noting that the risk of groundwater flooding within the wider London area is being controlled to a large extent by managed abstractions, as set out by the Mayor's London Plan (refer Section 3.3.2).

Topography

146. The London Borough of Southwark is situated immediately adjacent to the River Thames, and its topography is characterised to a large degree by a distinct 'line' (approximated by the A202) at around 5mAOD above and beyond which the risk of fluvial and/or tidal flooding no longer exists. The borough to the south of the A202 is relatively undulating, rising gently away from the River Thames. To the north of the A202 (encompassing Bermondsey and Camberwell) the borough is characterised by a 'basin' of low lying land towards which water will flow following a storm event and/or failure of the River Thames defences. This is the area that is considered at highest risk, governed by the topography, and the planning recommendations set out as part of this SFRA have been developed accordingly.
147. The topography of the London Borough of Southwark is provided in Figure A.

Geology

- 148. The geology of the London Borough of Southwark is characterised by London Clay to the south, and river terrace deposits (Thames Gravels) to the north. The impermeable nature of the soils within the south of the borough (away from the River Thames) can increase the susceptibility of the area to surface water (or flash) flooding following periods of heavy rainfall. Immediately adjoining the River Thames, the deposits of gravel can lead to localised incidents of groundwater flooding. A lens of chalk is evident within the low lying area of Bermondsey, and this too may indicate a slightly higher susceptibility to possible groundwater flooding.
- 149. The geology of the borough will heavily influence the functionality of Sustainable Drainage (SuDS) techniques, and should be carefully considered as part of the design process. In simple terms, infiltration techniques including for example soakaways are unlikely to operate efficiently in areas overlaying impermeable soils. To the south of the borough therefore, engineered solutions (including tanked on-site storage) may be more suitable.
- 150. An overview of the geology of the London Borough of Southwark is provided in Figure B.

5.4 Impacts of Climate Change upon Flood Risk

Assessing the Impacts of Climate Change upon Flood Risk (River Thames Flooding)

- 151. A considerable amount of research is being carried out worldwide in an endeavour to quantify the impacts that climate change is likely to have on flooding in future years. Climate change is perceived to represent an increasing risk to low lying areas of England, and it is anticipated that the frequency and severity of flooding will change measurably within our lifetime. PPS25 (Appendix B) states that a 10% increase in the 1% AEP (100 year) river flow can be expected within the next 20 years, increasing to 20% within the next 50 to 100 years. In tidally affected areas within the east of England, including London, an increasing rate of change in predicted sea levels is to be assumed with time as summarised in the table below.

Recommended Contingency Allowances for Net Sea Level Rise in London¹⁸
(relative to 1990 base sea level)

1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
4.0mm/yr	8.5mm/yr	12.0mm/yr	15.0mm/yr

- 152. Within the London Borough of Southwark, the potential impact that climate change may have upon peak design river levels within the Thames is complicated to a large degree by the operation of the Thames Tidal Defences (TTD). As part of the TE2100 Strategy, a detailed review of the TTD design and operation into future years is underway by the Environment Agency. Currently the impacts of climate change can be mitigated by making space for water, and reducing reliance upon the barrier.
- 153. Clearly future investment in the TTD over the coming century cannot be assured today however, and therefore it is essential that planning policy takes a proactive stance when considering the potential impact of climate change. For this reason, developers should consult with the EA as part of the design process to seek advice on the appropriate climate change related design level to use for design purposes.

¹⁸ PPS25 (Appendix B, Table B1)

154. No detailed modelling of the potential impacts of climate change upon flood risk within the London Borough of Southwark has been carried out to date. It is important to emphasise that the operation of the Thames Tidal Defences (TTD), including both the barrier and the raised flood defences, is expected to mitigate the potential impacts of climate change within London to a large extent¹⁹. For design purposes therefore, developers should approach the Environment Agency for sensible predictions of flood levels incorporating climate change within the borough of Southwark.
155. For planning purposes however, Zone 2 Medium Probability is considered a reasonable approximation of the likely extent of the High Probability flood zone in 100 years as a result of climate change.

Planning Response to Climate Change

156. **It is clear that climate change will not markedly increase the extent of river flooding within the borough.** Consequently, few areas that are currently situated outside of Zone 3 High Probability will be at substantial risk of flooding in the foreseeable future. This is an important conclusion from a spatial planning perspective.
157. It is important to recognise that **those properties (and areas) that are currently at risk of flooding may be susceptible to more frequent, more severe flooding in future years.** It is essential therefore that the development control process (influencing the design of future development within the borough) carefully mitigates against the potential impact that climate change may have upon the risk of flooding to the property.
158. For this reason, all of the development control recommendations set out in Section 6.4 require all floor levels, access routes, drainage systems, infrastructure and flood mitigation measures to be designed *with an allowance for climate change*. This provides a robust and sustainable approach to the potential impacts that climate change may have upon the borough over the next 100 years, ensuring that future development is considered in light of the possible increases in flood risk over time.
159. It is essential that developers consider the possible change in flood risk over *the lifetime of the development* as a result of climate change. The likely increase in flow and/or tide level over the lifetime of the development should be assessed proportionally to government guidance as outlined above. For design purposes, the Environment Agency recommend that the 'lifetime of development' is adopted as 60 years and 100 years for commercial and residential development respectively.

Climate Change Impacts upon Localised Flooding

160. It is important to remember however that the potential impacts of climate change will affect not only the risk of flooding posed to property as a result of river and/or tidal flooding, but it will also potentially increase the frequency and intensity of localised storms over the borough. This may exacerbate localised drainage problems, and it is essential therefore that the detailed FRA considers the potential impacts of climate change upon localised flood risks, as well as the risks of river related flooding.
161. PPS25 Appendix B (Table B2) provides guidance as to the anticipated increase in rainfall intensity that should be considered for design purposes. Designers should assume a 10% increase in rainfall intensity over the next 20 years, increasing to 20% in 50 years, and 30% in 100 years.

¹⁹ However there is likely to be increasing use of floodplain management, making space for water, flood preparedness and emergency response

5.5 Residual Risk of Flooding

162. 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. 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 local drainage system has been designed;
 - the residual danger posed to property and life as a result of flood defence failure;
 - general uncertainties inherent in the prediction of flooding.
163. The modelling of flood flows and flood levels is not an exact science, therefore there are inherent uncertainties in the prediction of flood levels used in the assessment of flood risk. The adopted flood zones underpinning the borough of Southwark are largely based upon breach modelling within the area. Whilst these provide a robust depiction of flood risk from a strategic perspective, all detailed modelling requires the making of core assumptions and the use of empirical estimations.
164. Taking a conservative approach for planning purposes therefore, the Environment Agency advises that finished floor levels are raised to 300mm above the 0.5% (200 year) peak design flood level (including climate change) when advising developers

6 Sustainable Management of Flood Risk

6.1 Overview

165. 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.
166. 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.
167. 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

168. 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.
169. The Greater London Authority should consider flood risk when reviewing strategic planning decisions including (for example) the provision of future housing and transport infrastructure. The GLA is responsible for developing a Regional Flood Risk Assessment (RFRA) to inform the development (and distribution) of housing targets for boroughs throughout the Greater London area.
170. The Environment Agency has a statutory responsibility for flood management and defence in England and Wales. It assists the planning and development control process through the provision of information and advice regarding flood risk and flooding related issues.
171. The Local Planning Authority is responsible for carrying out a Strategic Flood Risk Assessment. The SFRA should consider the risk of flooding throughout the district and should inform the allocation of land for future development, development control policies and sustainability appraisals. Local Planning Authorities have a responsibility to consult with the Environment Agency when making planning decisions.
172. Landowners & Developers²⁰ 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.

²⁰ Referred to also as 'landowners' within PPS25

173. The Environment Agency has developed a guide entitled “Living on the Edge” that provides specific advice regarding the rights and responsibilities of property owners, the Environment Agency and other bodies. The guide is targeted at owners of land situated alongside rivers or other watercourses, and is a useful reference point outlining who is responsible for flood defence, and what this means in practical terms. It also discusses how stakeholders can work collaboratively to protect and enhance the natural environment of our rivers and streams. This guide can be found on the Environment Agency’s website at www.environment-agency.gov.uk

6.3 Strategic Flood Risk Management - The Environment Agency

6.3.1 Overview

174. With the progressive development of urban areas along river corridors, particularly during the industrial era, a reactive approach to flood risk management evolved. As flooding occurred, walls or embankments were built to prevent inundation to developing areas, often without consideration as to the effect that such limiters had on the ability of the watercourse to redistribute the risk of flooding elsewhere.
175. The Environment Agency (EA) 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.
176. A number of flood risk management strategies are underway within the region, encompassing the large river systems that influence flood risk within the borough of Southwark. A brief overview of these investigations is provided below.

6.3.2 Thames Catchment Flood Management Plan (CFMP)

177. *“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.*
178. *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.*
179. *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.”²¹*

²¹ Catchment Flood Management Plans – Volume 1 (Guidance), Version 1.0, July 2004

180. A CFMP is being developed for the River Thames catchment. A consultation summary document has recently been provided outlining the main messages from the CFMP (January 2007). Key messages have been provided by the Environment Agency for specific reference within Southwark, and these are included as Appendix A.
181. Four overarching key messages have been highlighted by the CFMP:
- Flood defences cannot be built to protect everything;
 - Climate change will be the major cause of increased flood risk in the future;
 - The floodplain is our biggest asset in managing flood risk;
 - The ongoing cycle of development and urban regeneration is a crucial opportunity to manage flood risk.
182. Specific messages have been provided for characteristic reaches along the River Thames, including areas that are protected against flooding through the presence of raised defences (i.e. the London Borough of Southwark). The Thames CFMP states that, within these areas:
- At present it is still possible and effective to maintain these flood defences.
 - Climate change will mean that these defences will become less effective in the future. We therefore need to make sure that:
 - 2 any redevelopment reduces the residual flood risk in the areas benefiting from these flood defences using the measures set out in PPS25;
 - 2 the natural flood plain is used upstream and downstream of these areas to accommodate additional floodwater.
183. In summary, the CFMP seeks a sustainable 'planning' led solution to flood risk management within the Greater London area. The CFMP encourages local authorities (and indeed developers) to strive for a positive reduction in flood risk through future development and regeneration. This is striving to ensure that collectively decisions taken not only avoid the creation of a future legacy of new development at risk of flooding, but also progressively reduces the risk of flooding to existing development. This is a key objective of PPS25.

6.3.3 Thames 2100 Strategy (TE2100)

184. The Environment Agency's Thames Estuary 2100 (TE2100) project is currently developing a strategic plan for managing flood risk in the River Thames estuary to the year 2100. It covers the areas bordering the River Thames from the estuary upstream to Teddington Lock (Richmond upon Thames) where the tidal influence ends.
185. The following quotation has been provided by the EA to describe the objectives and conclusions of the TE2100 Strategy (December 2007):

"The present system of tidal flood risk management provides a very high standard of protection, but rising water levels as a result of climate change, will continue to increase the probability of flooding. By the year 2030 the probability of tidal flooding in any single year will reach one in a thousand, and this probability will continue to increase throughout the century.

Flood risk is a combination of probability and consequences. Since the probability of flooding will increase with climate change, placing emphasis on measures to reduce the consequences of flooding will maintain or reduce the level of flood risk." The rigorous implementation of Planning Policy Statement 25 for new development and regeneration is necessary to reduce the cost and risk to life impacts of any flood.

Regeneration and development initiatives can provide real opportunities for reducing flood risk by factoring-in flood risk at early planning stage in a development and ensuring the "Prevent, Avoid, Manage" hierarchy of flood risk management planning is maintained.

The creation of new, more sustainable, defences in the estuary (e.g. set-back with soft engineering) will help reduce the whole-life costs of flood defence infrastructure in the Thames estuary. This can also help to reduce the visual/amenity impact that raising walls throughout London might have. The TE2100 project is exploring ways to create a better place in London and the Thames Estuary through creative flood risk management..

Studies confirm that the Thames Barrier will continue to provide a high standard of protection well beyond 2030, and could still be providing a high standard of protection at the end of the century, with some improvements and additional supporting measures such as tidal storage."

6.4 Planning & Development Control – London Borough of Southwark

6.4.1 Planning Solutions to Flood Risk Management

186. The risk of flooding is most effectively addressed through *avoidance*, which in very simple terms equates to guiding future development (and regeneration) away from areas at risk. Development that is sustainable for future generations is imperative, and it is widely recognised that the risk of flooding cannot be considered in isolation. There are many tests and measures of 'sustainability' that must be weighed in the balance when locating and designing future development. Within Southwark, there is a pressing demand to regenerate deprived areas and contribute to accommodating London's growth (refer Section 1.2).
187. PPS25 endeavours to guide Local Planning Authorities in this decision making process, and the Sequential and Exception tests underpin the method by which flood risk should be taken into consideration as part of the planning process. The application of these tests within the London Borough of Southwark (by the Council) is outlined below.

The Sequential Test

188. 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.
189. The ideal solution to effective and sustainable flood risk management is a planning led one, i.e. steer urban development away from areas that are susceptible to flooding. PPS25 advocates a sequential approach that will guide the planning decision making process (i.e. the allocation of sites). In simple terms, this requires planners to seek to allocate sites for future development within areas of lowest flood risk in the initial instance. **Only if it can be demonstrated that there are no suitable sites within these areas should alternative sites (i.e. within areas that may potentially be at risk of flooding) be contemplated.** This sequential approach is referred to as **The Sequential Test**, and is summarised in Figure 3.1 of the PPS25 Practice Companion Guide (A Living Draft, February 2007)

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

190. As indicated by the bottom right hand corner of Figure 3.1, PPS25 stipulates permissible development types. This considers both the degree of flood risk posed to the site, and the likely vulnerability of the proposed development to damage (and indeed the risk to the lives of the site tenants) should a flood occur. The Council must restrict development to the permissible land uses summarised in PPS25 Appendix D (Table D2). These are replicated in Appendix E of this report for ease of reference. This may involve seeking opportunities to 'swap' more vulnerable allocations at risk of flooding with areas of lesser vulnerability that are situated on higher ground.
191. It is important to recognise that the principles of the sequential approach are applicable throughout the planning cycle, and refer equally to the forward planning process (delivered by Council as part of the LDF) as they do to the assessment of windfall sites. Where windfall sites come forward for consideration, it is essential that the developer to consider the planning 'need' for the proposed site (adopting a sequential approach in accordance with PPS25). The Council will assist where possible with supporting information. The detailed FRA will be required to demonstrate the careful and measured consideration of whether indeed there is an alternative site available within an area of lesser flood risk, in accordance with the PPS25 Sequential Test.

The Exception Test

192. A proportion of the borough of Southwark is situated within Zone 3a High Probability. This is a particularly vibrant part of London and future investment and regeneration is paramount. Prohibiting future residential development in these areas is likely to have a detrimental impact upon the economic and social welfare of the existing community, and consequently there are clearly other non-flooding related planning 'needs' that warrant further consideration of these areas. Given that this is the case, following the application of the Sequential Test, the Council and potential future developers are required to work through the **Exception Test** (PPS25 Appendix D) where applicable. For the Exception Test to be passed:
- *"It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared. If the DPD has reached the 'submission' stage, the benefits of the development should contribute to the Core Strategy's Sustainability Appraisal;*
 - *the development should be on developable, previously development land or if it is not on previously developed land, that there are no reasonable alternative sites on previously development land; and*
 - *a FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and where possible, will reduce flood risk overall."*
193. The first two points set out in the Exception Test are planning considerations that must be adequately addressed. A planning solution to removing flood risk must be sought at each specific location in the initial instance, seeking to relocate the proposed allocation to an area of lower flood risk (i.e. Zone 1 Low Probability or Zone 2 Medium Probability) wherever feasible.
194. The Southwark SFRA has been developed to inform the Sequential Test. It will be the responsibility of the Council to carry out the Sequential Test on the basis of this information, allocating potential sites for future development accordingly. Furthermore, the developer will be required to demonstrate within the detailed Flood Risk Assessment that the Sequential Test has been applied, and (where appropriate) that the risk of flooding has been adequately addressed in accordance with PPS25.
195. The management of flood risk throughout the borough must be assured should development be permitted to proceed, addressing the third critical element of the Exception Test. The SFRA has provided specific recommendations that ultimately should be adopted as design features, with evidence provided of how they will be fulfilled prior to permission being granted for all future development. It is the responsibility of the prospective developer to build upon these recommendations as part of a detailed Flood Risk Assessment to ensure that the specific requirements of PPS25 can be met.

196. An overview of flood risk throughout the borough has been provided in Section 5 and the adjoining flood risk maps. **Future planning decisions should consider the spatial variation in flood risk across the District, as defined by the delineated flood zone that applies at the specified site location, and apply the recommendations provided below accordingly.** It is reiterated that PPS25 applies equally to both allocated sites identified within the emerging LDF and future windfall sites.

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

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

6.4.3 Localised Flood Risk within the Planning Process

201. The PPS25 Practice Guide advocates the application of a sequential approach when allocating land, taking into consideration *all* sources of flooding. The local drainage related problems identified within the Southwark SFRA are generally localised, and relate to historical incidents, the source of which is often somewhat uncertain. It is important to recognise therefore that these cannot be adopted as a measure of 'risk' of future localised flooding, but rather problems that have occurred due to a particular set of local circumstances in the past (for example, the blockage of a local gully inlet). These may or may not reoccur. More importantly however, areas that have not flooded previously can certainly not assume that (for this reason alone) they will not be affected in future years.

202. From a spatial planning perspective therefore, it is considered unreasonable to restrict future development within areas that may have suffered a localised flooding incident in years past. It is essential however not to overlook the potential risk of localised flooding during the design process. Whilst the incidents that have been identified will typically not result in widespread damage or disruption, a proactive approach to risk reduction through design can mitigate the potential for damage, both to the development itself and elsewhere. Specific development control recommendations have been provided accordingly.

Policy Response		Zone 3a High Probability (refer Figure D)			Zone 3b Functional Floodplain			Zone 2 Medium Probability			Zone 1 Low Probability				
Extreme & Significant Hazard		Medium Hazard			Low Hazard										
SPATIAL PLANNING RECOMMENDATIONS	Important Considerations	Future development within Zone 3b Functional Floodplain can only be considered following application of the Sequential Test. Within the London Borough of Southwark, Zone 3b is restricted solely to areas situated in front of the raised Thames defences.			Future development within Zone 2 Medium Probability can only be considered following application of the Sequential Test			Future development within Zone 2 Medium Probability can only be considered following application of the Sequential Test			It is important to recognise that sites in Zone 1 may be susceptible to flooding from other sources. Development may contribute to an increase in flood risk elsewhere if not carefully mitigated.				
		Water Compatible Development & Essential Infrastructure			Land use should be restricted to Water Compatible or Less Vulnerable development. More Vulnerable development may only be considered if Exception Test can be passed			Land use should be restricted to Water Compatible, Less Vulnerable or More Vulnerable development. Highly Vulnerable development may only be considered if Exception Test can be passed			No restrictions				
DEVELOPMENT CONTROL RECOMMENDATIONS															
Detailed Flood Risk Assessment (FRA)	Rate of Inundation <6hrs	Required			Required			Required			Required for all sites greater than 11 area				
		More Vulnerable Development	N/A			No residential development is permitted at ground floor level. Ground floor levels for non residential development should be situated 300mm above the Q200 plus Climate Change flood level, assuming a breach of the River Thames defences			Flood resilient design techniques should be adopted to mitigate the potential damage to property in case of flooding. Further guidance is provided in Figure 5.1 of PPS25 Practice Companion Guide (A Living Draft, February 2007)			No minimum level stipulated by PPS25			
			Rate of Inundation >12hrs			Flood resilient design techniques should be adopted to mitigate the potential damage to property in case of flooding, guided by Figure 5.1 of PPS25 Practice Companion Guide (A Living Draft, February 2007)			Flood resilient design techniques should be adopted to mitigate the potential damage to property in case of flooding, guided by Figure 5.1 of PPS25 Practice Companion Guide (A Living Draft, February 2007)			No minimum level stipulated by PPS25			
Less Vulnerable Development	N/A			Flood resilient design techniques should be adopted to mitigate the potential damage to property in case of flooding, guided by Figure 5.1 of PPS25 Practice Companion Guide (A Living Draft, February 2007)			Flood resilient design techniques should be adopted to mitigate the potential damage to property in case of flooding, guided by Figure 5.1 of PPS25 Practice Companion Guide (A Living Draft, February 2007)			Site specific emergency evacuation procedures must be in place to ensure that the risk to life is minimised should a breach of the River Thames defences occur. Coordination with the emergency services will be required in the event of a flooding emergency					
	More Vulnerable Development			Access and egress routes should be designed to meet Environment Agency defined criteria, as set out in Appendix B. It is essential to ensure that the nominated evacuation route does not divert evacuees onto a 'dry island' upon which essential supplies (ie. food, shelter and medical treatment) will not be available for the duration of the flood event			Access and egress routes should be designed to meet Environment Agency defined criteria, as set out in Appendix B. It is essential to ensure that the nominated evacuation route does not divert evacuees onto a 'dry island' upon which essential supplies (ie. food, shelter and medical treatment) will not be available for the duration of the flood event			No minimum level stipulated by PPS25					
	Less Vulnerable Development			Site specific emergency evacuation procedures must be in place to ensure that the risk to life is minimised should a breach of the River Thames defences occur. Coordination with the emergency services will be required in the event of a flooding emergency			Site specific emergency evacuation procedures must be in place to ensure that the risk to life is minimised should a breach of the River Thames defences occur. Coordination with the emergency services will be required in the event of a flooding emergency			Basements must be flood resistant, and have an internal access to a higher plus climate change flood level, assuming a breach of the River Thames defences. Sleeping accommodation is not permitted at basement level. Flood resilient design techniques must be used for all basements (refer Section 6.7).					
Basements (refer Figure C)	Rate of Inundation <6hrs	N/A			Basements must be flood resistant and have an internal access to above the Q200 plus climate change flood level, assuming a breach of the River Thames defences. Sleeping accommodation is not permitted at basement level. Flood resilient design techniques must be used for all basements (refer Section 6.7).			Basements must be flood resistant, and have an internal access to above the Q200 plus climate change flood level, assuming a breach of the River Thames defences. Sleeping accommodation is not permitted at basement level. Flood resilient design techniques must be used for all basements (refer Section 6.7).			Basements must be flood resistant, and have an internal access to a higher plus climate change flood level, assuming a breach failure). Flood resilient design techniques must be used for all basements (refer Section 6.7).				
		6 to 12hrs			Basements must be flood resistant and have an internal access to above the Q200 plus climate change flood level, assuming a breach of the River Thames defences. Sleeping accommodation is not permitted at basement level. Flood resilient design techniques must be used for all basements (refer Section 6.7).			Basements must be flood resistant and have an internal access to above the Q200 plus climate change flood level, assuming a breach of the River Thames defences. Sleeping accommodation is not permitted at basement level. Flood resilient design techniques must be used for all basements (refer Section 6.7).			Basements must be flood resistant, and have an internal access to a higher plus climate change flood level, assuming a breach failure). Flood resilient design techniques must be used for all basements (refer Section 6.7).				
		Rate of Inundation >12hrs			Basements must be flood resistant, and must have an internal access to a higher floor (situated 300mm above the Q200 plus climate change flood level, assuming breach failure). Sleeping accommodation is not permitted at basement level.			Basements must be flood resistant, and must have an internal access to a higher floor (situated 300mm above the Q200 plus climate change flood level, assuming breach failure). Sleeping accommodation is not permitted at basement level.			Basements must be flood resistant, and must have an internal access to a higher plus climate change flood level, assuming a breach failure). Flood resilient design techniques must be used for all basements (refer Section 6.7).				
Implement SuDS to ensure that runoff from the site (post redevelopment), as a minimum is not increased. A reduction in site runoff should be sought, aiming to reduce run-off rates by at least 50% over current levels. Any SuDS design must take due account of the surrounding context and protect local residents. Some infiltration techniques (including, for example, permeable paving) are unlikely to be effective in this context (London Borough of Southwark).													Site Runoff (refer Sections 6.7 & 7.6.3)		

6.5 SFRA Interpretation

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

London Borough of Southwark (Forward Planning)

Figure 2 provides an overview of the spatial variation in *tidal and fluvial* flood risk throughout the borough. It is necessary to adopt a sequential approach when considering where land should be allocated for future development, and this is described in Section 6.4. This figure should be used to inform this sequential approach. Furthermore, PPS25 provides clear guidance on permissible land use within areas potentially at risk from flooding, and this too is discussed in Section 6.4.

The borough of Southwark is defended however, and therefore primary risk of flooding is a *residual* risk (i.e. to be realised only should there be a failure of the River Thames defences). Given that this is the case therefore, it is important that a more robust assessment of the 'real' risk to property and life is considered, and the planning decisions taken accordingly. Figures C to E provide an overview of the variation in flood hazard across the borough. The Council should exercise a sequential approach within Zone 3a High Probability, steering more vulnerable development away from areas of highest hazard.

Whilst there is no particular constraint placed upon land use within areas of Zone 1 Low Probability within the borough, it is strongly recommended that the Council takes due consideration of flooding from other sources (i.e. non fluvial). Areas that have previously flooded from localised and non fluvial sources are depicted in Figure 4. Many of these localised sources of flooding within Southwark can be effectively managed through the design process, however it is recommended that advice is taken from the Environment Agency to ensure that the severity of the local issue that may affect (or be exacerbated by) the proposed allocation is fully appreciated.

London Borough of Southwark (Development Control) & Developers

It is important that the potential risk of flooding is considered as an integral part of all proposed development within the borough. Figures C to E provide a measure of the severity of flooding within the proposed development site. These should be used to trigger a more detailed assessment of flood risk related issues.

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

- Figure 4 provides an indication of areas that have been susceptible to localised flooding historically. This is not a comprehensive record of flooding, and relies upon community reports of flooding made to the Council(s). It is a good indication of areas that may be susceptible however, and reiterates the importance of considering flood risk related issues in areas that are outside of the designated PPS25 flood zones.
- Figures A and B provide an overview of the topography and geology of the borough. The detailed FRA should use this information to assess (in a site based context) the potential risk of localised ponding, flash flooding and/or inundation from groundwater.