Strategic Flood Risk Assessment
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Planning Policy Statement 25; Development and Flood Risk (PPS 25) represents a move away from building only physical defences to stop river and tidal flooding to a more holistic understanding of flooding, which factors in the impact of climate change and introduces a ‘risk based management approach’ to flooding. It requires local authorities to assess all forms of flooding and associated risk and set out appropriate management measures in their Strategic Flood Risk Assessment (SFRA). Although the SFRA is not itself a policy document the information it contains can be used as a source to inform policy and management.

The Local Development Framework (LDF) will be a key document in setting out how the city council will adapt and mitigate for the threat of flooding in Westminster. As part of our evidence base the details within the draft SFRA have been used to help inform the strategic policies for flooding within the Submission Draft Core Strategy March 2010. It will also be used to inform discussion and seek views in preparation for the more detailed polices for flooding which will be contained within the City Management Development Plan Document.

In order to inform the draft SFRA, the city council appointed Halcrow as consultants. Their report, dated 27 June 2008 and technical recommendations comprise Appendix 1 of this document.

Although all sources of flooding should be taken into account, in Westminster flooding from the River Thames and from surface water have been identified as having the greatest potential risks.

In terms of flooding from the River Thames, the Environment Agency flood maps and advice contained within PPS 25 assumes there are no flood defences in place and therefore a large part of south Westminster has been designated as being within Flood Zone 3 (1 in 100 or greater annual probability of river flooding or a 1 in 200 or greater annual probability of flooding from the sea). However, Westminster has an extremely high level of flood protection from fluvial and tidal flooding including the Thames Barrier and the Embankment wall, which together provide a 1 in 1,000 annual probability of flooding. In order to assess the implications of breaches in the Embankment wall, the city council asked Halcrow to identify the extent of flooding from 14 separate locations. This has enabled the city council to identify a ‘residual risk’ area, which represents those parts of Flood Zone 3 that are most likely to be flooded if such an unlikely event were to occur. Halcrow have also identified a ‘rapid inundation zone’, these are low lying areas, close to the River Thames which would rapidly inundate to significant depth in the event of a breach. Given the international and national importance of buildings within this area and their occupiers, not to mention the numbers of individual occupiers, a more refined approach to the risk and management of flooding within Zone 3 will need to be taken by the city council and relevant stakeholders. In view of this, the mapping exercise undertaken by Halcrow is already informing the city council’s Emergency Planning Team’s emerging contingency plan for flooding.

As set out in PPS 25, The Sequential Test requires new development to be built in the lowest possible area at risk from flooding. However, given the historical nature of development on the floodplain in Westminster, the complexity of existing development and the shortage of land and requirements to meet our housing targets, this may not always be possible in Westminster. Where relevant and in line with PPS 25 The Exception Test will be required to ensure that development is consistent with wider sustainability objectives; that it is safe and will not increase flood risk elsewhere and, if possible, will reduce flood risk overall.
Much of the information and detailed advice in PPS 25 concerns flood risk from rivers and the sea. Recently, however, government has highlighted the importance of managing surface water flooding at both a national and local level. Specific government advice on how to deal with this matter, and in particular its relationship with spatial planning, is still emerging. However in preparation for this, the city council requested that Halcrow carry out modelling to identify those areas in Westminster most at risk from surface water flooding.

Halcrow identified surface water flooding as a more probable occurrence (1 in 100 annual probability) in Westminster than flooding from the River Thames and they have identified 19 specific areas which have been highlighted as ‘Critical Surface Water Flood Locations’.

The use of Sustainable Urban Drainage Systems (SUDs) will become increasingly important in the adaptation to climate change (in particular with more heavy rain events). The use of SUDs is viewed as a particularly useful device in mitigating against surface water.

The SFRA is a ‘living document’ which will be updated in light of emerging legislation and guidance, and as new or improved data becomes available.
1. Introduction

Background

1.1 Planning Policy Statement 25: Development and Flood Risk (PPS 25), issued December 2006 and revised March 2010, aims to ensure that flood risk is taken into account at all stages of the planning process; to avoid inappropriate development in areas at risk of flooding and to direct development away from areas of highest risk. It advises that where new development is exceptionally necessary in areas of higher risk, this should be safe, without increasing flood risk elsewhere, and where possible, reduce flood risk overall.

1.2 In order to assess this matter PPS 25 requires local authorities to carry out a Strategic Flood Risk Assessment (SFRA) that will contribute to the Sustainability Appraisal of their Local Development Frameworks (LDF), and inform all Development Plan Documents (DPDs), Supplementary Planning Documents (SPDs) (produced as part of the LDF) and the authority’s corporate approach to flooding. Map 1 shows the fluvial and tidal Flood Zones (1, 2 and 3), in Westminster, as defined by the Environment Agency.

The Local Context

1.3 Westminster is a riparian authority located on the north side of the River Thames in central London. It is a complex, and in parts, dense urban environment comprising, some 9 million sq m of office floorspace, approximately 1.7 million sq m of retail floorspace and containing educational, medical and legal organisations of national and international importance. It is of strategic importance in terms of the media, arts, culture, entertainment and tourism industries and has an average day time population of over one million including workers and visitors. It is also home to a long standing and diverse residential community of 231,8741 people with some 45,000 existing residents living within a high probability flood area (Flood Zone 3). Map 2 illustrates the complexity of development in Westminster by showing the predominant land uses. All these uses take place within 21km², of which 4km² are Royal Parks.

1.4 The River Thames has been critically important in the physical development of Westminster. The city grew around a 30 acre island (Thorney Island) bounded by drainage dykes and the River Thames. The first substantial building here, in 1050, was later to become Westminster Abbey and a royal palace was established on Thorney Island in 1060. Since then, Westminster has remained the main location for the functions of Monarchy and State. The Houses of Parliament and virtually all Government and related departments (including BERR (Business, Enterprise and Regulatory Reform), Ministry of Defence, and the Home Office), No. 10 Downing Street and New Scotland Yard are all located within Flood Zone 3. Buckingham Palace and the Royal Courts of Justice are within some 2km of the River Thames Embankment wall.

1.5 As well as the River Thames, the city contains other water features, including the Regent’s Canal, the Grand Union Canal, Paddington Basin and Little Venice, totalling 6.4 kilometres of canal frontage. There are also five ‘hidden rivers’; the Westbourne, Tyburn, Tyburn Brooke, Kilbourne and Long Ditch. The Serpentine (in Hyde Park) and the lakes in Buckingham Palace Gardens and St James’s Park are the remnants of the Westbourne. Westminster sits above a regional chalk aquifer covered with gravels and clay. However, as would be expected in a dense highly urban environment much of the physical landscape is constructed of hard, non-porous materials. Map 3 shows the geology of Westminster and its water features and Map 4 shows the contours above sea level.

1 ONS MYE 2006
1.6 Westminster contains 31 Sites of Importance for Nature Conservation (SINCs); of these five are SINC of Metropolitan Importance. It has; over 11,000 listed buildings and 55 Conservation Areas which cover some 75% of the city (as shown on Map 5). It also has the Palace of Westminster and Westminster Abbey World Heritage Site. There are 21 registered historic squares and gardens, five archaeological priority areas and 2 scheduled monuments.

1.7 As would be expected in the heart of the London, Westminster contains important national and local infrastructure (as shown on Map 6). It has four of London’s main line railway termini and 10 out of the 12 London underground lines. The network’s busiest station, Victoria, which is used by approximately 75 million passengers a year, is located within Flood Zone 3.

1.8 Westminster has 4.7 kilometres of tidal Thames frontage, all of which has good protection against flooding by the (partly listed) Embankment wall. The Thames Barrier, downstream at Woolwich and other tidal defences also provide considerable protection from flooding. Discounting any breach in these defences, Flood Zone 3 has a 1 in 1,000 annual probability of flooding.

1.9 However, without these defences parts of Westminster could be flooded on a more regular basis. The Environment Agency’s Flood Map (Map 1) has been drafted assuming that no tidal defences, including the existing Thames Barrier, are in place and in which case, Flood Zone 3 has a 1 in 100 or greater annual probability of river flooding or a 1 in 200 or greater annual probability of flooding from the sea.

1.10 Flood Zone 3 comprises a substantial part of Westminster (14%) including Pimlico and Millbank, which contain well established residential communities and associated services, including shops and schools, and Victoria and Whitehall, which have a more commercial and governmental mixed use character respectively. The majority of land in Westminster (85%) is in Flood Zone 1, only 1% is in Flood Zone 2. This is comprised of a number of very small individual areas either on the boundary with Flood Zone 3 or scattered within it.

Objectives

1.11 The aim of this draft Strategic Flood Risk Assessment (SFRA) is to provide an audit of all sources of flooding within Westminster and to set out a number of approaches to avoid, reduce and manage this risk as part of a wider objective to ensure a sustainable environment.

1.12 The draft SFRA does not contain advice for existing occupiers who currently live in designated flood zones. For further information and advice on flooding and how to safeguard premises the Environment Agency can be contacted on 08708 506506 or via their Website at http://www.environment-agency.gov.uk/subjects/flood/?lang= e. This site also contains useful links to other sites that cover all aspects of flooding including building and insurance. The Environment Agency advise that there 20 people in Westminster registered to Flood Warnings Direct (FWD). This is less than 1% of the properties at risk from flooding. However, this low percentage can be attributed to the fact that those at tidal risk receive alternative warnings and are protected by the Thames Barrier. The Environment Agency offers the FWD flood warning service, which gives advance warning of flooding via phone, text, email, pager or fax and they encourage all households at risk of flooding to register for this service. Warnings are also broadcast on local radio, particularly LBC who have agreed to broadcast flood warnings in London. Section 8 of the draft SFRA provides details of the city council’s Contingency Plan for major emergencies, including flooding.
a) Appraising Risk

1.13 The most likely sources of flooding in Westminster are listed below and set out in further detail in Section 4.

- Flooding from the River Thames
- Flooding from Surface water
- Flooding from Sewers
- Flooding from Groundwater
- Flooding from Canals, water features and water mains

1.14 Flooding from the River Thames and from surface water has been identified as posing the most likely risks in Westminster. Therefore the city council appointed Halcrow to carry out a more detailed study of these potential sources of flooding. This work included a breach analysis of the tidal defences, with the aim of calculating the ‘residual risk’ posed to Westminster from tidal flooding, using a 2-dimensional hydraulic model (TUFLOW) to represent the spread of flood water from discrete breach locations.

1.15 In addition, Halcrow employed the same TUFLOW model to produce an indicative surface water flood map of areas at the highest risk of surface water flooding in the City. This involved surface water flows being applied to the 2-dimensional model to represent either an intense rainfall event or, for example, a burst water main. The runoff invariably produced flows and pools in topographic low points, allowing the indicative areas at risk of surface water flooding to be mapped. The Environment Agency is revising National Flood Risk Assessment (NaFRA) that will take account of new climate change science and climate change scenarios produced by UK Climate Impact Programme 2008.

1.16 The results of these hydraulic assessments, details of the methods used and Halcrow’s suggested recommendations are contained in ‘The Westminster Breach Analysis and Surface Water Flooding Assessment - Hydraulic Study’, Halcrow, June 2008, which comprises Appendix 1. The Halcrow report is the primary technical assessment for this draft SFRA.

b) Reducing Risk

1.17 Having identified the sources of flooding, Planning Policy Statement 25 Development and Flood Risk (PPS 25) advises that the best way to reduce the risk of flooding from these sources is to avoid inappropriate development in high risk locations. Planning therefore plays the primary role of avoiding and reducing flood risk to and from new developments.

1.18 Detailed information on how to implement this process, in terms of flooding from rivers and the sea is set out in PPS 25, and the associated Practice Guide (December 2009). This is primarily achieved by the application of ‘The Sequential Test’, which is explained further detail in Section 3. The city council’s emerging policy approach for tidal and fluvial flooding and reasoning is set out in Section 5.

1.19 At the time of writing, government guidance on the use of the Sequential Test for surface water flooding is limited. However, in light of the recommendations from the Pitt Report (June 2008), and in preparation for emerging legislation (the Draft Floods and Water Bill - published in April 2009, and draft Surface Water Management Plan Guidance published by Defra in February 2009), critical surface water flood locations within Westminster have been identified by Halcrow which are shown in detail in their report (in Appendix 1) and which are set out in Table 1 in Section 4B and shown on Map 9. Section 6 sets out the implications of Halcrow’s technical recommendations which will help inform discussion in the preparation of the City Management DPD.
c) Managing Risk

1.20 PPS 25 recognises that it is not always possible to avoid building in high risk flood zones and to this end provides guidance on managing risk. PPS 25 states that:

‘Decision-makers should use the SFRA to inform their knowledge of flooding, refine the information on the Flood Map and determine the variations in flood risk from all sources of flooding across and from their area. These should form the basis for preparing appropriate policies for flood risk management for these areas.’ (Paragraph E5).

1.21 The Halcrow report provides a refinement of the areas most at risk from tidal and fluvial flooding. Map 7 shows the extent of flooding from the breach modelling showing the ‘residual risk’ and rapid inundation zone. This information has been used in the preparation of the flooding policy as set out in the Submission Draft Core Strategy document, March 2010. A Rapid Inundation Zone is an area which is at risk of rapid flooding should a flood defence structure be breached or overtopped. The zones at highest risk of rapid inundation are typically located close behind the flood defences.

1.22 Section 7 of the SFRA includes information on the most appropriate type of Sustainable Urban Drainage (SUDs) for use in Westminster, and a more detailed policy approach on this matter will be included in the City Management DPD (see Section 2, paragraph 2.32).

d) A Partnership Approach

1.23 An ongoing partnership with all relevant stakeholders, land owners, developers, agencies and emergency services, the Environment Agency, GLA and Transport for London is critical to avoid and minimise flood risk within Westminster and where relevant with our neighbours – the Royal Borough of Kensington & Chelsea, the City of London, the London Borough of Camden and London Borough of Brent.

1.24 The mapping and information contained within the Halcrow Report (Appendix 1) is already being used by the city council’s Emergency Planning Team in the drafting of their emerging contingency plan for flooding, the Westminster Multi Agency Flood Plan.

1.25 The city council considers that it is important to involve the local community and therefore the draft SFRA was subject to a consultation process wider than that statutorily required.

The role of the Environment Agency

1.26 The General Permitted Development Order was amended on 1 October 2006 to make the Environment Agency a statutory consultee for specified categories of development where flood risk is an issue. These include:

- development other than minor development in Flood Zones 2 and 3;
- development in Flood Zone 1 where there are critical drainage problems;
- any development exceeding one hectare in extent.

1.27 The Environment Agency is required to respond to consultations on pre-planning enquiries within 21 days, unless otherwise agreed, and will object if a Flood Risk Assessment (FRA) is required and has not been submitted, with a planning application. The Environment Agency advice, and the evidence submitted by the developer will be considered by the city council as the basis for taking flood risk issues into account in planning decisions. PPS 25 Practice Guide states that:
Map 7 Extent of Flooding From Breach Modelling

Rapid Inundation Zone
- 1-30 minutes
- 30 minutes to an hour
- Residual Risk Area
- Flood Zone 3

Source: Halcrow Report March 06
Environment Agency July 08

Reproduced by City Planning Group Peter Keller July 08 YOCA_City Planning Group/file/risks-assessment/flood risk assessment july 08.psd
In coming to its decision the Local Planning Authority should demonstrate how the requirements of the Sequential Test and where necessary, the Exception Test have been met. (Paragraph 2.42)

1.28 If the Environment Agency objects to a major application (defined as where the number of dwellings to be provided is 10 or more or for commercial development where the floorspace to be provided is 1,000 square metres or more, or the site area is 1 hectare or more) on flood risk grounds, all parties should discuss and agree the course of action which would need to be taken to enable the Environment Agency to withdraw its objection. If after discussions it becomes clear that the Environment Agency is unable to withdraw its objection, but the city council remains minded to approve, the Town and Country Planning (Flooding) (England) Direction 2007 requires the Local Planning Authority to notify the Secretary of State of the proposal. This provides the Secretary of State with an opportunity to check the application’s general compliance with the guidance in PPS 25 and to consider whether it would be appropriate to call it in for determination.

1.29 We have consulted with the Environment Agency at all stages in the preparation of this SFRA and will continue to do so throughout the LDF process.

Figure 1 Roles and responsibilities of Key Organisations managing Flood Risk
2. **Flood Risk and Planning Policy**

**National Policy**

**The Planning and Compulsory Purchase Act 2004**

The Planning and Compulsory Purchase Act 2004 has brought about a fundamental reform of the planning system. The objectives are to speed up plan preparation, to make plans ‘spatial’, improve community involvement in planning, strengthen policy content; contribute to more sustainable development and to produce a better focus on implementation.


**Planning Policy Statement 1: Delivering Sustainable Development (PPS1)**

2.2 This sets out the Government’s overarching planning policies on the delivery of sustainable development through the planning system. PPS: Planning and Climate Change Supplement to PPS 1, published December 2007 provides policy advice on how planning should contribute to reducing emissions and stabilising climate change, and requires local authorities to promote the use of Sustainable Urban Drainage Systems.


**Planning Policy Statement 3: Housing (PPS 3)**

2.3 PPS 3 sets out the delivery of the Government’s strategic housing policy objectives. This has an underlying aim to ensure ‘that everyone has the opportunity to live in a decent home, which they can afford in a community where they want to live’. This requires local authorities to identify a list of developable land for residential use for up to 15 years.


2.4 PPS 25 places planning at the forefront of dealing with flood risk and mitigation, and requires local authorities to prepare a Strategic Flood Risk Assessment. It provided further powers to the Environment Agency by designating them as a statutory consultee for most planning applications in Flood Zones 2 and 3 and identifies landowners as having primary responsibility for safeguarding their land and property.


2.5 This complements PPS 25, by providing guidance on how to implement its policies in practice. It draws on existing good practice, through case studies and examples, to show how regional planning bodies and local planning authorities can deliver the national policies in PPS: 25 in the light of their own varying circumstances.

Making Space for Water

2.6 Making Space for Water is a cross-governmental programme which sets out a holistic approach to take forward the development of a new strategy for flood and coastal erosion in England.

The Making Space for Water programme is divided into 4 themes:

i  A holistic approach to managing flood and coastal erosion risk,
ii  Achieving sustainable development,
iii  Increasing flood resilience, and
iv  Funding.

2.7 The aim of this strategy is to manage the risks from flooding and coastal erosion by employing an integrated approach which reflects, both national and local priorities, so as:

- To reduce the threat to people and their property; and
- To deliver the greatest environmental, social and economic benefit, consistent with the Government’s Sustainable Development principles.


The Pitt Review – Learning Lessons from the 2007 Floods (June 2008)

2.8 The conclusions of The Pitt Review – Learning Lessons from the 2007 Floods, makes 92 recommendations to be implemented as soon as possible to reduce the impact of flooding that might occur in the near future. These cover the areas of managing flood risk, groundwater monitoring, local and national planning and response, public information and public preparedness. The report calls on the Government to take a more ‘strategic role’ in making the case for adaptation to climate change and highlights the role of local authorities in the management of local flood risk.

http://www.cabinetoffice.gov.uk/thepittreview


2.9 The Government set out its response to the recommendations of the Pitt Review, in which they supported all recommendations including support for strategic flood risk assessments to ensure effective implementation of the objectives of PPS25


Future Water 2008

2.10 Future Water, the Government’s Water Strategy, sets out a vision for effective surface water drainage, taking account of climate change and housing development.

2.11 The Strategy also announced changes to householder permitted development rights, so that planning permission is not required for paving gardens provided porous materials are used (see Guidance on the Permeable Surfacing of Front Gardens 2008 below).

2.12 As part of this Strategy, Defra's consultation on Surface Water Drainage was completed in April 2008. The main proposals affecting a local authority are:

- Preparation of Surface Water Management Plans
- Clarifying responsibilities for adoption and management of SUDS
• Reviewing the automatic right to connect to surface water drains.

House of Commons Environment, Food and Rural Affairs Committee—Flooding – Fifth Report of Session 2007-08 Volume 1

2.13 In May 2008 the Parliamentary Select Committee for Environment Food & Rural Affairs published its report on 'Flooding', which addresses both the Pitt review on the 2007 floods and Defra's consultation on Surface Water Drainage: http://www.parliament.the-stationery-office.com/pa/cm200708/cmselect/cmenvfru/49/49.pdf

Draft Floods and Water Bill (April 2009)


The Town and Country Planning (General Permitted Development) (Amendment) (No. 2) England) Order 2008

2.15 The Order has changed current permitted ‘development’ arrangements relating to works that householders can carry out to enlarge or alter their dwelling or develop within their gardens without requiring planning permission. The amendments to the GDPO has allowed making the hard surfacing of more than five square metres of domestic front gardens permitted development, only where the surface in question is rendered permeable.

Guidance on the Permeable surfacing of Front Gardens – 10 September 2008

2.16 Following the changes to the GDPO, this guidance provides advice to householders of the options for achieving permeability and meeting the condition for permitted development status. This document can be found at: http://www.communities.gov.uk/publications/planningandbuilding/pavingfrontgardens

Surface Water Management Plan Technical Guidance (February 2009)

2.17 This is draft technical guidance advising local authorities how to develop Surface Water Management Plans, for example, who to involve, how to assess flood risk and management/mitigation measures, and how to develop a strategy and action plan. http://www.defra.gov.uk/environment/flooding/manage/surfacewater/plans.htm


2.18 English Heritage advises the public on all matters affecting the welfare of the built heritage and has designed this document to assist people who live in, own, or are responsible for historic buildings which, together with their historic fixtures and fittings, may be threatened by periodic flooding. The technical note provides guidance on preventative measures, first aid and other ways to minimise flood damage. It suggests sources of specialist help to inspect, conserve, repair or restore historic property after such disasters. http://www.english-heritage.org.uk/server/show/nav.18579
Regional Policy

The London Plan

2.19 In February 2008 The London Plan, Consolidated with Alterations since 2004, was published and is the spatial development strategy for London. Policy 4A.13 of The London Plan sets out the policy approach for flood risk management as follows:

Policy 4A.13 Flood Risk Management
Where development in areas at risk from flooding is permitted, (taking into account the provisions of PPS25), the Mayor will, and 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 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;
- Establish flood warning and emergency procedures.

Opportunities should also 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 floodplain 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.

www.london.gov.uk/thelondonplan

2.20 Policy 4A.14 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.

www.london.gov.uk/thelondonplan

The London Plan – Consultation Draft Replacement (October 2009)

2.21 This consultation draft of the new London Plan is being consulted on October 2009 – January 2010. This includes policies that aim to minimise and manage flood risk and promote sustainable drainage will be strengthened.

London Regional Flood Risk Appraisal (October 2009)

2.22 This set out a strategic overview of flood risk across London and contains a series of recommendations which are either region wide or applicable to boroughs in undertaking their SFRA to accompany emerging Local Development Documents (LDD’s). This document is available at http://www.london.gov.uk/sites/default/files/uploads/regional-flood-risk09.pdf

The Mayor’s Draft Water Strategy Draft for public consultation (August 2009)

2.23 This consultation document sets out an approach for the integration of water management. Section 4 considers managing rainwater and Section 5 considers the combined sewers. http://www.london.gov.uk/priorities/environment/vision-strategy/water

The draft climate change adaptation strategy for London – Public Consultation Draft report February 2010

2.24 This sets out a strategic framework for London to deal with the impacts of climate change and extreme weather. It takes a risk management approach but recognises that adapting London to climate change requires partnership work including national government and the private sector. This document can be read in full at: http://www.london.gov.uk/climatechange/strategy

The Mayor’s Sustainable Design and Construction Supplementary Planning Guidance – May 2006 (currently the subject of a review)

2.25 This document provides advice on the principles of sustainable design and how this should be implemented in London and includes advice on water pollution and flooding. This document can be viewed at: http://legacy.london.gov.uk/mayor estratégicas/sds/docs/spg-sustainable-design.pdf

The Environment Agency

Thames Estuary 2100

2.26 The Thames Estuary 2100 (TE2100) project was established by the Environment Agency in 2002 with the aim of developing a strategic flood risk management plan for London and the Thames estuary through to the end of the century. The TE2100 Plan Consultation Document was published in April 2009, and a final plan is due to be submitted to Government in 2010. http://www.environment-agency.gov.uk/research/library/consultations/106100.aspx
Local Policy

The Unitary Development Plan (UDP)

2.27 The council adopted its UDP on 24 January 2007, and parts of it were ‘saved’ by the Secretary of State on 24 January 2010. [http://www.westminster.gov.uk/environment/planning/unitarydevelopmentplan/]

2.28 Chapter 11 – River Thames contains policies which seek to protect and enhance townscape, quality, open aspect, nature conservation and to encourage greater use of the river for transport and recreation. The UDP was prepared under Planning Policy Guidance 25: Development and Flood Risk (July 2001) and in accordance with this guidance, the UDP contains policy (RIV 12) which protects Westminster’s existing flood defences. Map 11.2 in the UDP shows the indicative floodplain for Westminster, as identified by the Environment Agency.

2.29 All other relevant ‘saved’ UDP policies will be taken into account when assessing applications for proposals involving flood risk.

The Local Development Framework (LDF)

2.30 The Planning and Compulsory Purchase Act 2004 requires local planning authorities to produce Local Development Frameworks to replace the existing system of local plans. The LDF is a portfolio of documents, which will collectively provide the ‘spatial planning strategy’ for Westminster up to 2025 and will gradually replace UDP policies.

2.31 The first stage of the Core Strategy Development Plan Document (DPD), Issues and Options was carried out in May-June 2007 and the second stage, The Preferred Options was the subject of public consultation between 24 July and 30 September 2008. Having assessed all the comments received and assessed the evidence base and sustainability appraisal a Publication Draft Core Strategy was published (November 2009) for notification purposes. The Council submitted its Submission Draft Core Strategy to the Secretary of State in April 2010 and can be viewed at [http://www.westminster.gov.uk/services/environment/planning/ldf/submission-draft/]. Following a public examination, we are hoping to adopt the document by late 2010/early 2011.

2.32 Work has started on the preparation of the sister document to the Core Strategy – the City Management DPD - which will contain the city council’s development management policies and will include detailed policies in respect of sustainable development including flooding and the requirement for Flood Risk Assessments and will set out further information on Sustainable Urban Drainage (SUDs). This document which was subject to initial consultation notification in October 2008, and had stakeholder consultation workshops between June and August 2009. Information on the City Management DPD can be found at the following [http://www.westminster.gov.uk/environment/planning/ldf/cityplan.cfm]. The Council expects to submit the City Management DPD to the Secretary of State in 2010, and, following public examination, adopt the document in 2011.

Sustainability Appraisal

2.33 The Sustainability Appraisal requirements in relation to Local Development Frameworks (LDF) are set out in Section 19 (5) of the Planning and Compulsory Purchase Act 2004. A Strategic Environmental Assessment is required under ‘The Environmental Assessment of Plans and Programmes Regulations 2004’ Statutory Instrument No 1633; this transposes into UK legislation ‘Directive 2001/42/EC of the

2.34 This document recognises that there may be conflicting objectives, including between the provision of housing and flood risk. Appendix 2 sets out the city council’s 17 Sustainability Objectives as contained in the Scoping Report.

2.35 The Sustainability Appraisal for the Preferred Options was published for consultation purposes in July 2008. 
http://www.westminster.gov.uk/services/environment/planning/ldf/submission-draft/

The Open Space Strategy Supplementary Planning Document – Adopted February 2007

2.36 This aims to protect open space within Westminster and improve the quality, management, accessibility and usage of parks and open spaces and to provide new facilities where there are deficiencies in provision. 
http://www.westminster.gov.uk/services/environment/planning/ldf/open-space-strategy/ 

Supplementary Planning Guidance (SPG) on Sustainable Buildings

2.37 The Sustainable Buildings SPG was published in 2003 and contains guidance on how sustainable buildings can be achieved in Westminster. Section 6 of this document – Water and Drainage contains information on the efficient use of all water resources and how to minimise the risk of flooding and land contamination. 

2.38 A Sustainable Design Supplementary Planning Document is being prepared as part of the LDF.
3. **PPS 25 - Flood Zones, the Sequential Test and Exception Test**

**Flood Zones**

3.1 The Environment Agency Flood Map for Westminster was updated on 31 July 2008 and is shown in Map 1. The Flood Zones designated on this map and as defined in Planning Policy Statement 25 Development and Flood Risk (PPS 25), are as follows:

- **Flood Zone 1 (Low Probability)**
  This zone comprises land assessed as having less than a 1 in 1,000 annual probability of river or sea flooding in any year (< 0.1%).

- **Flood Zone 2 (Medium Probability)**
  This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% - 0.1%) in any one year.

- **Flood Zone 3a (High Probability)**
  This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (> 1%) or a 1 in 200 or greater annual probability of flooding from the sea (> 0.5%) in any year.

- **Flood Zone 3b (The Functional Floodplain)**
  This zone comprises land where water has to flow or be stored in times of flood.

3.2 Westminster, like many historic urban centres, no longer has a functional floodplain. Flood Zone 3b has been developed over the centuries and most recently by the Grosvenor Waterside Development scheme (formerly the Gatliff Road Depot site). Flood Zones 3a and b are, therefore, referred to throughout this draft SFRA as Flood Zone 3. PPS 25 states that:

> ‘The Flood Zones refer to the probability of flooding from rivers, the sea and tidal sources and ignores the presence of existing defences, because these can be breached, overtopped and may not be in existence for the lifetime of the development.’ (Paragraph 17 – footnote 6).

3.3 The breaching or overtopping of existing defences constitutes a ‘residual risk’ as defined in Annex G of PPS 25. Map 7 shows the extent of a breach within the Embankment and constitutes the residual risk area in Westminster based on the modelling undertaken by Halcrow. The Tidal Thames Extreme Water Levels Study (Halcrow, August 2005 – research study), calculated that with the current flood defence levels and an operational Thames Barrier, the risk of a tidal event overtopping the defences was significantly less than 0.1% (1 in 1,000 year) and therefore overtopping is not considered to be a risk within Westminster.

3.4 Flood Zone 2 consists of a small number of individual areas and the SFRA does not provide specific advice for this zone. Planning applications received for schemes in these areas will be subject to the requirements of PPS 25.

**The Sequential Test**

3.5 PPS 25 states that

> ‘Where decision-makers have been unable to allocate all proposed development and infrastructure in accordance with the Sequential Test, taking into account the flood vulnerability category of the
intended use; it will be necessary to increase the scope of the SFRA to provide the information necessary for the Exception Test. This should additionally, consider the beneficial effects of flood risk management infrastructure in generally reducing the extent and severity of flooding when compared to the Flood Zones on the Flood Map. The increased scope of the SFRA will enable the production of mapping showing flood outlines for different probabilities, impact, speed of onset, depth and velocity variance taking account of the presence and likely performance of flood risk management infrastructure.’ (Paragraph E6)

3.6 PPS 25 requires that the Sequential Test is used when drafting site/land allocation DPDs in the LDF and when determining individual planning applications for any development other than minor development and changes of use. The overall aim of the Sequential Test is to steer new development to areas with a lower probability of flooding by looking at available land and the vulnerability of the use. The Environment Agency Flood Zones are the starting point for this assessment. However, as set out above, these can be refined, in the SFRA, as is the case in Westminster. PPS 25 further advises that:

“In areas at risk of river or sea flooding, preference should be given to locating new development in Flood Zone 1. If there is no reasonably available site in Flood Zone 1, the flood vulnerability of the proposed development...can be taken into account in locating development in Flood Zone 2 and then Flood Zone 3. Within each Flood Zone new development should be directed to sites at the lowest probability of flooding from all sources...as indicated by the SFRA.’ (Paragraph 17).

3.7 PPS 25 Practice Guide – December 2009 advises that where a land use is not specifically referred to in table D.2, it should be allocated to the most appropriate vulnerability classification based on comparison with the characteristics of other uses in the table, informed by consideration of the risks from flooding.’ (Paragraph 4.73)

The definition of dwelling houses in PPS25 within Westminster is taken to refer to all residential dwellings including flats, with the exception of basement dwellings.

3.8 PPS 25 states that:

If, following the application of the Sequential Test in Annex D, it is not possible, consistent with wider sustainability objectives, for the development to be located in zones of lower probability of flooding, the Exception Test can be applied....(Paragraph 18).

It is clear throughout PPS 25 that the Exception Test can not be used to justify more vulnerable uses within higher probability flood zones until the Sequential Test has been carried out first.

The Exception Test

3.9 The Exception Test provides a method of managing flood risk while still allowing necessary development to occur (PPS 25 Paragraph 18). The Flood Risk Vulnerability Classification (Table D.2) and the Flood Risk Vulnerability and Flood Zone Compatibility matrix (Table D.3) from PPS 25 Annex D are set out below.
Table D.2. Annex D of PPS 25 defines schedule of vulnerability classes for different types of development as follows:

<table>
<thead>
<tr>
<th>Flood Risk Vulnerability Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essential Infrastructure</td>
</tr>
<tr>
<td>• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk</td>
</tr>
<tr>
<td>• Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood</td>
</tr>
<tr>
<td>• Wind turbines</td>
</tr>
<tr>
<td>Highly Vulnerable</td>
</tr>
<tr>
<td>• Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations required to be operational during flooding.</td>
</tr>
<tr>
<td>• Emergency dispersal points</td>
</tr>
<tr>
<td>• Basement dwellings</td>
</tr>
<tr>
<td>• Caravans, mobile homes and park homes intended for permanent residential use.</td>
</tr>
<tr>
<td>• Installations requiring hazardous substances consent</td>
</tr>
<tr>
<td>More Vulnerable</td>
</tr>
<tr>
<td>• Hospitals</td>
</tr>
<tr>
<td>• Residential institutions such as residential care homes, children’s homes, social services homes, prisons and hostels.</td>
</tr>
<tr>
<td>• Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels</td>
</tr>
<tr>
<td>• Non-residential uses for health services, nurseries and educational establishments.</td>
</tr>
<tr>
<td>• Landfill and sites used for waste management facilities for hazardous waste 20</td>
</tr>
<tr>
<td>• Sites used for holiday short-let caravans and camping, subject to a specific warning and evacuation plan.</td>
</tr>
<tr>
<td>Less Vulnerable</td>
</tr>
<tr>
<td>• Police, ambulance and fire stations which are not required to be operational during flooding.</td>
</tr>
<tr>
<td>• Buildings used for; shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non-residential institutions not included in ‘more vulnerable’ and assembly and leisure.</td>
</tr>
<tr>
<td>• Land and buildings used for agriculture and forestry</td>
</tr>
<tr>
<td>• Waste treatment (except landfill and hazardous waste facilities).</td>
</tr>
<tr>
<td>• Minerals working and processing (except for sand and gravel working)</td>
</tr>
<tr>
<td>• Water treatment plants which do not need to remain operational during times of flood.</td>
</tr>
<tr>
<td>• Sewage treatment plans (if adequate measures to control pollution and manage sewage during flooding events are in place).</td>
</tr>
<tr>
<td>Water-compatible development</td>
</tr>
<tr>
<td>• Flood control infrastructure</td>
</tr>
<tr>
<td>• Water transmission infrastructure and pumping stations</td>
</tr>
<tr>
<td>• Sewage transmission infrastructure and pumping stations</td>
</tr>
<tr>
<td>• Sand and gravel workings</td>
</tr>
<tr>
<td>• Docks, marinas and wharves.</td>
</tr>
<tr>
<td>• Navigation facilities</td>
</tr>
<tr>
<td>• MOD defence installations</td>
</tr>
<tr>
<td>• Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location</td>
</tr>
<tr>
<td>• Water based recreation (excluding sleeping accommodation)</td>
</tr>
<tr>
<td>• Lifeguard and coastguard stations</td>
</tr>
<tr>
<td>• Amenity and open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms</td>
</tr>
<tr>
<td>• Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to specific warning and evacuation plan.</td>
</tr>
</tbody>
</table>
Table D.3. Flood Risk Vulnerability and Flood Zone ‘Compatibility’

**Development is appropriate**

<table>
<thead>
<tr>
<th>Flood Risk Vulnerability classification (see Table D.2)</th>
<th>Essential Infrastructure</th>
<th>Water Compatibility</th>
<th>Highly Vulnerable</th>
<th>More Vulnerable</th>
<th>Less Vulnerable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zone 2</td>
<td></td>
<td></td>
<td></td>
<td>Exception Test</td>
<td>Required</td>
</tr>
<tr>
<td>Zone 3a</td>
<td>Exception Test Required</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zone 3b Functional Floodplain</td>
<td>Exception Test Required</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

**The Exception Test**

For the Exception Test to be passed:

a) It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by the SFRA where one has been prepared. If the DPD has reached the ‘submission’ stage –see Figure 4 of PPs12: Local Development Frameworks – the benefits of the development should contribute to the Core Strategy’s Sustainability Appraisal.

b) the development should be on developable or previously developed land or , if it is not on previously-developed land that there are no reasonable alternative sites on developable previously-developed land; and

c) A FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and where possible, will reduce flood risk overall.

PPS25, Annex D, para D9

3.10 PPS 25 states that all three elements of the test need to be passed for development to be allocated or permitted. Where the use of the Exception Test is required decision-makers should apply it at the earliest possible stage, to all Local Development Documents and all planning applications other than for minor development. This can only be applied, after the Sequential Test has been carried out. Minor Development is defined in PPS 25 as:

- Minor non – residential extensions: Industrial/Commercial/Leisure etc. extensions with a footprint of less than 250m2;
- Alterations: development that does not increase the size of the buildings for example alterations to external appearance;
- ‘Householder’ development: for example sheds, games rooms etc within the curtilage of the existing dwelling in addition to physical extensions to the existing dwelling itself. This definition EXCLUDES any proposed development that would create a separate dwelling within the curtilage of the existing dwelling, for example subdivision of houses into flats.
4. Sources of Flooding in Westminster and Infrastructure Flood Risk Management Options

4.1 Flooding is a natural process and can happen at any time in a wide variety of locations. The various forms of flooding present a range of different risks. The speed of inundation and duration varies greatly. With climate change, however, the frequency, velocity, depth, patterns and severity of flooding are forecast to change and to become more damaging. Although rivers and the sea are the principle causes of flood damage in England, a significant proportion of flooding results from other sources. The following section provides information on the most likely sources of flooding within Westminster.

A) Flooding from the Thames

Nature of Risk

4.2 Westminster sits on the north bank of the Tidal Thames and is therefore potentially susceptible to both tidal and fluvial flooding. Operationally the Thames flood defences within Westminster are sea defences and have a tidal designation in terms of Planning Policy Statement 25: Development and Flood Risk (PPS 25). The Thames is the only river in Westminster, earlier watercourses (the hidden rivers mentioned in paragraph 1.5) have been subsumed into the sewerage network.

4.3 Flooding from the sea and rivers can happen in a number of ways. These are as follows:

- Overtopping of defences
- Breaching of defences
- Inundation of floodplains

Information Available

4.4 On January 6th 1928 a tidal surge, at high tide, came up the River Thames Estuary resulting in the flood defence walls and embankments, of the time, being overtopped. The extent of the flood area is shown in Map 8. Most of the 14 fatalities in Westminster occurred in basement dwellings in Millbank. There was a major tidal flood event in 1953 which was the catalyst for the construction of the Thames Barrier and associated defence improvements in the 1980s.

4.5 Today, the River Thames is defended by 185 miles of flood defence walls, embankments, and nine tidal barriers, including the Thames Barrier, as well as 35 major gates and over 400 minor gates which offer protection against a tidal flood event that has a 0.1% annual probability of occurring up to the year 2030. The Thames Barrier and associated defences provide a very high level of protection against river and tidal flooding — one of the best in the world. The operation of the Thames Barrier and the associated gates is governed by the Thames Barrier and Flood Prevention Act 1972.

4.6 Meteorological Office data, real time tidal gauge data and three models contribute to the forecast procedure for the Tidal Thames. The models are

- The North Sea Model
- The Continental Shelf Model, and
- The River Thames ISIS model.

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4.7 Tides are tracked along the east coast of England approximately 36 hours in advance of them entering the Thames Estuary. The decision to close the Barrier, or not, is made when the tide reaches the Thames Estuary and is based on the following:

- The height of the tide
- The tidal surge
- The fluvial flow

4.8 The Thames Barrier takes approximately 1.25 hours to close all 10 gates and creates a ‘sufficiently empty’ reservoir for fluvial flow entering the tidal Thames, at Teddington Weir, to be stored. The Thames Barrier is closed over high tide until the water level downstream is equal to the water level upstream. The Thames Barrier is then opened to allow the water upstream to flow out on the ebb tide.

Figure 2

![Thames Barrier: Tidal-Fluvial dominated closures (up to 31st March 2007)](source: Environment Agency)

Nearly every year the Thames Barrier is closed more frequently against tidal flooding. Up to March 2007, the barrier has been closed a total of 103 times to protect London from tidal or river flooding. It is forecast that, by 2100, the Thames Barrier would need to be shut approximately 200 times a year based on current operating rules. It is estimated that the maximum number of closures per year that can be sustained is around 50 to 70.

High tide levels in central London are rising by some 60 cm each century. London is 30 centimetres nearer sea levels than it was in the 1940s. The reasons for this include rising sea levels; increasing storminess and tidal variation; the downward tilting of the south east corner of England; and the settlement of London on its bed of clay. Climate change is predicted to cause sea levels to rise by approximately 30 cm by 2050.

4.9 Westminster is also defended by the Embankment wall. This was constructed between February 1864 and July 1870 by Sir Joseph Bazalgette. Constructed of brick walls faced with granite and to a depth of 33ft below the high water mark it was one of the great Victorian engineering projects.

Likely impact of Climate Change

4.10 Climate change will have a major impact to the threat of flooding from the River Thames. Sea level rise will gradually reduce the level of protection that defences offer.
The predictions for how quickly sea level will rise vary considerably depending on the assumptions used about emissions and climate modelling. The Thames Estuary 2100 (TE2100) project is an Environment Agency project to develop a tidal flood risk management plan for the Thames Estuary through to the end of the century. It is considering a range of climate change scenarios for sea level rise from 0.9m (Defra Climate Change Scenario) to 4m (High ++ Level where all conceivable sea level rise contributions up to 2100 occur). Up to 2030 existing flood risk management will continue to provide appropriate defence for tidal and fluvial flood risk. Beyond 2030 there is more variation in the projections. Climate change has been factored into the Halcrow calculations. It has proposed a policy approach for the central London area, including Westminster, which is to take action to reduce the likelihood and consequence of flooding.

**Development locations which may be affected from Tidal and Fluvial Flooding of the River Thames**

4.11 The Environment Agency Flood Map for Westminster (Map 1) assumes no tidal or fluvial defences. The actual level of protection against flooding is, however, extremely high which offers protection against river and tidal flooding that has a 1 in 1,000 annual probability of occurring up to the year 2030.

4.12 The risk which remains after all risk avoidance, reduction and mitigation measures have been implemented is known as the ‘residual risk’. As mentioned earlier, Westminster has excellent flood defences for tidal and fluvial flooding, but the residual risks would involve overtopping or breaching of the Embankment Wall. The risk of overtopping the defences is extremely low. The Halcrow study therefore focussed on the residual risk from breach of the Embankment Wall.

4.13 Based on the results of the breach analysis along the full river frontage of Westminster, Halcrow have identified four critical lengths of tidal defence which if breached by an extremely high tide could lead to extensive inundation of the areas behind. These have been identified as areas around:

1. Area around and including the Houses of Parliament
2. Victoria Embankment and Whitehall, Adjacent to Downing Street
3. Tate Britain and Millbank
4. Churchill Gardens (including the Pimlico District Heating Undertaking) and Grosvenor Road, Pimlico
4.14 Maps a) to d) in paragraph 3.1.2 of the Halcrow Report show these areas in detail and Flood Map A5 in Appendix A of their report shows the areas of rapid inundation. These areas are considered to constitute the highest risk flood areas in Zone 3, that is, the areas at greatest risk if flood defences were breached and within the residual risk area as shown on Map 7. Halcrow consider that in other non-critical areas a breach of the defences would result in limited flooding due to the high elevation of the land behind.

4.15 In order to assess the likelihood of a breach in the Thames Tideway defence wall, Halcrow carried out a visual structural assessment. A review of the Environment Agency’s National Fluvial and Coastal Defences Database (NFCDD) was also undertaken, which showed that all flood defences in the Westminster embayment were inspected in 2007. All the defences observed and registered on NFCDD were above the Environment Agency identified target conditions. In summary, the Embankment wall is considered to be in good condition and the lifespan of the wall is considered to be commensurate with the lifespan of any development planned in the near future (a minimum of 60 years).

4.16 There are four underground stations in Westminster which are located in areas of rapid inundation.

- Temple
- Embankment
- Westminster
- Pimlico

St. James’s Park underground station and Victoria main line and Underground stations are located Flood Zone 3, but are not in the residual risk area or rapid inundation zone. Map 6 shows Transport and other Infrastructure and Strategic Utilities in relation to the identified Flood Zones in Westminster.

**Infrastructure Flood Risk Management Options**

**The Thames Barrier**

4.17 Westminster is well protected by 76 km of tidal defences along the River Thames. Supplementing this is 298 km of floodwalls, embankments and nine tidal barriers, including the Thames Barrier and associated flood gates. The Environment Agency owns and operates the Thames Barrier. Given predicted climate change scenarios current systems need renewing or adapting for the next 100 years. The TE2100 project is considering new approaches to flood defences that will protect Westminster and London into the next century. Up to 2030 the Thames Barrier and associated flood defences will convey a flood risk protection of 1 in a 1,000 likelihood of a flood happening. The TE2100 project has proposed a number of options to manage flood risk and will look at whether this level of protection is sufficient or whether it should be raised in the future. Westminster will continue to update its flood risk advice based on changes to flood risk management options. In the meantime the Environment Agency will continue to monitor and regulate necessary repairs and the replacement of existing flood defences and the Thames Barrier will continue to provide London and Westminster with a high level of protection.

**The Embankment Wall**

4.18 Most of the Embankment is listed. North of Westminster Bridge the Victoria Embankment is grade II listed. The Embankment wall is also grade II listed at Victoria Tower Gardens between the Houses of Parliament and Lambeth Bridge. To the south of Lambeth Bridge the River Thames embankment adjacent to Victoria Tower Gardens,
Millbank, Riverside Walk and Grovesnor Road is unlisted - unless part of associated listed buildings.

Embankment wall

4.19 The city council believes that the responsibility of repair and maintenance to the Embankment wall is as follows:

- Victoria Embankment and Wall (City of London boundary to Westminster Bridge) – Westminster City Council
- Thames Embankment and Wall (Westminster Bridge to east of Lambeth Bridge) – Crown/Parliamentary Works
- Thames Embankment and Wall (Lambeth Bridge to east of Vauxhall Bridge including Millbank Tower and Tate Britain) – Westminster City Council
- Thames Embankment and Wall (Vauxhall Bridge to rear of 141 Grosvenor Road and rear of Pimlico Gardens) – Westminster City Council
- Thames Embankment and Wall (rear of 128-140 Grosvenor Road – Owners/Crown Estate
- Thames Embankment and Wall (from 128 Grosvenor Road (but not rear of it to RB Kensington and Chelsea boundary - Westminster City Council

4.20 In light of their findings regarding the consequences of a breach in the Embankment wall, Halcrow have recommended the following measures (Appendix 1, paragraph 4.1):

- “In addition to the regular structural surveys carried out along the whole Westminster tidal defence, more emphasis is paid to the structural condition of tidal defences along the four critical reaches”
- “Priority funding, maintenance is given to the tidal defences along the critical reaches”.

The critical reaches are at:

i Tate Britain, Millbank
ii Grosvenor Road, Pimlico
iii Between Lambeth Bridge and Westminster Bridge
iv Victoria Embankment (from Richmond Terrace to Horse Guards Avenue);
4.21 Whilst carrying out their assessment of the Embankment wall, Halcrow came across anecdotal evidence that one section of the tidal defence at Millbank, across from Millbank Tower is subject to seepage, leading to localised flooding of the road. They note that "if this anecdotal evidence is confirmed then this may suggest that there is a structural weakness" (Appendix 1 Halcrow Report -June 2008 Paragraph 2.2.3).

4.22 The city council is currently investigating funding, inspection and repair works in connection with this matter.

4.23 The city council has recently been notified by the Environment Agency that maintenance works are required in the stretch of the Embankment wall between the city council boundary with the City of London and Westminster Bridge. These works are in the city council's Capital Programme. The SFRA will be updated with progress on this matter.

4.24 As an overall strategy for maintenance of local flooding defences, Policy 4A.13 of The London Plan advises that permanent built development should be set 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. The establishment of the Embankment in the nineteenth century and associated legislation which precluded development in close proximity to it has dictated the existing landscape of this area. Therefore, much of Westminster’s riverside frontage is set back from the Embankment Wall by at least the width of the Grosvenor Road.

4.25 Westminster’s adopted UDP policy RIV 12 ensures that any development protects the River Thames flood defences, that access to the defences for maintenance and emergency purposes is maintained and, if necessary, improvements to the flood defences will be sought as a condition, or required as a planning obligation, related to a development proposal. This approach to protect flood-related infrastructure and retain access for maintenance is continued in the Submission Draft Core Strategy policy CS44 Flood-related Infrastructure.

**Transport Infrastructure**

4.26 The Draft Climate Change Adaptation Strategy for London (Mayor of London, public consultation draft) February 2010, considers the resilience of London’s infrastructure to climate change. It recognises that the London Underground is more vulnerable to flooding because water will naturally flow to the lowest point. It recognises that the mainline rail system is less vulnerable, though acknowledges mainline terminal stations can be vulnerable from heavy downpours due to large roof expanses and limited drainage capacity. This document proposes an action for Transport for London to undertake a climate risk assessment of their assets and operations and develop prioritised action plans for key risks, and to review their drain and gully maintenance programme particularly in high-risk areas.
B) Flooding from Surface Water

Nature of Risk

4.27 In highly developed areas, such as Westminster, surface water flooding occurs when intense rainfall is unable to soak into the ground or enter drainage systems, because of blockages, or breakages in water pipes or where drainage capacity has been exceeded. In comparison with overtopping or breaching of the Thames, the Halcrow Report, June 2008 (Appendix 1, paragraph 4.3) advises that the more probable occurrence of flooding within Westminster is from surface water flooding. The Halcrow study also considered the residual risk from surface water flooding. This involved a hydraulic assessment of Westminster which assessed which areas are at the highest risk from surface water flooding.

Information Available

4.28 Detailed records of surface water flooding are not currently held for London as a whole. All parts of Westminster may be susceptible to varying degrees of surface water flooding. However, surface water run-off invariably pools in low lying areas indicating a greater risk of surface water flooding. The design of buildings can also contribute to localised surface water flooding. Developments with large roof areas e.g. Westminster’s four main line railway stations (see Map 6), underpasses or low lying land can be especially vulnerable.

4.29 Localised flooding of roads can also take place when gullies are unable to discharge into full ‘combined sewers’, sewers which receive both foul water and water from roofs, hard standing and highways. It is often difficult to identify the source of the problem as it can be exacerbated by blocked gullies from debris and is often temporary.

4.30 Given that this is an emerging issue and there is currently a lack of detailed information on surface water flooding at the national and regional levels, the city council asked Halcrow to carry out a surface water flooding hydraulic study (see Appendix 1). Their findings are summarised in Table 1 below and illustrated on Map 9 (these areas are mapped on pages 15 to 24 in Appendix B Halcrow Technical Note – Surface Water Modelling, and also shown on the Surface Water Modelling Study maps in Appendix A, to the Halcrow Report in Appendix 1).

Likely Impact of Climate Change

4.31 PPS 25 advises that:

“The climate changes already seen in the UK are consistent with the UKCIP02 scenarios. This suggests that winters will become wetter over the whole of the UK, by as much as 20 per cent by the 2050s. A shift in the seasonal pattern of rainfall is also expected, with summers and autumn becoming much drier than at present. Snowfall amounts will decrease significantly throughout the UK, but the number of rain-days and the average intensity of rainfall are expected to increase....’ (Annex B8)

4.32 With a predicted increase in the number of rain-days and a greater average intensity of rainfall an increase in incidents of surface water flooding is expected. Climate change was mapped into the Halcrow model by applying the recommended national factor of 30% to a 1 in 100 year rainfall depth.
Development locations which may be affected

4.33 The Halcrow report identifies 19 specific areas as 'Critical Surface Water Flood Locations' due to depth or the frequency with which they are expected to flood. The most critical areas are either large topographic depressions that could lead to flooding of large numbers of properties to a depth of 200mm or above, or locations along critical flow paths, draining the surrounding area. Map 9 shows the location of these areas and detailed maps are contained on pages 15 – 24 in Appendix B Halcrow Technical Note – Surface Water Modelling to the Halcrow Report in Appendix 1.

<table>
<thead>
<tr>
<th></th>
<th>Critical Surface Water Flood Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Whitehall, Great Scotland Yard, Horse Guard Avenue, Downing Street, Richmond Terrace, King Charles Street, Derby Gate, SW1</td>
</tr>
<tr>
<td>2</td>
<td>Buckingham Gate, Castle Lane, Caxton Street, Petty France, SW1</td>
</tr>
<tr>
<td>3</td>
<td>Great Peter Street, Old Pye Street, St Anne’s Street, SW1</td>
</tr>
<tr>
<td>4</td>
<td>Vincent Street and surrounding area, Marsham Street, SW1</td>
</tr>
<tr>
<td>5</td>
<td>Vauxhall Bridge Road, Stillington Street, Willow Place, Rochester Row and adjacent to Wilton Street, SW1</td>
</tr>
<tr>
<td>6</td>
<td>Buckingham Palace Road, Terminus Place, Bridge Place, SW1</td>
</tr>
<tr>
<td>7</td>
<td>Broadwick Street, Poland Street, Berwick Street, Lexington Street, Ingestre Place and Peter Street, W1</td>
</tr>
<tr>
<td>8</td>
<td>Bruton Lane, Charles Street, Curzon Street, Half Moon Street, Shepherd Street, Berkeley Street, Barlow Street, W1</td>
</tr>
<tr>
<td>9</td>
<td>Wigmore Street, James Street, Gilbert Street, Brook Street, Brooks Mews, Davies Street, W1</td>
</tr>
<tr>
<td>10</td>
<td>Langham Place, Margaret Street, Great Castle Street, W1</td>
</tr>
<tr>
<td>11</td>
<td>Bolsover Street, Great Portland Street, Clipstone Street, Great Titchfield Street, W1</td>
</tr>
<tr>
<td>12</td>
<td>Marylebone Street, Bulstrode Street, Marylebone Lane, W1</td>
</tr>
<tr>
<td>13</td>
<td>Grafton Street, Marylebone Road, NW1</td>
</tr>
<tr>
<td>14</td>
<td>Bishops Bridge Road, Queensway, Redan Place, W2</td>
</tr>
<tr>
<td>15</td>
<td>Boume Terrace, W2</td>
</tr>
<tr>
<td>16</td>
<td>Harrow Road, Droop Street, First Avenue, Second Avenue, W10</td>
</tr>
<tr>
<td>17</td>
<td>Dart Street, Bruckner Street, Lancefield St, W10</td>
</tr>
<tr>
<td>18</td>
<td>Shirland Road, W9</td>
</tr>
<tr>
<td>19</td>
<td>Abbey Road, Springfield Road, NW8</td>
</tr>
</tbody>
</table>

4.34 Halcrow have advised that these critical areas only highlight the main areas at risk, and other areas that are not listed may still be at risk of surface water flooding.

Infrastructure Flood Risk Management Options

4.35 It is increasingly being recognised that one of the key criteria in minimising surface water flooding is in the better management of the drainage infrastructure. The House of Commons - Environment, Food and Rural Affairs Committee report - Flooding Fifth Report of Session 2007-08 states that:

“managing surface water flood risk is intrinsically linked to managing surface water drainage at the local level. Responsibilities for surface water drainage systems are split between various organisations, partly as a consequence of the privatisation of the water industry”

(paragraph 21, page13)
4.36 The Pitt Review June 2008 found that:

“Surface water flooding is complex and affected by many factors, such as the capacity of the sewerage/drainage system, saturated ground and high river levels that prevent the system from discharging. The responsibilities for certain drainage assets remain unclear…This lack of transparency in ownership and complexity involved could be reduced by having a single national organisation with an overarching responsibility for all types of flooding. This is why we believe that government leadership should be supported by clear oversight of all flood risk management activity and the Environment Agency’s risk management responsibilities extended accordingly.

(paragraph ES.16, page 12)

4.37 The Government published its response to the Pitt Review in December 2008, accepting all of the recommendations. The Government published the draft Floods and Water Bill in April 2009 for consultation. The council will monitor the progress of the legislation and take appropriate action in line with Government advice.

4.38 The Draft Climate Change Adaptation Strategy for London (Mayor of London, public consultation draft) February 2010 recognises that there is a high probability of surface water flooding, particularly with increases in the volume and intensity of rainfall, the increasing impermeability of the urban landscape and limited drainage capacity. The Mayor created a partnership of organisations responsible for surface water flooding in 2007, known as the Drain London Forum. This forum will undertake a strategic analysis of surface water flood risk, prioritise areas of high flood risk and develop an action plan. Westminster City Council participates in the Drain London Forum.

C) Flooding from Sewers

Nature of Risk

4.39 Most of Westminster is served by combined sewers which receive foul water, water from roofs, hard standing and sometimes highways. These combined sewers were designed by Sir Joseph Bazalgette in the 1860’s. During periods of heavy rain the pipes fill up and overflow and Bazalgette designed a series of overflow outlets from the combined sewers into the tidal River Thames and its tidal tributaries. This overflow results in the release of raw sewage into the River Thames affecting water quality and biodiversity. Specialist barges are used to oxygenate the river to mitigate for impacts of combined sewer overflows on animals and plants.

4.40 Fat, oil and grease are also believed to contribute significantly to blockages in the sewer system and can cause overflow to properties and/or pollute watercourses. This can be a particular problem when there are a number of food establishments located within a particular area, all draining into the same sewer system. This matter is particularly relevant in Westminster given there are some 3,000 restaurants, bars and cafes, many of which are clustered in the West End, including Soho, Covent Garden and Chinatown. Most food establishments are required to pay for the removal of used cooking oil, which may increase the risk of its being tipped into the sewer. The city council is not authorised to deal with the removal of used oil and advises restaurant owners to make arrangements with specialist contactors to ensure this used cooking oil is removed from the premises.
Map 10: Properties flooded by sewers in last 10 years by Postcode area

Data Source: Thames Water 2010

Properties flooded by sewers

- 1 - 6
- 7 - 10
- 11 - 77
- No data

Borough Boundary

0 500 1000 Meters

Reproduced from Ordnance Survey mapping with the sanction of Her Majesty’s Stationary Office, Crown Copyright. Unauthorised reproduction may lead to prosecution or civil proceedings. City of Westminster LA100319597 City Planning Group.
J:19 City Planning Group/gis/Flood risk assessment
Information available

4.41 Thames Water holds details of incidents of sewer flooding for individual properties, either externally or internally, and they can be contacted at: http://www.thameswater.co.uk/UK/region/en_gb/content. The London Regional Flood Risk Appraisal (2009) advises that foul sewer flooding is most likely to occur where properties are connected to the sewer system at a level below the hydraulic level of the sewage flow, which in general are often basement flats or premises in low lying areas. (paragraph 110)

Likely Impact of Climate Change

4.42 In London, given the growth in development and strain on the existing system, even a relatively moderate rainfall can trigger an overflow in the combined sewers. During wet spells the sewers fill up with rainwater very quickly. The Mayor’s Draft Water Strategy (August 2009) states that

‘widespread heavy rainfall can lead to over a million tonnes of untreated sewage and rainwater legally discharging directly into the rivers.’ (paragraph 5.4)

The impact of climate change in terms of greater intensity of rainfall is therefore likely to have an adverse impact on flooding from this source.

Development Locations which may be affected

4.43 As set out above the overall problems concerning sewerage flooding are a London wide issue. Since 1989, 110 properties have experienced flooding from sewers, and are listed on the Thames Water Sewer Flood database (see Map 10). Out of these properties, 31 are due to be individually alleviated through the Thames Water Westbourne FLIP device (non-return valves and pumps) scheme

- There are 69 due to be alleviated through the Thames Water Westbourne Grove sewer flood alleviation scheme – below ground assets installed and completed October 2008.

- One property is due for a generic Flip project installation in 2008/09 – completion March 2009.

- The remaining nine are not tagged to schemes.

4.44 Thames Water requires customers to contact them when sewer flooding events occur and not all possible events may have been recorded.

4.45 Thames Water has carried out extensive works during 2008 to lay a new sewer on Westbourne Grove, including the location of an overflow tank in Hallfields Estate and Westbourne Grove.

Infrastructure Flood Risk Management Options

4.46 With greater intensity of rainfall, combined sewer discharge into the River Thames is likely to increase in the short term. In the future, the Thames Tideway Tunnel project is planned to address this sewer discharge for the whole of London, and is due to commence in 2012 (after the Olympics) and be completed by 2020 (subject to detailed planning and funding). This proposed 32km tunnel underneath the Thames will convey flows to Beckton Sewage Treatment Works for treatment instead of the flows being discharged into the River Thames. The Thames Tideway Tunnel project timings and funding are beyond the city council’s control (it will be implemented by Thames Water),
but this project is considered vital to minimising combined sewer overflows into the River Thames, and it will provide part of the solution required to ensure compliance with the EU Urban Wastewater Treatment Directive.

4.47 The city council’s states in the Submission Draft Core Strategy, that it ‘supports necessary infrastructure of this nature, subject to their detail and assessment of impacts’ (paragraph 5.85).

4.48 The indicative route for the Tunnel, as shown below, will run for approximately 32.2km from West London to Beckton Sewage Treatment Works in the east. The specific starting point is still to be determined.

**Figure 3**

Several major, intermediate and combined sewer overflow interceptor shaft sites will be needed to connect 34 Combined Sewer Overflows along the route. Eight combined sewer overflow sites have been initially identified in Westminster. These approximate sites, shown on the map above, where the normal sewers meet the river, are:

- Western pumping station (close to Kensington and Chelsea boundary),
- Kings scholar pond combined sewer overflow (CSO) outlet
- Grosvenor Ditch CSO outlet
- Regent Street CSO outlet
- Northumberland Street CSO outlet
- Savoy Street CSO outlet
- Norfolk Street CSO outlet
- Essex Street (close to City of London boundary).CSO outlet
D) Flooding from Groundwater

Nature of the Risk

4.50 Groundwater flows from the ground at the point where the water table meets the surface. This type of flooding is likely to occur in low-lying areas which are underlain by permeable rock (aquifers). Westminster sits above a regional chalk aquifer covered with gravels and clay. Chalk shows some of the largest seasonal variations in groundwater levels, and is the most extensive source of groundwater.

Information available

4.51 The recommendations from the Ground Water Flooding project, undertaken by the Environment Agency, under the Making Space for Water programme were published in 2007. This includes a recommendation that a national database collecting records from all sources of groundwater flooding is both desirable and feasible. The Environment Agency is currently progressing information from this report, in line with the recommendations of the Pitt Review (2007), including a possible option for mapping groundwater flooding.

Likely Impact of Climate Change

4.52 Like other forms of flooding, groundwater flooding is affected by increased levels of rainfall. The Mayor’s Draft Water Strategy (August 2009) states that:

“Following prolonged periods of rainfall, groundwater flooding can typically last weeks, and tends to happen late in the winter when groundwater levels reach a peak”. (paragraph 4.28)

Development locations likely to be affected

4.53 The London Regional Flood Risk Appraisal (2009) advises that: “There are no known locations where groundwater flooding has been a problem”. (paragraph 122)

4.54 Within Westminster there is local information about deep basement buildings in Leicester Square and Trafalgar Square that continuously pump excess groundwater from their basements. The Environment Agency grants licences to remove the surplus groundwater. The Mayor’s Draft Water Strategy (August 2009) advises “It is the Agency’s view that the chalk groundwater levels are now stable and no longer pose a significant threat to the underground infrastructure”. (paragraph 4.31)

Infrastructure Flood Risk Management Options

4.55 The groundwater level in London is being addressed by the General Aquifer Research Development and Investigation Team (GARDIT) an informal group of interested parties, and through increased abstraction of groundwater, notably by Thames Water. Thames Water is opening 20 or more new pumping stations to extract groundwater to ensure the stability of water levels. Thames Water Utilities Ltd investment programmes are based on a 5 year cycle, known as the Asset Management Plan (AMP) process. AMP 4 period in underway running from 1 April 2005 to 31 March 2010. The SFRA will be updated in line with relevant changes in AMP 5 in 2010 and the final version of five year plan 2010-2015.

4.56 In conclusion, flooding from rising groundwater is not considered to be a major problem in Westminster, however the current situation will be kept under review. The SFRA will be updated to include any mapping produced by the Environment Agency, when this becomes available.
E) Flooding from Canals, Water features and Water Mains

Nature of the Risk
4.57 In Westminster this type of flooding is most likely to result from burst water mains or from infrastructure failure in an artificial watercourse or water bodies, i.e. canals or other water features (See Maps 2 and 3).

Information Available
4.58 Thames Water holds records of all water mains running below Westminster. Information can be found on the following website: [http://www.thameswater.co.uk/UK/region/en_gb/content](http://www.thameswater.co.uk/UK/region/en_gb/content). British Waterways are responsible for the canals and can be contacted via the following website. [http://www.britishwaterways.co.uk/](http://www.britishwaterways.co.uk/). The Serpentine, St. James’s Park Lake and Regent’s Park Lake are located within the Royal Parks [http://www.royalparks.org.uk/](http://www.royalparks.org.uk/)

The likely impact of climate change
4.59 There is unlikely to be any impact of climate change on flooding from infrastructure failure.

Development locations likely to be affected
4.60 The areas affected from this type of flooding would mainly be localised to the source of the flooding.

Canals and Water Features
4.61 There are a number of canals and water features in Westminster which are shown in Maps 2 and 3.

- **Canals**
  - Paddington Branch of the Grand Union Canal, including Paddington Basin and Little Venice
  - The Regent’s Canal,

- **Water Features**
  - Serpentine (Hyde Park)
  - Regent’s Park Lake
  - St. James’s Park Lake
  - Kensington Gardens Lake
  - ‘Hidden Rivers’

4.62 The Grand Union and Regent’s Canals in Westminster present minimal flood risk as they have limited surface water inputs and none of the canals to our knowledge are on embankments. There are no canal locks within Westminster itself, the closest lock is to the east, and the next lock is at Hampstead Road, which is the first of several locks through Camden. Any malfunction to the east of Westminster would cause the water to flow east, not into Westminster. To the west, the level of the canal starts to rise at Cowley lock, which is near the M25 and located 16 miles from Westminster.

4.63 The Grand Union Canal lies alongside and crosses between the River Colne Valley and the River Lee Navigation which are linked to large fluvial catchments, however any flooding in these areas will not impact on The Grand Union Canal given they are at a lower level than Westminster.

4.64 The Serpentine, the lakes in Buckingham Palace Garden and St James’s Park are the remnants of the ‘hidden’ rivers in Westminster. Although the ‘hidden’ rivers themselves
are unlikely to result in flooding, any water sources they serve are susceptible to flooding. The Serpentine falls under the Reservoirs Act 1975 and may pose a risk of flooding if breached.

**Water Mains**

4.65 Water mains run below all parts of built Westminster, many of these date from Victorian times. Detailed records of the exact locations are held by Thames Water, however at the time of writing the city council has been unable to access these in a useable form. The number of burst mains incidents reported by Thames Water between 2003 and 2007 are shown in Table 2 below and on Map 11.

<table>
<thead>
<tr>
<th>post code</th>
<th>no. of burst mains</th>
</tr>
</thead>
<tbody>
<tr>
<td>NW6</td>
<td>21</td>
</tr>
<tr>
<td>NW8</td>
<td>13</td>
</tr>
<tr>
<td>W2</td>
<td>34</td>
</tr>
<tr>
<td>W9</td>
<td>19</td>
</tr>
<tr>
<td>W11</td>
<td>38</td>
</tr>
<tr>
<td>W10</td>
<td>7</td>
</tr>
<tr>
<td>SW1</td>
<td>48</td>
</tr>
<tr>
<td>SW7</td>
<td>23</td>
</tr>
<tr>
<td>WC2</td>
<td>43</td>
</tr>
<tr>
<td>EC4Y</td>
<td>21</td>
</tr>
<tr>
<td>Total</td>
<td>267</td>
</tr>
</tbody>
</table>

4.66 A water main can burst at any time and can have a serious impact on both property and the infrastructure (including transport). In October 2007, as a result of a burst main at the junction of Maida Vale and St John’s Wood Road, 20 businesses were flooded and water supplies to about 700 homes in Maida Vale were affected.
Infrastructure Flood Risk Management Options

4.67 Good management of the infrastructure itself is the key to minimising the treat of flooding from these sources.

4.68 British Waterways operate management regimes throughout the canal systems to help manage water level and reduce flood risk. These are set out in detail in their Assets Inspections Procedures (June 2008). In London British Waterways undertake length inspections of individual kilometres of water track on a monthly or three monthly cycle. Inspectors note changes in the condition of assets and waterway track. Any changes in condition brought about by natural wear and tear, accidental damage, natural occurrences, vandalism, third party works or anything else that may affect the track is noted. Inspections on the towpath side are undertaken monthly and standards are set out in the Assets Inspection Procedure at the following location:

http://www.britishwaterways.co.uk/

4.69 Thames Water has already started its Victorian mains replacement programme which by 2015 is aiming to replace over 2,500km of water mains in London. The consultation document ‘Our Plans for Water – What will you get and what will it cost’ can be viewed at the following:

http://www.thameswater.co.uk/cps/rde/xchg/corp/hs.xsl/6759.htm This is one of a number of measures Thames Water is undertaking as part of their ‘Taking Care of Water’ strategic direction statement for 2010 to 2035. This can be found at:

http://www.thameswater.co.uk/cps/rde/xchg/SID-E26B4507-6A977576/corp/hs.xsl/5372.htm

4.70 The Royal Parks are responsible for the management and repair of the water features within the Royal Parks. They are currently preparing an on-site contingency plan for the Serpentine, while the city council is preparing an off-site contingency plan.
5. **Towards a Policy Approach for tidal and fluvial flooding**

5.1 Section 5 sets out how we have applied the sequential test in Westminster, taking account of local circumstances, and how this has influenced the council’s proposed policy approach as set out in the Submission Draft Core Strategy, March 2010 (see paragraph 5.40 below) PPS 25 advises that policies for flooding need to be balanced with other policy objectives and national guidance. In Westminster it is considered that the complexity of existing development (and associated sustainability objectives) and that there is insufficient land to meet our housing targets needs to be taken into account in the development of strategic planning policies for flooding in Westminster and in particular in terms of the application of the Sequential Test.

5.2 The City Management Development Plan Document (DPD) will contain the detailed policies for flooding for development management purposes, including the requirement for a Flood Risk Assessments (FRA) and Sustainable Urban Drainage (SUDs). The policy approach for the City Management DPD has been discussed in consultation workshops during the summer 2009. Publication of the City Management DPD is planned during 2010 (See paragraph 2.32).

**The Sequential Test -**

5.3 PPS25 advises that preference be given to locating new development in Flood Zone 1. If there are no reasonably available sites are available in Flood Zone 1, then Flood Zone 2 should be considered. If no reasonably available sites are available in Flood Zone 2 then Flood Zone 3 should be considered. This is called the Sequential Test.

5.4 In Westminster the scarcity of sites means that development needs cannot be met by sites in Flood Zones 1 and 2 alone, and that sites in Flood Zone 3 need to be considered suitable for development, subject to the requirements of the Exception Test. Development need and available land and sites are discussed in the paragraphs below to demonstrate how the Sequential Test has been applied to identified sites and the impact for windfall sites.

**Identified Development Sites**

5.5 PPS 25 assumes that local authorities will produce a sequentially tested land allocations Development Plan Document (DPD). However, given the existing highly built form, general shortage of land and complexity of development pressures and land use in Westminster, the city council does not allocate land in this way. However, the City Council will list Major Proposals Sites in the Core Strategy, and maintains a 5-15 Year Rolling Housing Land Supply to ensure housing targets are met:

5.6 **Proposals Sites in the Core Strategy:** The Submission Draft Core Strategy contains a schedule of major sites for development (Proposals Sites), including preferred uses for these sites (over 70% of the sites include a preferred use for housing). The most recent version of the Proposals Sites is contained in Appendix 3. The sites set out in this Appendix are of strategic importance to the delivery of the Core Strategy. It includes sites necessary for the delivery of major infrastructure projects, or for the regeneration of an area. It also includes major housing sites located within Flood Zone 3, and housing sites with the capacity for over 100 units, which a failure to deliver within the plan period would have implications for the housing target and the
housing trajectory. Appendix 4 lists the Proposals Sites, site area, flood risk and whether there is a requirement for a flood risk assessment according to PPS25 (Table D1), and considers in more detail Proposals Sites in Flood Zone 3.

5.7 5-15 Year Rolling Housing Land Supply: The city council also maintains a 5-15 Year Rolling Housing Land Supply to ensure there is sufficient available land to meet housing targets and provide guidance to potential developers about what will be expected from development sites. This schedule is updated annually through the Annual Monitoring Report and can be viewed at http://www.westminster.gov.uk/environment/planning/ldf/land-for-housing.cfm.

5.8 The current schedule (December 2008) is contained in Appendix 5. This schedule includes Proposal Sites in the Core Strategy. Where necessary detailed guidance for these sites are provided through Planning Brief Supplementary Planning Documents.

5.9 The Proposals Sites Schedule and the 5-15 Year Rolling Housing Land Supply show that there are no reasonably available sites in lower flood risk areas (Flood Zones 1 and 2) that have capacity for residential use and that have not already been 'allocated' for such purposes. These sites alone cannot meet the need and development of sites in Flood Zone 3 is necessary to meet development need and housing targets as demonstrated below.

Residential Targets for Westminster

5.10 Land values operate differently in Westminster than most other areas of the UK and indeed London and the high cost of land can make the delivery of housing, particularly affordable housing, difficult.

5.11 The delivery of new housing to meet growing requirements is a political priority for both national government and the Mayor for London. The London Plan has identified a capacity of 680 residential units per year for Westminster, equating to a target of 6,800 units between 2009/10 to 2018/19. The city council intends to meet these housing targets by protecting housing across the city and having housing as the priority use, that is the first land use choice for new development capacity in developments in most parts of Westminster (as shown in the schedule of Proposals Sites contained in Appendix 3) and by requiring at least an equivalent amount of residential floorspace in schemes where increases in commercial floorspace above 200sqm are proposed within the Central Activities Zone (CAZ).

5.12 In the future the GLA Strategic Housing Market Assessment and Strategic Housing Land Availability Assessment will provide information on the level of need and demand for housing and the opportunities that exist to meet it. This will provide the basis for future housing targets, which may well increase the required provision in Westminster. These revised targets will be included in the forthcoming revision of the London Plan. The consultation draft targets for Westminster for the period 2011-2021 is 7700 (770 per annum).

Residential Development Sites

5.13 The table below sets out the impact on the city council’s ability to deliver residential units within the ten year period 2009/10 to 2018/19 (using the rolling schedule of development sites contained in Appendix 5) within Flood Zones 1, 2 and 3, and in addition within the identified rapid inundation zone and residual risk area (as shown on Map 7).
Table 3 Housing sites contributing to the 10 year supply of residential units

<table>
<thead>
<tr>
<th>Sites within Flood Zone</th>
<th>Nbr sites</th>
<th>Net units</th>
<th>% net units</th>
<th>Affordable units expected</th>
<th>% affordable units expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood Zone 1 (85% of city)</td>
<td>68</td>
<td>3311</td>
<td>60%</td>
<td>560</td>
<td>31%</td>
</tr>
<tr>
<td>Flood Zone 2 (1% of city)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Flood Zone 3 (14% of city)</td>
<td>26</td>
<td>2251</td>
<td>40%</td>
<td>1258</td>
<td>69%</td>
</tr>
<tr>
<td>(Rapid inundation zone, 4%)</td>
<td>6</td>
<td>140</td>
<td>2%</td>
<td>80</td>
<td>4%</td>
</tr>
<tr>
<td>(Residual risk zone, 3%)</td>
<td>13</td>
<td>499</td>
<td>9%</td>
<td>227</td>
<td>12%</td>
</tr>
<tr>
<td>(Remaining areas in Flood Zone 3, 7%)</td>
<td>7</td>
<td>1612</td>
<td>29%</td>
<td>951</td>
<td>53%</td>
</tr>
<tr>
<td>Total</td>
<td>94</td>
<td>5562</td>
<td>100%</td>
<td>1818</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: 5-15 Year Rolling Housing Land Supply
NB: There are some gaps in data for the sites towards the end of the ten year period in terms of numbers of units and affordable units provided.

Contribution of deliverable sites to total housing provision

5.14 Flood Zone 1 accounts for 85% of the total land area of the city and contains 60% of Westminster’s deliverable housing units between 2009/10 and 2018/19. Flood Zone 2 is only 1% of the total land area of the city and does not contain any identified housing sites. The number of identified housing units provided in Flood Zones 1 and 2 is 3311, this is less than half of the required housing target of 6800. Clearly, the identified deliverable sites in these areas will be insufficient to meet the London Plan housing target.

5.15 Flood Zone 3 is only 14% of the total land area of the city but it accounts for 40% of Westminster’s deliverable housing units between 2009/10 and 2018/19. Flood Zone 3, excluding the Rapid Inundation Zone, is 10% of the total land area of the city but accounts for 38% of Westminster’s deliverable housing units. Flood Zone 3 excluding the Rapid Inundation Zone and the Residual Risk Area is 7% of the total land of the city but accounts for 29% of Westminster’s deliverable housing units.

5.16 The number of deliverable housing units for all three flood zones is 5562, which is 82% of the London Plan target. Housing sites are needed in Flood Zone 3 as all reasonable sites in Flood Zones 1 and 2 have been identified and these sites alone are insufficient to meet housing targets.

Affordable housing

5.17 Westminster is one of the most expensive places in the country in which to rent or purchase a home. With the average price of a home in Westminster being £722,017 (November 2008), it is virtually impossible for those on a low to middle income to purchase a new home in the City.
5.18 Westminster has a chronic shortage of affordable housing, with over 1,000 households per year accepted as homeless and 5,000 overcrowded households. Although we take into account the strategic London-wide target in the London Plan to seek to achieve 50% of new homes as affordable, in reality we have achieved between 11% and 29% since 2004. This is because:

- land in Westminster is too expensive for Registered Social Landlords (RSLs) to bid for and develop sites;
- the lack of large development sites in the city means that the majority of our planning permissions for residential involve small schemes of less than 10 units so do not yield affordable units;
- most sites in Westminster have a viable existing or alternative use value (i.e. commercial) therefore 30% is generally the normal on-site requirement (on viability grounds).

5.19 The housing provision figure for the 10 year period 2009/10 -2018/19 is 6,800 but in terms of affordable units, these are likely to be about 25% of housing provision i.e. about 1700 units.

5.20 Table 3 above shows that in terms of affordable housing, sites in Flood Zone 3 are likely to contribute 1258 affordable units, 69% of affordable units expected to be constructed in the city in the 10 yr period. This despite Flood Zone 3 accounting for only 14% of land in the city. The reason sites in Flood Zone 3 will yield a higher proportion of affordable units than the city as a whole is because:

- Flood Zone 3 includes the Grosvenor Waterside development which is the largest housing site in the city (expected to be delivered within the next 5 years) and this site alone is expected to yield 463 affordable units.

- Over half the identified housing sites in Flood Zone 3 are outside the CAZ and therefore a stepped 30% affordable housing policy applies, as opposed to a stepped 30% policy which applies within the CAZ.

5.21 This disproportionate contribution to the provision of affordable housing, adds further support to the importance of these sites in Flood Zone 3, to the provision of housing in the city, and the vital role they will play in meeting the affordable housing needs of residents.

5.22 The Housing (Market demand/Housing need) Study carried out by Fordham Research for the city council in July 2007 concluded that there was a significant requirement for additional affordable housing to be provided along with the requirement for units with two or more bedrooms in the owner-occupied sector. The consultants therefore suggested that the council maximise the availability of affordable housing from all possible sources. (Conclusions P.13).

5.23 There is evidence that household overcrowding is a particular problem in parts of Flood Zone 3. The South Westminster Local Area Renewal Partnership (LARP), in response to consultation on the Core Strategy Issues and Options document, stated:

‘in the last census over 6,000 households in the renewal area were identified as being overcrowded, with overcrowding in three of the south Westminster renewal wards being above the city wide average.’
Conclusion - residential sites

5.24 The allocation of sites suitable for residential use (by way of the Proposals Sites and the rolling supply of land for housing) within Flood Zone 3 have been sequentially tested in light of the unique circumstances in Westminster, by demonstrating that there are insufficient sites in Flood Zones 1 and 2 to meet the need for housing. Given the requirement to meet our housing provision it is considered that the sequential test has been met. The Exception Test will apply, to proposal sites containing residential accommodation in Flood Zone 3 where relevant (for example where there is an increase in the total number of units on site or an extension to an existing unit on ground and basement floors).

Social and Community uses

5.25 The provision of social and community facilities is integral to supporting sustainable communities. As Westminster grows and changes, social and community facilities must be provided to meet the needs of the city’s diverse communities, and to be in accessible locations. As shown on Map 2, Flood Zone 3 is predominantly residential and as such will require an adequate supply of these uses within local proximity and to avoid the need to travel. Sites outside this area would not be reasonable alternatives as they would not comply with the city councils sustainability objectives.

5.26 The Submission Draft Core Strategy identifies future need for social and community infrastructure (policy CS33 and supporting text), some of which is within Flood Zone 3, for example planned locations for provision of local services facilities include Pimlico and the Victoria Opportunity Area, and redevelopment of facilities at the Grey Coat Hospital School. In addition, the Chelsea Barracks Proposals Site (listed in Appendix 3) is identified as an opportunity for providing community facilities.

5.27 The need for these uses to be close to the population they are intended to serve, and redevelopment of existing facilities means that there are no reasonably alternative sites in Flood Zones 1 and 2, and therefore sites in Flood Zone 3 will need to be considered. The Exception Test will apply to social and community uses in Flood Zone 3.

‘Windfall development sites’

5.28 PPS 25 Practice Guide advises that local planning authorities should, through the completion of SFRAs, develop policies in their Local Development Documents on how windfall sites should be treated in flood risk terms. Westminster’s Housing Trajectory (as required by PPS3 Housing 2006) includes sites in the 5-15 Year Rolling Housing Land Supply plus an allowance for windfall sites (in accordance with PPS3 because of the local circumstances in Westminster). Windfall sites are those sites not identified in the Proposals Sites and the 5-15 Year Rolling Housing Land Supply which includes sites of 10 or more units. However, 93% of housing sites in the city yield less than 10 units and these small sites have yielded about 25% of new homes in the city. Historically, windfalls have accounted for 80% of housing delivered in the city. However, the 5-15 Year Rolling Housing Land Supply will now capture many of these sites so a far lower figure needs to be projected into the future. The Housing Trajectory allows for between 200 and 300 windfall units per annum for the period 2009/10-2018/19.

5.29 Most development in Westminster comes from ‘windfall sites’. Between April 2005 and March 2007, 98% of planning permissions (including 131 ‘Major’ approvals) came from windfall development.
Residential ‘windfall development sites’

5.30 The identified housing sites in the 5-15 Year Rolling Housing Land Supply discussed above (paragraphs 5.13-5.16) will not yield enough housing units to meet the housing target. Table 3 demonstrates that sites in Flood Zones 1 and 2 will be insufficient to supply sites to meet housing targets, and that in terms of the sequential test, sites in Flood Zone 3 can be considered. These identified sites in all Flood Zones are still insufficient to meet housing targets and can only be fulfilled through windfall sites. The city council is therefore dependent on ‘windfall’ sites to achieve its housing targets (the GLA have accepted that Westminster can use these sites as part of their housing capacity). The London Plan housing target for the next 10 year period is 6800. 82% is anticipated to be met by development of the sites identified in the 5-15 year Rolling Housing Supply. The remainder is expected to be met by windfall development sites.

5.31 By their nature, specific locations of windfall sites are not able to be predicted. However, there is no general policy to protect employment use, and in principle any office building can change to housing. Most offices are located in the Central Activities Zone (CAZ), and may therefore that area may be anticipated to provide more windfall sites. The CAZ includes all Flood Zones 1, 2 and 3, with nearly all of Flood Zone 3 being located in the CAZ. On the same principle for considering housing sites in paragraph 5.24, it is considered that windfall sites in Flood Zones 1 and 2 alone may not be enough to meet the housing target, and in line with the sequential test we will therefore need to consider sites in Flood Zone 3. The Exception Test will be required for such residential development within Flood Zone 3.

Social and Community uses on windfall sites

5.32 As discussed in paragraphs 5.25-7 above, the city council considers that social and community facilities need to be located close to the area which they serve. Large scale windfall sites may provide opportunities for social and community facilities. The Exception Test will apply to such sites in Flood Zone 3.

Other More Vulnerable uses on windfall sites

5.33 More Vulnerable Uses, other than residential dwellings and social and community uses, if they come forward are likely to require sequential testing at application stage. The Exception Test will apply to such sites in Flood Zone 3.

Less Vulnerable uses on windfall sites

5.34 Many of the applications for Less Vulnerable Uses in Westminster are likely to be of a minor nature or involve a change of use and there for will not require the Sequential Test, other proposals which do not fall into these categories will require sequential testing at application stage. The city council will need to take into account the complexity of existing development, within Westminster when making this assessment.

Victoria Opportunity Area

5.35 The Victoria Opportunity Area is located in Flood Zone 3 (see Map 12). In reference to Opportunity Areas, paragraphs 1.12 and 1.13 of the London Regional Flood Risk Appraisal (October 2009) states that

."Many of London’s remaining large brownfield areas are either substantially or partially within flood zones.....42% of the area of Opportunity Areas and 24% of the area of Intensification Areas are within known Flood Zones. However alternative sites for large scale development within London do not exist, without encroaching into
Map 12 Victoria Opportunity Area

Opportunity Area
Flood Zone 3
Flood Zone 2
Flood Zone 1
Westminster Tidal Defences
Source Core Strategy Preferred Options July 08
Green Belt, MOL or other protected spaces (paragraph 15)…Therefore from a strategic perspective, the sequential test permits the consideration of these sites for development. It will still be necessary for boroughs and developers to apply the sequential test locally and consider flood risk assessments at a more detailed level when allocating uses or applying for planning permission. It will still remain important to place more vulnerable uses in areas with lower flood risk in order to meet the Sequential Test at a local level. (paragraph 17)

Four of the Proposals Sites identified in the Submission Draft Core Strategy are located in the Victoria Opportunity Area, and have been included in consideration of the sequential test to identified housing sites discussed above. The Exception Test will still apply where relevant to sites within Opportunity Areas.

Redevelopment of an existing single property

5.36 Where an individual proposes to redevelop their property in Flood Zone 3 the consideration of an alternative site is unlikely to be a realistic option. The Exception Test will still apply where relevant for such applications.

New Basement Dwellings

Self-contained Basements

5.37 Self-contained basements or basement flats wholly or partially below ground without freely available access at all times to a habitable space above ground level within the same dwelling are ‘highly vulnerable’ uses and in accordance with PPS 25 the city council’s policy approach is not to allow these in Flood Zone 3.

Basement residential accommodation

5.38 Dwellings wholly or partially below ground with freely available access at all times to a habitable space above ground level within the same dwelling are ‘more vulnerable’ uses, and the Exception Test will apply to such sites. Within the Rapid Inundation Zone such uses will not be acceptable.

Basements with non residential uses

5.39 Basements associated with other forms of ‘more vulnerable’ development will be unaffected in their classification by the form of access to them. Basements associated with ‘less vulnerable’ development will be unaffected in their classification by the form of access to them.

The City Council’s Submission Draft Core Strategy for Flooding

5.40 The city council’s approach to flood risk is set out in the Submission Draft Core Strategy, Policy CS29 Flood Risk and is as follows:

- Highly Vulnerable Uses will not be allowed in Flood Zone 3, and in Flood Zone 2 will be required to pass the Exception Test

- Proposals for Essential Infrastructure and More Vulnerable Uses within Flood Zone 3 will be required to pass the Exception Test. Within the Rapid Inundation Zone, new residential units below the tidal breach flood level and extensions to residential at basement level will not be acceptable.

- All development proposals should take flood risk into account and new development should reduce the risk of flooding.
Alternative Policy Option

5.41 Given the requirement to apply the Sequential Test, and a request from the Environment Agency (in response to consultation at Issues and Options stage of the Core Strategy – May 2007) to be more explicit about the impact of flooding (in particular regarding the preferred use of the Queen Alexandra Military Hospital for housing in relation to flood risk) the Core Strategy – Preferred Options Document (July 2008) identified these sites for uses other than for residential purposes and/or social and community use (Alternative Option 1-D). Given the provision of residential accommodation, in line with national and regional policies (see below), is a priority for the city council and that social and community facilities are best located in close proximity to the people who have use these facilities (this area has a large existing residential population), this was an Alternative rather than Preferred Option and it conflicted with the city council’s sustainability objectives 1 and 3 as follows:

1. To create cohesive, inclusive and safe communities with appropriate levels of social and community facilities,

3. To ensure the provision of appropriate housing types to reduce homelessness; reduce overcrowded households and meet demand for affordable housing and family sized units

The Exception Test

5.42 Annex E (Para E6) of PPS25 states:

that where decision-makers have been unable to allocate all proposed development and infrastructure in accordance with the Sequential Test, taking account of the flood vulnerability category of intended use, it will be necessary to increase the scope of the SFRA to provide the information necessary for the application of the Exception Test.

5.43 In exceptional circumstances, PPS 25 advises that where there are valid reasons for a development type which is not compatible with the level of flood risk, all three criteria of the Exception Test need to be passed. The following sets out those factors that will be considered by the city council when evaluating information submitted by developers:

(A) Wider sustainability benefits to the community that outweigh flood risk as set out in the SFRA.

5.44 The primary source to assess this matter will be the aims and objectives of the Core Strategy and the city council’s 17 sustainability objectives contained in the Scoping Report for the Sustainability Appraisal August 2007 (Appendix 2) and our requirement to meet regional and national targets for the provision of new residential units, including affordable housing, within Westminster.

5.45 If a planning application fails to score positively against these objectives, the city council will consider whether the use of planning conditions and/ or Section 106 Agreements under the Town and Country Planning Act, 1990 or any emerging Community Infrastructure Levy (CIL) are appropriate. Where, this is not possible, and the Exception Test will been deemed not to have been satisfied planning permission will be recommended for refusal. This is in accordance with Paragraph 4.49 of PPS 25 Practice Guide.
Development to be on previously developed or developable land.

Given the existing densely built form of Westminster all sites that are appropriate for development in Westminster will be found on previously developed land (brownfield sites).

A Flood Risk Assessment (FRA) to demonstrate that the development will be safe, without increasing flood risk elsewhere and where possible, will reduce flood risk overall.

Flood Risk Assessment (FRA)

Site-specific Flood Risk Assessments (FRAs) are prepared by prospective developers for specific development sites. When submitted in connection with the Exception Test these will be passed to the Environment Agency for consideration and comment.

FRAs may be stand-alone documents submitted by the developer to accompany a planning application. In those instances where an Environmental Statement is required for a development the developer should ensure that the FRA is incorporated into the Statement.

Paragraph 3.81 of PPS 25 Practice Guide sets out the objectives of an FRA as follows:

- whether a proposed development is likely to be affected by current or future flooding from any source;
- whether it will increase flood risk elsewhere;
- whether the measures proposed to deal with these effects and risks are appropriate;
- if necessary provide the evidence to the LPA that the Sequential Test can be applied; and
- whether the development will be safe and pass part c) of the Exception Test if this is appropriate (Paragraph D9c of PPS 25).

The scope of an FRA will vary depending on the type and scale of the development and should be proportionate to the degree of flood risk. The scope should be agreed with the city council and the Environment Agency and any other relevant bodies, for example Thames Water and Transport for London (TfL). Applicants are advised to contact the Environment Agency on 08708 506 506 or via their website at www.environment-agency.gov.uk at the earliest stage possible to seek further advice on this matter. Paragraphs 3.80 – 3.94 in the Practice Guide set out the required specifications for an FRA including scope, outputs and level of FRA required.

To assist applicants with the submission of an FRA a checklist (as set out in PPS 25 Practice Guide Appendix B) is contained within Appendix 6.

The Environment Agency provides standing advice on the requirements of flood risk assessments and statutory consultation procedures. This can be found on the following website: http://www.environment-agency.gov.uk/research/planning/82584.aspx

In the rapid inundation zone, the Environment Agency also recommends consideration of flood resilient building design which would reduce the
consequences of flooding. Further guidance in given in the PPS25 Practice Guide (paragraphs 6.30-6.36)

**Flood Risk Assessment – Ensuring a safe development**

5.54 Halcrow’s policy recommendations for development in the Tidal Breach Flood Extent within Flood Zone 3, or the residual risk area, are set out in section 4.2 of their report. The relevant recommendations for considering Flood Risk Assessments are highlighted below.

*Flood Resilient Measures*

- *Proposed developments within area at risk of tidal breach flooding should consider various flood resilient measures (Appendix 1, paragraph 4.2.1)*

5.55 The detailed recommendations for the various flood resilient measures are contained in Paragraph 4.4 of the Halcrow report.

5.56 **Levels of Floors and Thresholds/Openings (Appendix 1, paragraph 4.2.2)**

- *Access to the ground level of new ‘more vulnerable’ developments within the modelled tidal breach flood extents, should have threshold levels designed to a level agreed with the Environment Agency’s Development Control. Ideally this should be 300mm above the maximum water level expected for the 0.5% tidal event (this level will be site specific). Although this may not be practical for developments within the rapid inundation zone (<30 minutes) which in some cases would require finished floor levels over 1m above ground level.*

5.57 **Recommendations for Evacuation Access and Egress (Appendix 1, paragraph 4.2.3)**

- *In addition, for planning permission to be granted the residential basement dwelling should have internal stair access to a safe haven within the building to a level above the threshold level (i.e. 300mm above the maximum water level expected for the 0.5% tidal event). Such a haven should be sufficient in size for all potential users and be reasonably accessible to the emergency services.*

5.58 **Recommended Evacuation Plan (Appendix 1, paragraph 4.2.4)**

- *A robust Evacuation Plan should be implemented for all proposed development within the modelled tidal flood extent, especially if the land use is within the rapid inundation zone (>30 minutes). This should include:*

  - Sign up to the Environment Agency’s Flood Warning Direct service;
  - Develop procedures for acting on a Flood Warning received, including evacuating vulnerable people – children and those with impaired hearing, sight or mobility;
  - Obtain advice from the Local Authority Emergency Planning Team and from the Emergency Services relevant to the site.*
6. Towards a Policy Approach for Surface Water Flooding

6.1 Dealing with flooding from surface water is now being recognised by government as important as that from fluvial and tidal flooding. The Pitt Review – June 2008 highlighted that better management of the drainage infrastructure is of uppermost importance in managing surface water. Defra consulted on the draft Floods and Water Bill in 2009 which looks at all sources of flooding and covers duties and roles for the Environment Agency, local authorities, owners and water and sewerage companies. Development of Surface Water Management Plans are likely to be progressed, these will assess flood risk and management/mitigation measures, and develop a strategy and action plan.

6.2 The role of land use planning in managing this type of flooding is still evolving. PPS 25, annex F, requires that flood risk assessments take account of all types of flooding including surface water flooding (including development sites in Flood Zone 1, where there are critical drainage problems).

6.3 Paragraph 5.8 of the PPS 25 Practice Guide advises that management of surface water flooding is a developing area of flood risk management, but sets out the four steps of the flood risk management hierarchy that should be considered as follows:

- **Assess** – risks associated with surface water through Regional Flood Risk Appraisals, Strategic Flood Risk Assessments and Flood Risk Assessments for individual applications, and surface water management plans where completed
- **Avoid** – risks from surface water by controlling water at source (SUDS) and locating development away from risk areas
- **Substitute** – applying the sequential approach to locate more vulnerable development in lower risk areas
- **Control** – Use SUDs and implement Surface Water Management Plans to manage and reduce risk

6.4 Paragraph 5.9 of the Practice Guide states that:

“For new developments, the best way of reducing flood risk within the development is to:
- control the water at source through sustainable drainage systems (SUDs).
- consider exceedance i.e. what flow paths will be taken by excess surface water when the capacity of the drainage system is exceeded”

The complexity of development in Westminster and the difficulty in meeting housing requirements (as set out in detail in Section 5) makes a sequential approach to the location of highly vulnerable and more vulnerable uses in areas of critical surface water flooding (see Table 1, Map 9) difficult to achieve. However development will not be allowed if it involves highly vulnerable basement dwellings in an area of critical surface water flooding (see definition in Paragraph 5.37).

6.5 The city council’s Submission Draft Core Strategy for flooding as set out in Policy CS29 (see paragraph 5.40) provides a strategic approach for all forms of flooding in Westminster. This states that All development proposals should take flood risk into account and new developments should reduce the risk of flooding. At the time of writing the city council considers the most appropriate method of dealing with this matter in terms of surface water flooding in the critical surface water flood locations.
is to make sure development is safe and by the use of SUDs. The details of which should be incorporated into any submitted Flood Risk Assessment (FRA) at application stage. The detailed policies for surface water flooding will be set out in the City Management DPD (see paragraph 2.32).

6.6 In accordance with the PPS 25 Practice Guide Halcrow have included a number of recommendations for the management of surface water within the Critical Surface Water Flood Locations (Appendix 1, paragraph 4.3).

6.7 Halcrow make it clear in their report, however, that any recommendations they have made for surface water flooding require further consultation and agreement between the city council and the Environment Agency to ensure they reflect the best approach to flood management and the most sustainable option for Westminster.

6.8 The Halcrow Recommendations are as follows:

**SUDs** (Appendix 1, paragraph 4.5)
- That any proposed development site considers implementing SUDs, even if the site is not at direct risk of flooding. This would reduce the overall amount of run-off produced and would help alleviate surface water flooding in areas currently at high risk.

**Highly Vulnerable and More Vulnerable uses** (Appendix 1, paragraph 4.3.1)
- Any proposals for the re-development of Highly Vulnerable land uses such as self contained basement dwellings, emergency command centres and power stations (sub-stations) should if possible be located/re-located outside of the critical surface water flood areas shown in the surface water technical note provided in Appendix B (of the Halcrow Report).

- More Vulnerable land uses should also (where possible) be directed away from the areas identified as critical flood areas in the surface water technical note provided in Appendix B (of the Halcrow Report)

**Flood Risk Assessment – Ensuring a safe development**

**Flood Resilient Measures** (Appendix 1, paragraph 4.3.1)

All proposed developments within areas at risk of surface water flooding (see surface water flood maps Appendix B (of Halcrow Report)), should incorporate various flood resilient measures into the design and layout.

6.9 The detailed recommendations for the various flood resilient measures are contained in Appendix 1, paragraph 4.4 in the Halcrow report.

**Recommendations for the Levels of Floors and Thresholds/Openings** (Appendix 1, paragraph 4.3.2)

- It is recommended that if any development is proposed within the 1 in 100yr or 1 in 100yr (plus climate change) surface water flood extent, appropriate threshold levels to the development should be designed to minimise the risk of inundation from surface water flooding.
• For small developments it is recommended that appropriate threshold levels are derived from the grids of water depth produced from the surface water modelling carried out in this study (the Halcrow Study). Care should be taken when interpreting the required flood depths to ensure that the results seem realistic for that particular area.

• For larger developments, or where deemed appropriate, it is recommended that a more detailed surface water flood risk assessment is carried out. This could involve a combined surface-drainage model, whereby the drainage network for the area is explicitly modelled.

Recommendations for Evacuation Access and Egress (Appendix 1, paragraph 4.3.3)

• If planning permission is to be granted for self contained residential basement dwellings, these developments should have internal stair access to a safe haven within the building.

Recommended Evacuation Plan (Appendix 1, paragraph 4.3.4)

• A robust Evacuation Plan should be implemented for all proposed development within the critical flood areas. In addition, existing more vulnerable land uses such as schools, care homes and hospitals located within these critical areas should also consider the implementation of an evacuation plan.

7.1 Sustainable Urban Drainage Systems (SUDs) are designed to drain water in a more sustainable way than some conventional techniques, by mimicking natural drainage. They can achieve a number of objectives including controlling surface water run-off from developments, removing pollutants from urban run-off at source, and combining water management with green space, which can improve landscape, amenity and biodiversity. The use of SUDs will become increasingly important in the adaptation to climate change, given increased heavy rainfall events and will help deliver EU Water Framework Directive (transposed into UK Law in 2003) objectives for improving water quality. Halcrow have made the following recommendations for sustainable flood risk management using SUDs:

- **Consideration should be given to permeable paving, infiltration and rainfall harvesting systems to reduce runoff rates to the conventional drainage system.** (Appendix 1, paragraph 4.5)
- **Regular checks should be carried out on any SUDs scheme to ensure that the system remains fully operational at all times. Issues of adoption and future maintenance should be fully explored before implementation.** (Appendix 1, paragraph 4.5)

7.2 The Environment Agency have commented that they would encourage the use of SUDs in any new development because cumulatively this approach will help Westminster reduce surface water flooding (Letter dated 20 June 2008 setting out comments on the Core Strategy DPD – Issues and Options). The Use of SUDs can also help in addressing sewerage flooding.

Appropriate types of SUDs in Westminster

7.3 There are a range of SUDs, not all of them suitable for a complex urban environment such as Westminster. At this stage those considered most appropriate, and subject to other policy considerations, in particular design, are set out below as follows:

**Rainwater harvesting and recycling**

7.4 Tanked systems and rainwater harvesting can be used to reduce or remove the risk of flooding by retarding and/or attenuating surface water and rainwater runoff. Reducing or removing the risk of surface water runoff also reduces or removes the potential wash off of pollutants from hard surfaces into the drainage network or groundwater systems. Rainwater harvesting has additional benefits by providing a separate water source for gardens and open space, and flushing toilets, thereby reducing the pressure on water resources.

**Permeable paving and filter drains**

7.5 Increased surface water runoff is directly related to the amount of impervious hard surfacing. Permeable surfaces suitable for Westminster include:

- Grass
- Gravel
- Paving blocks with soil or gravel filled pores
- Paving blocks separated by gaps
- Porous paving
7.6 Permeable surfaces can also act as receptors for run-off from pipes, drains and guttering.

7.7 In all instances SUDs should aim to direct water flows back to the natural drainage path as close to source as possible.

7.8 In addition to encouraging new permeable surfaces, the city council considers that existing green spaces and landscaping areas provide an important contribution to the provision of natural drainage in Westminster. The loss of private gardens and landscaped areas to non porous paved surfaces can incrementally erode this natural drainage.

**Living Roofs**

7.9 Living roofs store rainwater in the plants and growth mediums and evaporate water into the atmosphere. The amount of water stored on a green roof and evaporated back is dependent on the growing medium, its depth and the type of plants used. Over summer green roofs can retain 70-80% of rainfall and over winter they retain between 25-40%.

7.10 They also reduce and delay run off during times of heavy and prolonged precipitation and, therefore, reduce the impact of run off on the storm water drainage system, reducing the likelihood of localised flooding. Living roofs have benefits for air quality, biodiversity, energy conservation (through improved thermal insulation and an extended life of the roof), countering the heat island effect, retarding and reducing storm water run-off, noise insulation.

7.11 Further information on SUDs can be found at the following website [http://www.ciria.org/suds/background.htm](http://www.ciria.org/suds/background.htm).

The city council’s detailed approach to the use of SUDs (including criteria and quantitative standards) in Westminster will be considered in further detail in the forthcoming City Management DPD.
8. **Contingency Planning for all sources of flooding**

8.1 Contingency plans are designed to enable the mobilisation of resources at short notice, in response to a major incident such as flooding, in addition to ensuring that core critical services are maintained in the event of major disruption.

8.2 The city council has developed the ‘City of Westminster Contingency Plan for Major Emergencies’, including flooding which sets out the procedures applied to emergency management and is designed as guidance for staff who are responsible for implementing and managing the council's response to a major incident.

8.3 This includes what actions the council will take and how, including the command, control and communications structures that to be used, the roles and responsibilities of council services, and how the council will work with others to respond to a major emergency. A copy of this document can be found at the following location. [http://www3.westminster.gov.uk/docstores/publications_store/Public%20Continuity%20Plan.pdf](http://www3.westminster.gov.uk/docstores/publications_store/Public%20Continuity%20Plan.pdf)


8.5 The city council’s Emergency Planning Team is drafting a specific Contingency Plan for flooding, the Westminster Multi Agency Flood Plan.

8.6 For further information on any of the matters above our Contingency Planning team can be contacted on 0207 641 7054.

8.7 Highly Vulnerable Uses defined by PPS25 includes police, ambulance and fire stations and command centres required to be operational during flooding. New highly vulnerable uses should not be located in Flood Zone 3. It is recommended that emergency command centres are not located in Flood Zone 3. Map 13 provides details of existing ‘highly vulnerable’ and ‘more vulnerable uses and features located in Flood Zone 3.
Map 13 Highly Vulnerable, More Vulnerable Uses & Features in Flood Zone 3

- Westminster Tidal Defences
- Flood Zone 3
- Flood Zone 2
- Flood Zone 1
- Extent of flooding from breach modelling
- Water Feature
- Subway

Highly Vulnerable
- Ambulance Station (1)
- Fire Station (1)
- Police Station (4)
- Mortuary (1)
- Petrol Station (1) Open
- Petrol Station (1) Vacant

More Vulnerable
- High Density Housing
- Nursery (2)
- School (14)
- Hostel
- Hotel
- Hospital (2)

Tourist Attractions
- 10 DOWNING STREET
- BUCKINGHAM PALACE
- CABINET WAR ROOMS
- HORSE GUARDS PARADE
- HOUSES OF PARLIAMENT
- LEICESTER SQUARE
- MARBLE ARCH
- PICCADILLY CIRCUS
- TRAFALGAR SQUARE
- WESTMINSTER ABBEY

Approx 23,150 homes in Flood Zone 3
Flood Zone 3 covers 317 ha 14.4% of Westminster
Flood Zone 2 covers 13.7 ha 0.62% of Westminster

Source: Environment Agency Flood Maps July 08