London Boroughs of Wandsworth, Merton, Sutton and Croydon

Strategic Flood Risk Assessment

Merton Level 2 Final Report
July 2009
Revision Schedule

**Merton Level 2 Strategic Flood Risk Assessment**
Final Report

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<th>Reviewed by</th>
<th>Approved by</th>
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<td>3</td>
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1 Introduction

1.1 Specific Overview

1.1.1 Planning Policy Statement 25: Development and Flood Risk (PPS25) published in December 2006 emphasises the active role Local Planning Authorities (LPAs) should have in ensuring flood risk is considered in strategic land use planning. PPS25 encourages LPAs to undertake a Strategic Flood Risk Assessment (SFRA) as part of their evidence base for the Local Development Framework (LDF) process and to use their findings to inform strategic land use planning.

1.1.2 Where decision-makers are unable to allocate all proposed development and infrastructure in accordance with the Sequential Test (i.e. steer development to areas at lowest risk of flooding), it is necessary to increase the scope of the Level 1 SFRA to provide information necessary for application of the Exception Test (Level 2 SFRA).

1.1.3 Scott Wilson has undertaken a joint Level 1 SFRA for the London Boroughs of Wandsworth, Merton, Sutton and Croydon which has identified the need for a specific Level 2 SFRA for each of the London Boroughs. This report forms the Level 2 report for the London Borough (LB) of Merton to provide further information following their Sequential Test on their preferred allocation sites that may require the Exception Test.

1.2 Aim of Level 2 SFRA

1.2.1 The aim of this study is to provide supplementary information to the Level 1 SFRA, to inform on flood risks associated with allocation sites that may require the Exception Test as identified in the LB Merton Sequential Test as part of their preparation of the Local Development Framework (LDF). This report aims to provide sufficient information to inform the application of the PPS25 Exception Test.

1.2.2 This report presents the findings of the Level 2 FRA. Specifically, it details the results of the recently completed Beverley Brook modelling and the draft River Wandle modelling mapping outputs with respect to the fluvial flood risk areas within the Borough.

1.2.3 The aim of the flood modelling is to simulate flood events to determine and illustrate the potential flood extents, depth and the areas at high, medium and low flood hazard. As well as informing forward planning, this information can also enable a sequential approach to site allocation and/or development within a Flood Zone.

1.2.4 The Level 2 mapping compliments that produced in the Level 1 SFRA, to provide a complete suite of flood mapping from all sources, based on available data. The Level 1 and 2 reports should be used in conjunction with each other for both forward strategic planning and to inform ongoing development control decisions.

1.3 Study Area

1.3.1 Merton is located south of the LB Wandsworth and north of the LB Sutton. The Beverley Brook forms the LB Merton’s western boundary and its main tributary, the Pyl Brook flows north-west through the south west corner of the Borough. The River Wandle flows north through the centre of the Borough and its main tributary, the River Graveney forms the Borough’s eastern boundary. These rivers and their tributaries form the main source of flood risk in the Borough.
1.4 Level 2 SFRA Objectives

1.4.1 The aim of the LB Merton Level 2 SFRA will be met through the following guidance, set out in PPS25 with the following specific objectives:

- Provide depth and hazard mapping from the Beverley Brook and (draft) River Wandle model outputs to illustrate the distribution of flood risk across flood zones to enable a sequential approach to site allocation within flood zones;
- Provide appropriate guidance for the Beverley Brook / Pyl Brook Flood Zones to enable a sequential approach to site allocation within Flood Zones;
- Provide guidance on application of the Exception Test in the potential development areas.
- Provide guidance to developers and SFRA users on the application of the Level 2 report.
2 Flood Sources

2.1 The Level 2 SFRA requires detailed plans to show the flood depth and hazard that potential development sites may experience. As such, the modelling results form the main deliverables of this report, in the form of depth and hazard maps.

2.2 Fluvial

2.2.1 The Beverley Brook / Pyl Brook and the River Wandle / River Graveney form the dominant sources of fluvial flood risk within the LB Merton. Fluvial flooding occurs when channel capacity is exceeded and water spills onto the surrounding area. Where flood defences have been constructed flooding can be caused by overtopping or breaching of defences, however the Level 1 SFRA identified that there are very few formal flood defences present within Merton.

2.2.2 The land adjacent to a river is its natural floodplain, which will vary in size due to local topography. Flood defences and urban development can significantly alter the natural flow paths within the floodplain area and affect the dispersion of floodwater.

2.2.3 The River Wandle catchment that lies within the Borough is heavily urbanised and generally responds rapidly to rainfall. One dimensional modelling was recently completed by the Environment Agency for the River Wandle and the draft outputs of this study have been provided for use in the Level 2 SFRA. However, following an independent review of this hydraulic modelling, additional work has been commissioned to improve the model by linking the one dimensional channel sections with a two-dimensional model of the floodplain. The new model will provide an improved representation of the flooding mechanisms throughout the catchment and is anticipated to be finalised in late 2009.

2.2.4 The information presented within this report is the best available information at the time of writing. However, the SFRA should be updated following the issue of the revised River Wandle model results. During the interim period, it is recommended that the Environment Agency should be consulted to ensure the most up to date information is used to assess flood risk.

2.2.5 The Environment Agency has recently completed a 2 dimensional modelling study of the Beverley Brook and revised flood outlines have been provided in addition to depth and velocity outputs, which have been used to determine flood hazard for the Beverley Brook catchment.

2.2.6 Following completion of the Beverley Brook modelling study, the Environment Agency has undertaken further work to improve the JFLOW model outputs used to create the Flood Zone 2 extent. This has involved refining the outputs to be consistent with the modelling study and a revised Flood Zone 2 extent has been provided for use in the latest version of this report.

2.2.7 As all modelling outputs are continually being updated and improved it is recommended that the Environment Agency should be consulted to confirm that the most up to date information is used to assess flood risk.

2.3 Other Sources of Flooding

2.3.1 The Level 1 SFRA identified the areas of the Borough at risk from sewer flooding from the Thames Water DG5 register. Local knowledge was used to pinpoint instances of surface water flooding.

2.3.2 In addition, the Level 1 SFRA used topographic data and records of surface water flooding to highlight areas at risk from this source. These areas tend to be concentrated in the lower lying areas of the Borough along the fluvial floodplain areas.

2.3.3 Incidents reported as groundwater flooding were mapped in the Level 1 SFRA and tend to be concentrated in the north and south west of the Borough around the areas of Wimbledon, Morden and Raynes Park. The incidents that coincide with outcrops of aquifers are more likely to be due
to actual groundwater flooding. The incidents concentrated in the north of the Borough coincide with the outcrop of Black Park Gravel (sand and gravel) and the incidents in the south west are associated with high groundwater levels in the underlying Kempton Park Gravel aquifer.

2.3.4 The Level 1 SFRA mapping should be used in conjunction with the mapping in this Level 2 report to provide an overview of the flood risks across the Borough.
3 Methodology

3.1.1 This section describes the methodology used in the production of mapping and deliverables for this study.

3.1.2 The fluvial flood risk areas associated with the Beverley Brook and River Wandle have been mapped to show the variation of depth and hazard along the catchment. This provides additional information on the variation of risk within Flood Zones 3a and 3b which will facilitate application of the Exception Test to sites in these areas that cannot be located in lower flood risk zones.

3.1.3 The assessment has been made at a strategic level and is only intended to inform how the potential strategic development areas may be at risk from these sources. This should therefore form a ‘stepping-stone’ for a site specific FRA, considering the recommendations discussed throughout the SFRA.

3.2 Depth maps

3.2.1 The main output from the River Wandle one-dimensional model is a grid showing the maximum depth of flooding during each simulation. The Beverley Brook has been modelled using 2-dimensional software therefore these depth grid outputs include any variation in flood level across the floodplain. The depth information is presented in metres. In order to determine the water level, the flood depth should be added to the topographic height to produce a water level in mAOD. It should be noted that limitations have been identified in the River Wandle modelling as discussed in section 2.2 therefore it stands to reason that there are limitations in the depths provided.

3.3 Hazard maps

3.3.1 The Beverley Brook model outputs include flood hazard based on ‘Flood Risks to People Phase Two Draft FD2321/TR1 and TR2. Flood hazard has been calculated as [(depth x (velocity + 0.5)) + Debris Factor] and classified into the following bandings:

<table>
<thead>
<tr>
<th>Key (Flood Hazard*)</th>
<th></th>
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<tbody>
<tr>
<td>ZUK0 = 0</td>
<td>No Hazard</td>
</tr>
<tr>
<td>0 &lt; ZUK0 &lt;= 0.75</td>
<td>Low Hazard</td>
</tr>
<tr>
<td>0.75 &lt; ZUK0 &lt;= 1.25</td>
<td>Moderate Hazard</td>
</tr>
<tr>
<td>1.25 &lt; ZUK0 &lt;= 2.5</td>
<td>Significant Hazard</td>
</tr>
<tr>
<td>ZUK0 &gt; 2.5</td>
<td>Extreme Hazard</td>
</tr>
</tbody>
</table>

*TuFLOW (2-dimensional) model output ‘ZUK0‘ variable.

3.3.2 The flood hazard categories shown above have been presented for sites located in the Beverley Brook catchment. However the flood hazard maps for the River Wandle catchment are based on outputs from the 1 dimensional model of the Wandle and as such do not have an associated velocity output for lateral floodplain flow.

3.3.3 In the absence of velocity data, the flood hazard has been classified as a function of depth, assuming zero velocity. The hazard categories have been mapped using the ‘FD2320/TR2 – Flood Risk Assessment Guidance for New Development’ depths and associated hazard with an assumed zero velocity as shown in Table 13.1 of that document.

3.3.4 While this method of hazard mapping (using zero velocity) is not ideal, the classification of hazard in relation to depth presents the best available information.
3.3.5 It should be noted that further investigations have been undertaken in relation to various hazard mapping methodologies including those outlined in report FD2320/TR2. The Supplementary Note on Flood Hazard Ratings and Thresholds for Development Planning and Control Purpose, published in May 2008 provides further clarification regarding the detail and limitations of the approach used assuming zero velocity. Although it is not practical to provide an in depth summary of the note it is recommended that it is reviewed when analysing the flood hazard mapping.

3.4 Climate change

3.4.1 In accordance with PPS25 the Beverley Brook and River Wandle modelling included an increase of 20% in peak flows to account for climate change increases in fluvial systems. The draft outlines have been provided from this study and are presented in the mapping in Appendix A of this report.
4 The Sequential Approach

4.1 The Sequential Test

4.1.1 The PPS25 Sequential Test is a simple decision making tool designed to ensure that sites at little or no risk of flooding are developed in preference to areas at higher risk of flooding.

4.1.2 The risk of flooding is primarily established using the Environment Agency Flood Zone maps. These show that the majority of the LB Merton is located in Flood Zone 1, however there are significant areas of Flood Zones 2, 3a and 3b associated with the River Wandle in the north east of the Borough. There are also Flood Zones associated with the Pyl Brook (the main tributary of the Beverley Brook) however these are mainly constrained to the relatively narrow river corridor.

4.1.3 The PPS25 Flood Zones are determined on the basis that defences or flood management measures are not in place. The NFCDD data (see Level 1 report, Figure 6C) shows there are very few formal flood defences within LB Merton, although the Derwent Road flood storage area on the Pyl Brook provides a 1 in 100 year standard of protection. The Flood Zones therefore provide a realistic picture of flood risk in this area, and an appreciation of the residual risk where defences are in place.

4.1.4 Development is only permissible in areas at risk of flooding where it can be demonstrated that there are no reasonably available sites in areas of lower risk and that the benefits outweigh the risks from flooding i.e. the development must pass the Sequential Test and where appropriate the Exception Test.

4.2 Site Allocations

4.2.1 The LB of Merton has completed a draft Sequential Test, identifying potential allocation sites in respect to Flood Zones. Due to the significant area of Flood Zone 1 within the Borough, many of the sites are appropriate for development under the Sequential Test. However there are some remaining sites located within the River Wandle /Graveney and Beverley / Pyl Brook Flood Zones which may require the Exception Test. These sites have been assessed in the tables in Appendix A.

4.2.2 It should be noted that LB Merton draft Sequential Test was originally completed in 2008, based on the best available information at the time. This did not include the recently completed Beverley Brook modelling. This report has since been updated to include the Beverley Brook modelling outputs, which typically shows that the risk of flooding from this source is less than previously shown by the Environment Agency’s flood zones. A number of sites are therefore presented in this report which will no longer require the Exception Test, however these have been retained within the report to provide consistency and continuity with previous versions.

4.3 Development Control

4.3.1 Development is only permissible in areas at risk of flooding where it can be demonstrated that there are no reasonably available sites in areas of lower risk and that the benefits outweigh the risks from flooding i.e. the development must first pass the Sequential Test and where necessary the Exception Test.

4.3.2 Where there are no reasonably available sites in Flood Zone 1, decision makers should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2, applying the Exception Test if required. Only where there are no reasonably available sites in Flood Zones 1 or 2 should decision makers consider sites in Flood Zone 3, taking into account flood risk vulnerability and applying the Exception Test where necessary.
4.3.3 In LB Merton, it is likely that most development can be sequentially steered away from high risk Flood Zones, due to the extensive spatial coverage of Flood Zone 1.

4.3.4 However, in exceptional circumstances it is possible that some development in flood risk areas will be necessary. In this case development should be directed to areas at lowest probability of flooding, and the flood vulnerability should be matched to the flood risk zones of the site. E.g. higher vulnerability uses should be located on parts of the site with the lowest probability of flooding.

4.3.5 The production of Flood Hazard maps has allowed an appreciation of differing levels of flood hazard within the Flood Zones. This enables an extended sequential approach to be taken as illustrated in Figure 4.1 below.

4.3.6 Stage 1 of Figure 4.1 represents the PPS25 Sequential Test. Steps 1 to 3 are to be followed, with each, from a flood risk point of view, being less desirable than the previous for a given development type (i.e. Flood Zone 2 is less desirable than Flood Zone 1). As the user progresses through the steps, they must be confident that a site of lesser flood risk is not reasonably available for the specific development under consideration.

4.3.7 Stage 2 of Figure 4.1 represents the additional Hazard Zone test. To move to Stage 2 the user must again be confident that no site of a lesser flood risk is appropriate for the specific development under consideration. As with Stage 1, each step represents, from a flood risk point of view, a less desirable site than the previous step.

4.3.8 As can be seen from Figure 4.1, the interrogation of Hazard Zone information is a series of further steps beyond the usual procedure of applying the PPS25 Sequential Test. It is intended that the Hazard Zones classification of low-medium-high remains subjective and is inherently relative to a specific site.

4.3.9 A planning authority’s decision to allocate development land within areas where Hazard Zone maps have been produced in this Strategic Flood Risk Assessment should examine all of the following:

- The vulnerability of the proposed development type to flooding;
- The residual risk to the development and;
- The options for managing the residual risk.
Figure 4.1: Suggested Sequential test for London Borough of Merton

STAGE 1

Step 1

Site in Flood Zone 1?

Yes → All development types generally acceptable

No →

Step 2

Site in Flood Zone 2?

Yes → Most development types generally acceptable

No → Exception Test required for Highly Vulnerable development

Step 3

Site in Flood Zone 3?

Yes → Some development types not acceptable

Proceed to Stage 2

Exception test may be required

STAGE 2 (Level 2 SFRA Mapping informs this)

Step 1

Site in Low Hazard Zone?

Yes → Vulnerable development may be acceptable

No →

Site in Medium Hazard Zone?

Yes →

Decreasing likelihood that development is acceptable and decreasing preference of site allocation

No →

Site in High Hazard Zone?

Yes → Vulnerable development not acceptable

No →

It should be noted that this flow diagram should also be applied to the hazard categories presented for the Beverley Brook catchment (Low ➔ Moderate ➔ Significant ➔ Extreme)
5 Proposed Allocations

5.1.1 The LB Merton has undertaken a draft Sequential Test of development sites allocated in their Unitary Development Plan, adopted in 2003. The Sequential Test process highlights potential sites which may require the application of the Exception Test in order to permit development.

5.1.2 The sites identified by LB Merton as potential Exception Test candidates are listed in Table 5.1 below and presented as Figure 1 in Appendix A.

5.1.3 The Flood Zone, depth and hazard mapping for each site is presented within Appendix A.

5.1.4 As detailed in section 4.2, the draft Sequential Test was originally completed in 2008, based on the best available information at the time. Therefore a number of sites are presented in Appendix A which will no longer require the Exception Test, however these have been retained within the report to provide consistency and continuity with previous versions.

Table 5.1: Sites identified by LB Merton as potential Exception Test candidates following draft Sequential Testing

<table>
<thead>
<tr>
<th>Site Ref</th>
<th>Name</th>
<th>Current Suggested Use</th>
<th>Flood Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High Street Colliers Wood</td>
<td>Residential and retail</td>
<td>2, 3a, 3b</td>
</tr>
<tr>
<td>2</td>
<td>Priory Development</td>
<td>Residential, retail and employment</td>
<td>2, 3a</td>
</tr>
<tr>
<td>3</td>
<td>The Tandem Centre</td>
<td>Retail</td>
<td>1, 2</td>
</tr>
<tr>
<td>4</td>
<td>Brown and Roots Tower, Colliers Wood</td>
<td>Residential with mixed use on lower levels</td>
<td>3b</td>
</tr>
<tr>
<td>5</td>
<td>Industrial units at Waterfall Road</td>
<td>Industrial</td>
<td>3a, 3b</td>
</tr>
<tr>
<td>6</td>
<td>Stadium site area including Copper Mill Lane and substation</td>
<td>Residential</td>
<td>1, 2, 3a, 3b</td>
</tr>
<tr>
<td>7*</td>
<td>New housing development in Sutton</td>
<td>Residential</td>
<td>1, 2</td>
</tr>
<tr>
<td>8*</td>
<td>Raynes Park Employment Centre / Rainbow Industrial</td>
<td>Employment and industrial</td>
<td>1</td>
</tr>
<tr>
<td>9**</td>
<td>Shannon Corner</td>
<td>Retail, residential and employment</td>
<td>1, 2, 3a, 3b (river runs through the site)</td>
</tr>
<tr>
<td>10*</td>
<td>LEA Sports Ground, Grand Drive</td>
<td>Residential</td>
<td>1, 2</td>
</tr>
<tr>
<td>11**</td>
<td>LESSA Sports Ground, Grand Drive</td>
<td>Residential and sports facilities</td>
<td>1, 2, 3a, 3b</td>
</tr>
<tr>
<td>12***</td>
<td>Garages at West Barnes Lane and West Way</td>
<td>Residential</td>
<td>2, 3a, 3b</td>
</tr>
<tr>
<td>13</td>
<td>The Hub, Bishopsford Rd</td>
<td>Residential and sports facilities</td>
<td>1, 2, 3a, 3b</td>
</tr>
<tr>
<td>14</td>
<td>Willow Lane Industrial Estate</td>
<td>Industrial and employment</td>
<td>1, 2, 3a, 3b</td>
</tr>
<tr>
<td>15</td>
<td>St. Mark’s Academy</td>
<td>Education</td>
<td>1, 2, 3a</td>
</tr>
</tbody>
</table>

*The Exception Test is no longer required due to updated and improved flood risk information provided by Beverley Brook model outputs

**The majority of the site lies within Flood Zones 1 and 2

***The majority of the site lies within Flood Zones 2 and 3a
6 The Exception Test

6.1 Background

6.1.1 Following the application of the Sequential Test, it may not be possible for an allocation or development to be located in a lower flood risk zone. In this case, it may be possible to apply the Exception Test at the site-specific level, providing the development is consistent with the wider sustainability objectives of the area.

6.2 Application

6.2.1 The Exception Test consists of three sections which are detailed below. All of these sections must be passed before a development is deemed appropriate within the Flood Zone.

Part A – Wider Sustainability to the Community

6.2.2 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 Development Plan Documents have reached the ‘submission’ stage (Figure 4 of PPS12; Local Development Frameworks) the benefits of the development should contribute to the Core Strategy’s Sustainability Appraisal.

- The site should be scored against the sustainability criteria of the Sustainability Appraisal.
- Where a development fails to score positively against the SA the LB Merton could consider planning conditions or Section 106 Agreements.

Part B – Redevelopment of Previously Developed Land

6.2.3 The development must be on developable previously developed land or, if it is not on previously developed land, it must be shown that there are no reasonable alternative sites on developable previously developed land.

6.2.4 Planning Policy Statement 3: Housing defines previously developed land as:

‘Previously-developed land is that which is or was occupied by a permanent structure, including the curtilage of the developed land and any associated fixed surface infrastructure.’

6.2.5 The definition includes buildings, but excludes:

- Land that is or has been occupied by agricultural or forestry buildings.
- Land that has been developed for minerals extraction or waste disposal by landfill purposes where provision for restoration has been made through development control procedures.
- Land in built-up areas such as parks, recreation grounds and allotments, which, although it may feature paths, pavilions and other buildings, has not been previously developed.
- Land that was previously-developed but where the remains of the permanent structure or fixed surface structure have blended into the landscape in the process of time (to the extent that it can reasonably be considered as part of the natural surroundings).

6.2.6 There is no presumption that land that is previously-developed is necessarily suitable for housing development nor that the whole of the curtilage should be developed.
Part C – Safe from Flood Risk

6.2.7 A Flood Risk Assessment (FRA) must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall. The PPS25 Practice Guide provides details on the definition of ‘safe’ in Chapter 6 – Risk Management by Design, and Chapter 7 – Residual Risk.

6.2.8 The minimum requirements regarding the definition of ‘safe’ development which will not increase flood risk elsewhere has been discussed with the Environment Agency and the current interpretation is set out below.

Beverley / Pyl Brook and River Wandle Fluvial Flood Zone 3b (Developed Areas)

- Redevelopment of previously developed land should typically be restricted to ‘less vulnerable’ uses. ‘More vulnerable’ uses should generally be opposed and only considered within sites of equivalent existing use.
- The redevelopment must not result in increased flood levels in adjacent properties, which can be achieved by ensuring the existing building footprint is not increased and/or floodplain compensation is provided on the site;
- Basements are not permitted in functional floodplain areas;
- Safe* access and egress routes should be provided above the 1 in 100 year flood level with climate change and lead to high ground outside the floodplain;
- A flood warning and emergency response plan should be prepared and agreed in consultation with the Local Planning Authority, the Environment Agency and Emergency Planners.
- It should be recognised that the functional floodplain areas are expected to flood on average no less than once every 20 years therefore appropriate flood proofing measures should be incorporated within redevelopments.

*Where possible dry access is preferred for such a route however a minimum standard of ‘Low Hazard/Hazard for some’ as classified FD2320/TR2 – Flood Risks Assessment Guidance for New Development may be accepted in exceptional circumstances

Beverley / Pyl Brook and River Wandle Fluvial Flood Zone 3a – undefended i.e. actual risk

- The development must not result in increased flood levels in adjacent properties, which can be achieved by ensuring the existing building footprint is not increased and/or floodplain compensation is provided on the site;
- Finished floor levels should be set above 1 in 100 year flood level with climate change plus 300mm freeboard for all uses;
- Basement access threshold levels should be raised above the 1 in 100 year flood level with climate change and all basements must include provision of internal staircases to upper floors. N.B. Self contained basement dwellings are classified as highly vulnerable development and are not permitted in Flood Zone 3.
- Safe* access and egress routes for ‘more vulnerable’ uses should be provided above the 1 in 100 year flood level with climate change and lead to high ground outside the floodplain;
- A flood warning and emergency response plan should be prepared and agreed in consultation with the Local Planning Authority, the Environment Agency and Emergency Planners.

*Where possible dry access is preferred for such a route however a minimum standard of ‘Low Hazard/Hazard for some’ as classified FD2320/TR2 – Flood Risks Assessment Guidance for New Development may be accepted in exceptional circumstances

6.2.9 The assessment of ‘safety’ will depend on the nature of the site therefore it is recommended that the Environment Agency is consulted to confirm specific requirements for individual sites.
6.2.10 Consideration should be given to the probability of flooding and condition of flood defences alongside the potential flood depth and duration when determining appropriate flood warning and emergency response plans.

6.3 Exception Test Candidate Site Assessments

6.3.1 The Flood Zone, depth and hazard mapping for each site is presented within Appendix A. A table has been prepared for each site including recommendations regarding development type and layout for safe development.
7 Site specific FRA

7.1.1 The LB Merton SFRA Levels 1 and 2 together provide a comprehensive collation of existing flood risk information in the area. The Level 2 goes further, deriving new information on the potential risks and hazards from fluvial sources. However, the scope of these documents is strategic in nature and so it is imperative that site-specific flood risk assessments (FRAs) are produced by those proposing development.

7.1.2 It is probable that flood risk exists within an area that has not been highlighted in either the Level 1 or 2 SFRAs due to a lack of available information. Therefore, site specific FRAs are required to assess the flood risk posed to proposed developments and to ensure that where necessary and appropriate, suitable mitigation measures are included in the development. They should use information from the SFRA, where this is helpful or strengthens the assessment.

7.1.3 The tables presented within Appendix A provide further guidance regarding the potential scope of site specific FRAs and identifies where further modelling is likely to be required. The tables have been prepared based on currently available information and are provided for guidance only. It should be noted that there is currently no modelling information available for the Beverley Brook / Pyl Brook and in the absence of this it is not possible within the scope of this study to accurately quantify flood risk on a site specific scale.

7.1.4 It is the developer’s responsibility to ensure that their proposals are based on appropriate and accurate information therefore developers may wish to undertake independent modelling works for the Beverley / Pyl Brooks prior to completion of the Environment Agency’s catchment wide study. It should be noted that any modelling works should be undertaken by competent persons and will be subject to checks and verification by the Environment Agency.

7.1.5 A site-specific FRA forms the 3rd tier of the assessment approach advocated by PPS25 and its Companion Guide. The LB Merton should request a FRA to inform both local Sequential Tests and site-specific Exception Tests, rather than relying solely on the information presented within the Level 1 and 2 SFRAs.

7.1.6 This section presents the recommendations for site specific FRAs prepared for submission with planning applications in the LB Merton administrative area.

7.2 Flood Risk Assessment Guidance Table

7.2.1 The Flood Risk Assessment Guidance Table provided in Appendix B provides guidance to developers and Local Authorities on the requirements of a FRA.

7.2.2 The table provides a framework with which Local Authorities and Developers will be able to assess the requirements of each individual development with regard to flood risk. The table has been based on the Environment Agency’s current standing advice on FRA requirements, available at http://www.pipernetworking.com/floodrisk/.

7.2.3 The standing advice is currently being updated and is due to be released in 2008. It is understood that the guidance will be available directly through the Environment Agency’s website http://www.environment-agency.gov.uk which should be referred to for updated FRA guidance in the future.

7.2.4 In addition, Annex E of PPS25 presents the minimum requirements for a FRA.

7.3 Things for developers to consider when developing in Flood Risk Areas

7.3.1 Developing in flood risk areas can result in significant risk to a development and site users. It is possible to reduce the risk through mitigation measures, however flood risk cannot be removed
altogether, and developments located in floodplains will always be at risk from flooding. This creates Health & Safety and Insurance considerations, potential additional costs and potential trauma for future residents during flood events, which could result in homes and businesses being uninhabitable for substantial periods of time.

- Failure to consider wider plans prepared by the Environment Agency or other operating authorities may result in a proposed scheme being objected to;
- Failure to identify flood risk issues early in a development project could result in redesign of the site to mitigate flood risk;
- Failure to adequately assess all flood risk sources and construct a development that is safe over its lifetime could increase the number of people at risk from flooding and/or increase the risk to existing populations;
- Failure to mitigate the risk arising from development may lead to claims against the developer if an adverse effect can be demonstrated (i.e. flooding didn’t occur prior to development) by neighbouring properties/residents;
- Properties may be un-insurable and therefore un-sellable if flood risk management is not adequately provided for the lifetime of the development;
- By installing SuDS without arranging for their adoption or maintenance the SuDS will eventually cease to operate as designed and may present a flood risk to the development and/or neighbouring property;
- The restoration of river corridors and natural floodplains can significantly enhance the quality of the built environment whilst reducing flood risk. Such an approach can significantly reduce the developable area of sites or lead to fragmented developments, however positive planning and integration throughout the master planning process should resolve these.

N.B. Advice from the Environment Agency’s National Development Control Policy team on brownfield functional floodplain is that, for redevelopment of functional floodplain, the Environment Agency will consider existing building footprints to be part of the functional floodplain, unless it can be proven that they exclude flood waters. If these buildings do exclude flood waters, then solely the area around these buildings will be deemed functional. When undertaking an FRA this matter should be clarified and ideally pre-agreed with the Environment Agency.

Access and Egress

7.3.2 Safe access and egress is required to enable the evacuation of people from the development, provide the emergency services with access to the development during times of flood and enable flood defence authorities to carry out any necessary duties during periods of flood.

7.3.3 ‘Safe’ access/egress route is typically defined as a route that is safe for use by occupiers without the intervention of the emergency services or others and should be considered for the lifetime the development, including climate change allowances.

7.3.4 For developments located in areas at fluvial risk the EA consider ‘safe’ access/egress to be in accordance with ‘FRA Guidance for new Developments FD 2320’ (Joint DEFRA and EA document). The requirements for safe access and egress from new developments are as follows in order of preference:

- Safe, dry route for people and vehicles;
- Safe, dry route for people;
- If a dry route for people is not possible, a route for people where the flood hazard (in terms of depth and velocity of flooding) is low and should not cause risk to people (modelling outputs should be used to determine this);
- If a dry route for vehicles is not possible, a route for vehicles where the flood hazard (in terms of depth and velocity of flooding) is low to permit access for emergency vehicles.
Riverside Development

Main River

7.3.5 Under Section 109 of the Water Resources Act 1991 and/or EA Thames Region’s Byelaws, any works in, over, or under or within 8 metres of the top of the channel of any statutory main river requires Environment Agency consent. Furthermore the Environment Agency would seek an 8 metre wide undeveloped buffer strip alongside main rivers, and would also ask developers to explore opportunities for river restoration as part of any development.

Ordinary watercourses

7.3.6 The Environment Agency requires a 5 metre undeveloped buffer strip alongside such watercourses. This is to allow access for maintenance and encourage conservation and wildlife habitats.

De-culverting

7.3.7 The Environment Agency would seek de-culverting as part of a development over or in ownership of a culverted structure. Figures 12A – 12D presented within the Level 1 SFRA show existing culverts contained in the NFCDD, this should be used in conjunction with the large scale flood risk maps (Figure 4, Level 1 SFRA) as a reference point to identify any potential structures that could result in increased flood risk within the area and could benefit from de-culverting in the future.

Development Site Sequential Approach

7.3.8 A sequential approach should be applied at a site-specific scale, to locate higher vulnerability uses within the lowest flood risk areas and vice versa. On larger sites considerable reduction in flood risk may be gained through careful design and land use in accordance with the inherent degrees of flood risk / hazard as promoted throughout PPS25.

Finished Floor Levels

7.3.9 Where development in flood risk areas is unavoidable, the most accepted method of mitigating flood risk is to ensure habitable floor levels are raised above the maximum flood water level. This can substantially reduce the damage to property and significantly reduce the risk of injury and fatalities.

7.3.10 In areas of minimal floodwater depth, raising finished floor levels can usually be easily be accommodated in building design. In areas where a substantial depth of floodwater is expected properties can incorporate a garage, utility area or public space on the ground floor with habitable areas above.

7.3.11 The Environment Agency have confirmed that finished floor levels should be set a minimum of 300mm above the 1 in 100 year modelled flood level with climate change, however the floodplain compensation requirements set out below must be adhered to.

Floodplain Compensation

7.3.12 New development located within the floodplain will be required to raise ground levels to prevent the area from flooding. However this would reduce the total volume of floodplain storage and increase flood levels in other areas. Floodplain compensation must therefore be provided to ensure that this is not the case. This involves the lowering of areas of land that currently lie outside the floodplain to allow them to flood and store water during flood events.

7.3.13 Floodplain compensation must be provided on a level for level basis to the 1 in 100 year level with climate change, to ensure that the shape of the flood hydrograph is not altered. The provision of
compensation is a mechanism for reconfiguring the developable land within a site, to a more favourable layout and will not increase the total area available for development.

7.3.14 The requirement for ‘no loss of floodplain storage’ means that it is not possible to modify ground levels on sites which lie completely within the floodplain (when viewed in isolation). This is because there is no land available for lowering to provide compensation storage through incorporation into the floodplain. However it is possible to provide off-site compensation within the local area e.g. on a neighbouring or adjacent site. This would be subject to detailed investigations and agreement with the Environment Agency to demonstrate that the proposals would improve and not worsen the existing flooding situation.

Flood Routeing

7.3.15 In order to demonstrate that ‘flood risk is not increased elsewhere’ development in the undefended floodplain will need to prove that flood routeing is not adversely affected by the development, for example giving rise to backwater affects or diverting floodwaters onto other properties.

Flood Defences

7.3.16 Riparian developments are required to have flood defences renewed / made good for the life of the development. This is classified as at least 100 years in the case of residential development as defined in the PPS25 Practice Guide.

7.3.17 Where the development site is undefended to the 1 in 100 year with climate change standard, a hydraulic modelling investigation must be carried out to determine the effects of raising the banks to protect the development to this standard. This should identify changes in water level and where flooding is being alleviated and exacerbated in order to demonstrate that ‘flood risk is not increased elsewhere’ and compliance with the CFMP.

Flood Warning and Evacuation Plans

7.3.18 Flood Warning and Emergency Procedures tend to form part of a higher level emergency management plans for the wider area. These plans include information such as repair procedures, evacuation routes, refuge areas flood warning dissemination and responsibilities.

7.3.19 The LB Merton has emergency plans in place to respond to any incident that occurs within their administrative area. These documents should be updated to include the information generated by this SFRA. This will ensure that emergency plans are appropriate to the conditions expected during a flood event and that the local authority and emergency services are fully aware of the likely conditions and how this may affect their ability to safeguard the local population.

7.3.20 When submitting FRAs for developments within flood risk areas, developers should make reference to local Flood Warning and Emergency Procedures to demonstrate their development will not impact on the ability of the LB Merton and the emergency services to safeguard the current population.

7.3.21 Flood Hazard in a particular area must be viewed in the context of the potential evacuation and rescue routes to and from that area and discussed as part of a site specific FRA.

Sewer Flooding

7.3.22 In areas at risk of sewer flooding a site specific FRA should assess the level of risk to the site. Thames Water should be approached to obtain any information regarding sewer flooding records in the area and any recent capital improvement works undertaken, which should be reviewed in relation to local topography and potential flow paths to determine the actual risk to the site. This will allow appropriate mitigation measures to be incorporated where necessary.
Groundwater Flooding

7.3.23 In areas at risk of ground water flooding a site specific FRA should assess the level of risk to the site and the increased risk of flooding at adjacent properties. Local groundwater monitoring should be identified and where possible analysed to assess ground water levels as part of a FRA, in addition to detailed geology mapping which identifies potential spring lines.

Surface Water Flooding

7.3.24 In areas at risk of surface water flooding, development should seek to reduce surface water runoff rates from the site. Furthermore, the appropriate application of sustainable drainage systems (where possible) to reduce the overall level of flood risk in the area through the outlay and form of the development would be required. Figure 9A – 9D in the Level 1 SFRA show the areas assessed to be at risk of flooding from overland flow and this should be investigated further as part of a site specific FRA.

7.3.25 Potential overland flow paths should be determined and appropriate solutions proposed to minimise the impact of the development, for example by configuring road and building layouts to preserve existing flow paths and improve flood routing, whilst ensuring that flows are not diverted towards other properties elsewhere.

7.3.26 The London Plan Supplementary Planning Guidance (SPG) aims to provide additional information and support implementation of the London Plan, which includes important requirements regarding water usage and surface water drainage. The SPG encourages the use of SuDs and aspires to achieve 100% attenuation of the undeveloped site’s surface water run-off at peak times, which is specified as a ‘preferred’ standard. The ‘essential’ standard is to achieve 50% attenuation of the site’s undeveloped run-off at peak times. All development sites must comply with this standard. Details of how this will be achieved should be included within site specific FRAs.

Artificial Source/Infrastructure Failure Flooding

7.3.27 Artificial sources of flooding within a 1km radius of the any site should be considered in order to assess the residual risk of a water body overtopping and potential flow paths. Reservoir or canal flooding may occur as a result of the facility being overwhelmed and/or as a result of dam or bank failure and therefore a crude assessment of flood flow routes should be assessed. If a perched waterbody is in close proximity, where possible a cross section should be taken in relation to the proposed site, showing the level of the waterbody and its water level. The impact of burst water mains in the vicinity of the site should also be considered.

7.3.28 This study has not identified any significant artificial sources of flood risk therefore it is unlikely that FRAs will need to consider this potential source of flooding in detail, however a review of the area in close proximity of development sites should be undertaken to confirm the presence of any potential flood sources.
8 Policy Recommendations

8.1 Policy Introduction

8.1.1 To ensure a holistic approach to flood risk management and make sure that flooding is taken into account at all stages of the planning process, the findings of this report, including flood hazard maps need to be considered through the London Borough of Merton’s LDF process.

8.1.2 The flooding policy recommendations stem from National, Regional and Local Policy described in the Level 1 SFRA, in particular the principals of PPS25. This has been used in conjunction with specific guidance supplied by the local Environment Agency team.

8.1.3 The local policies should be used for a review of the proposed Core Strategy policies and detailed area action plan proposals within the borough of Merton. This will ensure that flood risk is considered throughout the planning and implementation phase of proposed development.

8.2 National Policy

8.2.1 National policies including ‘Making Space for Water’ and ‘Planning Policy 25: Development and Flood Risk’ have been discussed in detail as part of the Level 1 SFRA which should be referred to. National Policy is in place to ensure that:

- Development is located in the lowest flood risk area through application of Sequential and Exception Test (where appropriate);
- New development is flood-proofed to a satisfactory degree and does not increase flood risk elsewhere;
- Surface water is managed effectively on site;
- Flood risk is suitably assessed for Windfall sites in accordance with PPS25 guidelines, as they will not have been through the Sequential Test as part of the SFRA process;
- Greenfield floodplain areas are an important flood risk management asset. Development proposals should ensure that remaining Greenfield floodplain areas are protected from future development;
- Sites where developer contributions could be used to fund future flood risk management schemes should be identified. However, it should be noted that developer funded defences should not wholly justify development in unsuitable locations.

8.3 Regional Policy

8.3.1 Regional policies that should be considered when planning in the London Borough of Merton include the ‘London Plan’, ‘London Plan Supplementary Planning Guidance’ and ‘Sub Regional Strategy’. These provide more detail on policies that should be adhered to when planning in London including policies covering flooding, flood risk management and rising groundwater. Further details are included in the Level 1 SFRA.

8.4 Local Policy

8.4.1 Information and recommendations contained in this Level 2 SFRA should be used to inform policy, development control and technical issues. To this end the following points should be used as guidance for informing local policy specific to the London Borough of Merton.
Building Design

8.4.2 Flood Risk areas are largely confined to the River Wandle and Pyl Brook corridors. The Pyl Brook has only a small area of flood risk associated with it. Flood Zones correlating to the River Wandle in Merton are larger, affecting the centre of the borough. The River Graveney forms the north eastern borough boundary.

- PPS25 does not permit self contained basement dwellings to be located within Flood Zone 3a, as basement occupants have the highest risk to life, even when considering shallow flooding at ground level. By definition, self contained basement properties provide no means of escape to higher floors within a development.
- Under PPS25 basements can be provided for non-residential uses with lower flood risk vulnerability, however, a satisfactory means of escape to above the floor level is absolutely essential. If escape cannot be provided then in accordance with PPS25 the basement should not be permitted;
- Single storey residential development should not normally be considered in flood risk areas as they offer no opportunity for safe refuge areas on upper floors;
- When re-developing existing buildings in flood risk areas, the use of flood resilient measures should promoted at the individual property level.

Flood Risk Assessments and Vulnerability

- Flood Risk Assessments should be undertaken for all developments within Flood Zones 2 and 3 to assess the risk of flooding to the development and identify options to mitigate the flood risk to the development, site users and surrounding area;
  - Developers and Local Authorities proposing to develop in Flood Zones 2 and 3 should seek opportunities to:
    - Reduce flooding by considering the layout and the form of the development and the appropriate application of sustainable drainage techniques.
    - Relocating existing development to land in zones with a lower probability of flooding, and;
    - Create space for flooding to occur by restoring functional floodplains and flood flow pathways and by identifying, allocating and safeguarding open space for storage.
- In Flood Zone 1, Flood Risk Assessments are also required for all development sites greater than 1ha to ensure that flood risk is not increased to other properties due to increased site runoff. In addition, residential developments sites greater than 0.5 ha, or greater than 10 dwellings and commercial development sites greater than 1 ha or with a floor area greater than 1000 m2 require site specific FRAs.
- If development is to be constructed with less vulnerable uses on the ground level, agreements need to be in place to prevent future alteration of these areas to ‘more vulnerable’ uses without further study into the associated flood risks to the site;
- Potential opportunities to move existing development from within the floodplain to areas with a lower risk of flooding should be maximised. This should include consideration of the vulnerability of existing developments and whether there is potential for land swaps with lower vulnerability uses.

Developments behind Flood Defences

8.4.3 The Pyl Brook, and River Wandle including Bruce’s Ditch flow through the London Borough of Merton. The River Graveney forms the north eastern borough boundary. Figure 6B included in the Level 1 SFRA shows that small sections of the River Wandle are defended to a standard of 1
in 25 years and small sections of the River Graveney are defended to a standard of 1 in 50 years. The Pyl Brook in the south west of the borough is defended to a standard of 1 in 100 years for short sections.

- When proposing development behind flood defences, the impact on residual flood risk to other properties should be considered. New development behind flood defences can increase the residual flood risk should defences be breached or overtopped by disrupting flow paths and or the displacement of flood water. If conveyance routes that allow flood water to pass back into a river following failure of a flood defence are blocked, this may potentially increase flood risk to existing properties;
- Flood defences (if present) provide flood protection and should continue to be maintained;
- Where a development lies adjacent to an area benefiting from flood defence, opportunities should be sought for the maintenance of these flood defences to be partly funded by the development for its lifetime;
- Take opportunities to reduce the dependency on assets that do not contribute to effective flood risk management;
- Residual flood risk should be managed through emergency planning, site design and mitigation measures.

The River Wandle, Pyl Brook and River Graveney

- In order to develop specific policies with regard to the River Wandle, Pyl Brook and River Graveney consultation should be undertaken with the Environment Agency to develop suitable policies in line with the wider strategy and aims of the CFMP set out for the Pyl Brook, Wandle and Graveney policy units. These strategies highlight that for rivers in Merton the following approach needs to be taken:
  - Re-create a river corridor so that there is more space for the river to flow and flood naturally (Thames CFMP);
  - Link flood risk management planning with regeneration and redevelopment so that the location and layout of development can help to reduce the flood risk (Thames CFMP);

Further details on the CFMP are included in the level 1 SFRA.

- An 8m buffer strip must be maintained along fluvial river corridors, to ensure that maintenance of the channel can be undertaken;
- Where floodplain storage is removed, the development should provide compensatory storage on a level for level basis to ensure that there is no net loss in flood storage capacity;
- Proposed developments located within the River Wandle, Pyl Brook and River Graveney floodplains should be accompanied by a FRA including detailed hydraulic modelling and topographic surveys to enable accurate flood level estimation and consideration of potential flood flow paths. The external relations team at the Environment Agency office, local to the site to be developed should be consulted for further guidance and specific requirements for modelling in FRAs. For the London Borough of Merton, the Environment Agency office is located at Frimley.
- Finished floor levels of all residential accommodation should be raised above the 1 in 100 year modelled flood level including climate change. Where flood level information is not available, further hydraulic modelling may be required by the developer to determine the appropriate finished floor levels in relation to flood risk. Potential access & egress routes should also be considered and recommendations made for appropriate actions of future occupants.
• River channel restoration should be undertaken where possible to return the river to its natural state and restore floodplain to reduce the impact of flooding downstream;

• Consult the Environment Agency regarding the potential for future management regime of the River Wandle, Pyl Brook and River Graveney catchment including the potential for any flood alleviation schemes, upgrading and/or replacement of existing flood defences;

• Look at opportunities to make space for water to accommodate climate change in order to assist in managing future flood risk;

• Opportunities should be sought to de-culvert rivers, where possible, to return them to a natural system, reducing back up of flows and under capacity where this does not exacerbate the flooding elsewhere;

Surface Water Flooding and the use of SuDS

• Sustainable Drainage Systems should be promoted in new developments as a way to manage surface water and should be considered in line with the Management Train hierarchy set out in Table E-1, Level 1 SFRA.

• The vulnerability and importance of local ecological resources (such as water quality and biodiversity) should also be considered when determining the suitability of drainage strategies/SuDS.

• The Council should ensure new development in an area known to suffer surface water flooding does not increase the discharge to the existing drainage system either though restricting site discharge rates and/or through capital contributions to improvements works of the existing drainage infrastructure.

• In areas where the potential for surface water flooding has been identified, Flood Risk Assessments should ensure suitable SuDS techniques are incorporated as part of redevelopment.

• Potential overland flow paths should be considered to ensure that buildings do not obstruct flows.

• Where basements are proposed in areas of Flood Zone 1 and 2 the risk of surface water flooding should be considered, with potential mitigation to include raising thresholds and including storage for surface water in such developments.

• Developers should aim to achieve Greenfield runoff from their site through incorporating sustainable drainage systems.

• London Borough of Merton 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.

• Opportunities should be sought to reduce the risk of flooding from the sewer network through consultation with Thames Water to determine key areas for maintenance and flood alleviation schemes.

• It is recommended that the London Borough of Merton undertake a surface water management plan as the SFRA has highlighted that currently only broad data with regard to surface water flooding is available.

Water Resources (supply & demand)

8.4.4 As populations increase and climate change leads to changes in weather patterns, the prospect of droughts may increase. New development can tackle this by incorporating water efficiency measures such as grey water recycling, rainwater harvesting and water use minimisation
technologies. In doing so, knock-on benefits could be felt by the sewer system which will receive less wastewater from properties, potentially freeing up capacity during flood events.

8.4.5 In addition, increasing people’s awareness of the water environment around them, its importance and its hazards, will contribute to their understanding of where floods come from and what individuals can do to limit the consequences of flooding and resource shortages.

- Ensure that proposed developments can be accommodated by the existing resource provision. Where a development cannot be met by current resources, ensure that the phasing of development is in tandem with resource infrastructure investment;
- For large schemes suggest a water strategy is carried out to determine there is sufficient water resources for the proposed increase in demand.

Residual Risk and Emergency Planning

- Where development within flood risk areas is absolutely necessary flood proof construction methods should be utilised to reduce the impact of flooding.
- Emergency planning strategies should be put in place in order to direct people to safety during times of flood;
- Current emergency planning strategies should be reviewed to determine the suitability of refuge centres and evacuation routes based on the Flood Zone mapping produced in this study;
- Where a development is applying for a change of use, flood evacuation plans should be developed through liaison with the emergency planners and the emergency services. For lower to higher vulnerability properties a FRA would be required.
9 Conclusions

9.1.1 The Level 2 SFRA aims to refine information on the probability of flooding to areas defined by the LPA. Hazard and depth maps have been provided for the fluvial areas of the River Wandle and the Beverley / Pyl Brook.

9.1.2 The River Wandle catchment is currently being remodelled and the outputs are anticipated to be available in late 2009. The Environment Agency should be contacted for the most up to date information.

9.1.3 The Level 1 SFRA identified the fluvial floodplains associated with the Beverley / Pyl Brook and the River Wandle.

9.1.4 The Level 1 and Level 2 SFRA reports should be used in conjunction with each other to provide a more detailed overview of the flood risks to the LB Merton, to assist in the development of policies, strategic planning and flood risk management.

9.1.5 Policy recommendations should be reviewed in line with the Core Strategy to ensure flood risk considerations are included as part of the LDF process and future strategic planning.

9.1.6 This document should be considered a ‘Living Draft’ whereby should flood risk policy, climate change recommendations or modelling information change, the information provided in the SFRA should be reviewed.

9.1.7 This report version includes the Beverley Brook modelling outputs and it is recommended that a further revision should be produced following completion and issue of the River Wandle modelling outputs by the Environment Agency.
References

DEFRA/Environment Agency, March 2006: Flood Risks to People Phase 2, FD2321/TR1 and TR2


ODPM, February 2005: Planning Policy Statement (PPS) 1, Delivering Sustainable Development

CIRIA C624, 2004: Development and flood risk, guidance for the construction industry.

Mayor of London, February 2004: The London Plan

Greater London Authority, May 2006: The London Plan Supplementary Planning Guidance

Environment Agency/DEFRA, March 2005: Flood and Coastal Defence Programme, Phase 1 and 2 reports

Environment Agency, 2007: Thames Region Catchment Flood Management Plan


Scott Wilson, 2007 London Boroughs of Wandsworth, Merton, Sutton and Croydon Level 1 Strategic Flood Risk Assessment


Suresh Surendran & Geoff Gibbs, Environment Agency and Steven Wade & Helen Udale-Clarke, HR Wallingford, May 2008. Supplementary Note on Flood Hazard Ratings and Thresholds for Development Planning and Control Purposes– Clarification of the Table 13.1 of FD2320/TR2 and Figure 3.2 of FD2321/TR1
Appendices
Appendix A: Exception Test Candidate Site Assessments
Exception Test Candidate Site Assessments – Key to Tables A.1 to A.15

<table>
<thead>
<tr>
<th>Flood Zones</th>
<th>Flood Depth</th>
<th>Flood Hazard -based on depth</th>
<th>Flood Hazard -based on depth &amp; velocity</th>
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<tr>
<td>Flood Zone 1</td>
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**Notes:**

1. The information presented within the tables has been based on available information at the time of production. It is recommended that the user consults the Environment Agency to confirm the most up to date information for their assessment. This is of particular relevance for sites in the vicinity of the River Wandle as the Wandle modelling outputs have only been provided in draft format at the time of production.

2. The Flood Hazard mapping for the River Wandle has been produced based on joint Environment Agency and DEFRA R&D guidance document FRA Guidance for New Developments: Phase 2 FD2320/TR2, Table 13.1, with a zero velocity as discussed in section 3.3.

3. The Flood Hazard mapping for the Beverley Brook has been produced based on TuFLOW model outputs using the ‘ZUK0’ output which is based on Environment Agency and DEFRA R&D guidance document Flood Risks to People Phase Two FD2321/TR1 and TR2, consult TuFLOW manual and Beverley Brook modelling report for further details.

4. Comments have been included in each table to provide guidance on how site planning and mitigation could assist in satisfying the requirements of part (c) ‘safe development’ of the Exception Test. The comments are provided for information only and have been derived on a strategic scale, which may omit small scale features that could impact on the flow paths and localised flood risk, theses should be confirmed as part of a site specific flood risk assessment.

5. The comments in the table are focused upon fluvial and tidal risk, however surface water management is a key consideration for all new developments. The Mayor of London’s SPG states that 50% surface water attenuation must be achieved on all new development; with 100% attenuation preferable therefore surface water management should be considered when preparing development proposals and fully expanded upon within site specific flood risk assessments.

6. The tables are provided to highlight potential constraints and to indicate whether development of the site is likely to meet the ‘safe development’ definition required in order to satisfy the Exception Test. A detailed Flood Risk Assessment is necessary as part of the Exception Test part c), which will be required to verify the flood issues specific to the proposed development site in accordance with PPS25.
Table A.1

| Site Ref: 1 | Site Name: High Street, Colliers Wood |

### Flood Zones

#### Proposed Use: Residential and retail units
Significant parts of site are classified as functional floodplain and are not considered suitable for residential development under PPS25.
Only water compatible development is appropriate within functional floodplain.
Obtain modelled flood levels and compare with topography to confirm flood extents. Sequential approach should be applied to locate residential units within lowest possible flood risk areas.

#### Draft River Wandle outputs show site lies within functional floodplain. Flood depths for the 100 year climate change event vary between 1.0 and 1.4m in southern half of site.
Minimum finished floor levels should be set at 1 in 100 year with climate change levels plus 300mm freeboard. Level for level compensation will be required for any lost volume of flood storage.
8m setback from R.Wandle required, Flood Defence Consent required for any works within this 8m zone.

#### Dry access and egress likely to be available from the north of the site to areas north of railway line. Development layout should be configured to provide safe access from southern parts of site.

#### Note: Flood depth & hazard information taken from Draft River Wandle model outputs, June 2008. Outputs are currently undergoing final review and may be subject to future changes. Consult Environment Agency for latest information.

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**Table A.2**

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<th>Site Ref: 2</th>
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<td>Flood Depth</td>
<td><img src="image" alt="Flood Depth Diagram" /></td>
</tr>
<tr>
<td>Flood Hazard (based on depth only)</td>
<td><img src="image" alt="Flood Hazard Diagram" /></td>
</tr>
</tbody>
</table>

**Proposed Use:** Residential, retail and employment uses

Residential development should be located in Flood Zones 1 or 2 where possible; Exception Test required for Flood Zone 3a. Retail and residential uses can be located within Flood Zones 1, 2 & 3a. 8m setback distance from River Wandle and Pickle Ditch required. Flood Defence Consent required for works within 8m zone.

Draft River Wandle outputs show that site does not lie within 100 year climate change flood outline i.e. site is not flooded during this event. Obtain draft R.Wandle modelled flood levels and minimum finished floor levels should be set at 1 in 100 year with climate change levels plus 300mm freeboard.

Level for level compensation will be required for any lost volume of flood storage.

**Summary:**

Site specific FRA to confirm flood extents by comparing modelled flood levels with topography. Minimum finished floor levels and set at 1 in 100 year with climate change flood level plus 300mm freeboard. Safe access & egress route onto A24 at south of site likely to be available.

**Note:** Flood depth & hazard information taken from Draft River Wandle model outputs, June 2008. Outputs are currently undergoing final review and may be subject to future changes. Consult Environment Agency for latest information.

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Draft River Wandle outputs show that site does not lie within 100 year climate change event, therefore there is no associated flood hazard on site. Model outputs show dry access and egress route is available to south of site on to A24 at Christchurch Road, Merantum Way and Tandem Way junction).
### Table A.3

<table>
<thead>
<tr>
<th>Site Ref: 3</th>
<th>Site Name: The Tandem Centre</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flood Zones</strong></td>
<td><strong>Flood Depth</strong></td>
</tr>
</tbody>
</table>

#### Proposed Use: Retail units
Retail units are appropriate within Flood Zones 1, 2 and 3a.

Draft River Wandle outputs show that site does not lie within 100 year climate change flood outline i.e. site is not flooded during this event.

Obtain draft R.Wandle modelled flood levels and minimum finished floor levels should be set at 1 in 100 year with climate change levels plus 300mm freeboard.

Draft River Wandle outputs show that site does not lie within 100 year climate change event, therefore there is no associated flood hazard on site.

Model outputs show dry access and egress route is available to south and west of site on to A24 and Prince Georges Road.

#### Summary:
Site specific FRA to confirm flood extents by comparing modelled flood levels with topography. Minimum finished floor levels and set at 1 in 100 year with climate change flood level plus 300mm freeboard. Safe access & egress route south and west of site likely to be available.

---

Note: Flood depth & hazard information taken from Draft River Wandle model outputs, June 2008. Outputs are currently undergoing final review and may be subject to future changes. Consult Environment Agency for latest information.

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Table A.4

<table>
<thead>
<tr>
<th>Site Ref: 4</th>
<th>Site Name: Brown and Root Tower</th>
</tr>
</thead>
</table>

**Flood Zones**

**Flood Depth**

**Flood Hazard (based on depth only)**

---

**Proposed Use: Mixed use with residential units**

Residential development should be located in Flood Zones 1 or 2 where possible: Exception Test required for Flood Zone 3a. However, site lies completely within functional floodplain, where residential development is not appropriate. Lower vulnerability uses should therefore be considered.

Significant mitigation measures are likely to be required in order to permit development including emergency planning and site design required in order to demonstrate that development will be safe.

Draft River Wandle model outputs show site lies within functional floodplain. During the 100 year climate change event flood depths are typically 1.0m.

Obtain R. Wandle modelled flood levels and minimum residential finished floor levels should be set at 1 in 100 year with climate change levels plus 300mm freeboard.

Floodplain compensation will be required on a level for level basis to the 1 in 100 year climate change flood level, for any lost volume of flood storage.

**Summary:** Draft R. Wandle outputs show site lies within functional floodplain. Only water compatible development is appropriate in the functional floodplain. Under its present proposed use, this site would not pass the Sequential Test. Significant mitigation measures would be required to demonstrate safety of development, which is likely to be very challenging and will require significant emergency planning and site design. In addition flood compensation storage is likely to be prohibitive for the entire site.

---

Note: Flood depth & hazard information taken from Draft River Wandle model outputs, June 2008. Outputs are currently undergoing final review and may be subject to future changes. Consult Environment Agency for latest information.

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Draft River Wandle model outputs show site and surrounding area is dominated by medium hazard zones.

Provision of dry access and egress unlikely to be possible, consideration of safe access route required during site specific FRA.
Table A.5 | Site Ref: 5 | Site Name: Industrial Units at Waterfall Road

<table>
<thead>
<tr>
<th>Flood Zones</th>
<th>Flood Depth</th>
<th>Flood Hazard (based on depth only)</th>
</tr>
</thead>
</table>

**Note:** Flood depth & hazard information taken from Draft River Wandle model outputs, June 2008. Outputs are currently undergoing final review and may be subject to future changes. Consult Environment Agency for latest information.

**Proposed Use: Industrial and commercial units**

Significant part of site is classified as functional floodplain and not suitable for the proposed development.

Only water compatible development is appropriate within functional floodplain.

Obtain modelled flood levels and compare with topography to confirm flood extents. Sequential approach should be applied to locate development within lowest possible flood risk areas.

Draft River Wandle outputs show site lies within functional floodplain. Flood depths for the 100 year climate change event are approximately 0.6m. Minimum finished floor levels should be set at 1 in 100 year with climate change levels plus 300mm freeboard. Level for level compensation will be required for any lost volume of flood storage.

Draft River Wandle model outputs show part of site lies within functional floodplain.

The western part of the site consists of medium hazard zones, however model results show that the east of the site is not flooded.

Dry access and egress likely to be available from the east of the site to areas north of railway line. Development layout should be configured to provide safe access from western parts of site.

**Summary:** Site specific FRA likely to confirm whether site is located in functional floodplain (if correct, only water compatible development appropriate). For non-functional floodplain areas, proposed mitigation measures likely to include raising finished floor levels 300mm above R.Wandle modelled 1 in 100 year climate change levels, although level for level floodplain compensation required for any loss storage due to ground raising. Dry access & egress route to land outside the floodplain is available from east of site.
### Table A.6

<table>
<thead>
<tr>
<th>Site Ref: 6</th>
<th>Site Name: Stadium Site Area</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flood Zones</strong></td>
<td></td>
</tr>
<tr>
<td>Summerstown</td>
<td></td>
</tr>
</tbody>
</table>

**Proposed Use: Residential units**

Residential development should be located in Flood Zones 1 or 2 where possible; Exception Test required for Flood Zone 3a. Car parking is likely to be less vulnerable and able to be located in Flood Zones 1, 2 and 3a. Open space is likely to be water compatible and able to be located within all Flood Zones. However, the site lies largely within functional floodplain, where only water compatible development is permitted. Residential development is not appropriate.

**Draft River Wandle model outputs**

Draft River Wandle model outputs show site lies within 1 in 100 year climate change flood outline with typical flood depths of 1.5m. Obtain R.Wandle modelled flood levels and confirm flood extents. Minimum finished floor levels should be set at 1 in 100 year with climate change levels plus 300mm freeboard. Floodplain compensation will be required on a level for level basis to the 1 in 100 year climate change flood level, for any lost volume of flood storage.

**Summary:** Draft R.Wandle outputs show site lies within functional floodplain, where residential development is not appropriate therefore lower vulnerability uses should be considered. Significant mitigation measures required to demonstrate safety of development, which is likely to be very challenging and will require significant emergency planning and site design.

---

Note: Flood depth & hazard information taken from Draft River Wandle model outputs, June 2008. Outputs are currently undergoing final review and may be subject to future changes. Consult Environment Agency for latest information.

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Flood Hazard (based on depth only)

Draft River Wandle flood outputs show part of site lies within functional floodplain. The site and surrounding area is dominated by medium hazard zones. Provision of dry access and egress unlikely to be possible. However egress/access improvements could be included in the proposal. Consideration of safe access route required during site specific FRA. 8m setback from the River Wandle is required.
Proposed Use: Residential units
Residential development should be located in Flood Zones 1 or 2 where possible; Exception Test required for Flood Zone 3a.
Updated modelling outputs show that the site lies within Flood Zones 1 and 2, therefore the Exception Test is not required.

Beverley Brook modelling outputs and revised JFLOW Flood Zone mapping show that the vast majority of the site lies within Flood Zone 1.
However finished floor levels should be set a minimum of 300mm above the 1 in 100 year plus climate change modelled flood level.

A safe access route will be required from development to higher ground outside the floodplain. As the majority of the site is located in Flood Zone 1 this should be easily achievable.

Summary: Residential development should be located in Flood Zones 1 & 2. 8m setback distance from Beverley Brook required. Vast majority of site is located in Flood Zone 1, however finished floor levels should be set a minimum of 300mm above 1 in 100 year climate change level. Safe access and egress route required to high ground outside the floodplain, which should be easily achievable. Surface water run-off from developed site must be restricted to existing (Greenfield) rates.
Table A.8 | Site Ref: 8 | Site Name: Raynes Park Employment Centre and Rainbow Industrial Park

| Flood Zones | Flood Depth | Flood Hazard (based on depth & velocity) |

**Proposed Use: Employment and Industrial uses**

Employment and Industrial uses can be located in Flood Zones 1, 2 and 3a.

Updated modelling shows that the site lies within Flood Zone 1 and therefore the Exception Test is not required.

Beverley Brook modelling outputs and revised JFLOW Flood Zone mapping show that the vast majority of the site lies within Flood Zone 1. However finished floor levels should be set at 300mm above the 1 in 100 year plus climate change modelled flood level.

Beverley Brook modelling outputs and revised JFLOW Flood Zone mapping show that the vast majority of the site lies within Flood Zone 1. A safe access route will be required from development to higher ground outside the floodplain. As the majority of the site is located in Flood Zone 1 this should be easily achievable.

**Summary:** Employment / Industrial use appropriate within Flood Zones 1, 2 & 3a. 8m setback distance from Beverley Brook required. The sites lies within Flood Zone 1, however, finished floor levels should be set a minimum of 300mm above 1 in 100 year climate change level. Safe access and egress route required to high ground outside the floodplain, which should be easily achievable.
**Table A.9**  
**Site Ref: 9**  
**Site Name: Shannon Corner**

| Proposed Use: Residential, retail and employment uses | Beverley Brook modelling outputs and revised JFLOW Flood Zone mapping show that the site lies within Flood Zones 1 and 2, with 3b present on the site along the watercourse.  
Updated modelling shows site as lying within Flood Zones 1 and 2, therefore Exception Test not required.  
8m setback distance from Beverley Brook required.  
Flood Defence Consent required for works within 8m.  
Finished floor levels should be set 300mm above 1 in 100 year climate change modelled flood level.  
Floodplain compensation will be required on a level for level basis to the 1 in 100 year climate change flood level, for any lost volume of flood storage.  
A safe access route will be required from development to higher ground outside the floodplain.  
Development should be carefully configured to provide safe access to and from the site. |
|---|---|

**Summary:** A sequential approach should be applied on the site to locate residential units in areas of lowest flood risk. Development should be set back by a minimum of 8m from the watercourse. Finished floor levels should be set 300mm above 1 in 100 year climate change level. Safe access and egress route required to high ground outside the floodplain, which should be easily achievable.
**Table A.10**  
**Site Ref:** 10  
**Site Name:** LEA Sports Ground

<table>
<thead>
<tr>
<th>Flood Zones</th>
<th>Flood Depth</th>
<th>Flood Hazard (based on depth &amp; velocity)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Proposed Use: Residential units**

Residential development should be located in Flood Zones 1 or 2 where possible; Exception Test required for Flood Zone 3a.  
Updated modelling shows that the site is in Flood Zones 1 and 2 and therefore does not require the Exception Test.  
8m setback distance from Beverley Brook required. Flood Defence Consent required for works within 8m.

Beverley Brook modelling outputs and revised JFLOW Flood Zone mapping show that the vast majority of the site lies within Flood Zone 1.  
However finished floor levels should be set at 300mm above the 1 in 100 year plus climate change modelled flood level.

Beverley Brook modelling outputs and revised JFLOW Flood Zone mapping show that the vast majority of the site lies within Flood Zone 1.  
A safe access route will be required from development to higher ground outside the floodplain. As the majority of the site is located in Flood Zone 1 this should be easily achievable.

**Summary:** Residential development should be located in Flood Zones 1 & 2. 8m setback distance from Beverley Brook required. Finished floor levels should be set 300mm above 1 in 100 year climate change level. Safe access and egress route required to high ground outside the floodplain, which should be available to east of site. Surface water run-off from developed site must be restricted to existing (Greenfield) rates.
**Summary:** A sequential approach should be applied within the site to locate residential development in areas of lowest flood risk. Sports facilities are appropriate in all Flood Zones and should therefore be located in the southwest portion of the site. Finished floor levels should be set 300mm above 1 in 100 year climate change level. Level for level floodplain compensation will be required for any lost storage volume. Safe access/egress route required to high ground outside the floodplain, which should be available to east of site. Surface water run-off from developed site must be restricted to existing (Greenfield) rates.

### Table A.11 Site Name: LESSA Sports Ground

<table>
<thead>
<tr>
<th>Flood Zones</th>
<th>Flood Depth</th>
<th>Flood Hazard (based on depth &amp; velocity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sports Ground</td>
<td>Sports Ground</td>
<td>Sports Ground</td>
</tr>
</tbody>
</table>

**Proposed Use:** Residential units and sports facilities

A site wide sequential approach to vulnerability of uses should be applied.

Residential development should be located in Flood Zones 1 or 2 where possible; Exception Test required for Flood Zone 3a. Sports facilities are appropriate within all Flood Zones.

Beverley Brook modelling outputs and revised JFLOW Flood Zone mapping show that the site lies in Flood Zones 1, 2, 3a and 3b. Finished floor levels should be set at 300mm above the 1 in 100 year plus climate change modelled flood level.

Floodplain compensation will be required on a level for level basis to the 1 in 100 year climate change flood level, for any lost volume of flood storage.

A safe access route will be required from development to higher ground outside the floodplain, which is likely to be available to the east of the site. Development should be configured to provide safe access to the east of site.
Table A.12  Site Ref: 12  Site Name: Garages at West Barnes Lane and West Way

Flood Zones

Proposed Use: Residential units
Residential development should be located in Flood Zones 1 or 2 where possible; Exception Test required for Flood Zone 3a. Residential development is not appropriate in Flood Zone 3b.
Site is shown to be within Flood Zones 2, 3a and 3b therefore proposed development only appropriate in Flood Zones 2 or 3a. Only water compatible development is permitted in 3b, functional floodplain.

Residential development should be located in Flood Zones 1 or 2 where possible; Exception Test required for Flood Zone 3a. Residential development is not appropriate in Flood Zone 3b. Site is shown to be within Flood Zones 2, 3a and 3b therefore proposed development only appropriate in Flood Zones 2 or 3a. Only water compatible development is permitted in 3b, functional floodplain.

Flood depths of approximately 0.51m are experienced on the site during the 1 in 100 year plus climate change flood event. Finished floor levels should be set at 300mm above the 1 in 100 year plus climate change modelled flood level. Only water compatible and essential infrastructure development types are appropriate in Flood Zone 3b. Floodplain compensation will be required on a level for level basis to the 1 in 100 year climate change flood level, for any lost volume of flood storage.

Flood Zone

Modelling outputs for the Beverley Brook show that this site is classified Low Hazard. A safe access route will be required from development to higher ground outside the floodplain inline with Defra and Environment Agency Guidance FD2320. One possible route could be to the south of the site, along West Barnes Lane.

Summary: Site is located within Flood Zones 2, 3a and 3b. Residential development is not appropriate within 3b, Functional Floodplain. Only water compatible development is permitted in Functional Floodplain. The proposed development must be safe including provision of safe access and egress, or provision of safe refuge. Level for level floodplain compensation will be required for any lost storage volume.

Site is located within Flood Zones 2, 3a and 3b. Residential development is not appropriate within 3b, Functional Floodplain. Only water compatible development is permitted in Functional Floodplain. The proposed development must be safe including provision of safe access and egress, or provision of safe refuge. Level for level floodplain compensation will be required for any lost storage volume.
<table>
<thead>
<tr>
<th>Proposed Use: Residential units with sports facilities</th>
<th>Draft River Wandle model outputs show site lies within 1 in 100 year climate change flood outline with typical flood depths of 0.5m. Obtain R.Wandle modelled flood levels and confirm flood extents. Minimum finished floor levels should be set at 1 in 100 year with climate change levels plus 300mm freeboard. Floodplain compensation will be required on a level for level basis to the 1 in 100 year climate change flood level, for any lost volume of flood storage.</th>
<th>Draft River Wandle flood outputs show part of site lies within 100 year climate change outline. The surrounding area to the north east of the site is dominated by medium hazard zones. Provision of safe access and egress through this area is therefore unlikely to be possible. However model outputs show area to north west of site remains flood free therefore dry access should be available and development should be configured taking this into account.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential development should be located in Flood Zones 1 or 2 where possible; Exception Test required for Flood Zone 3a. Sports facilities are appropriate within all Flood Zones. Sequential approach should be applied to locate higher vulnerability uses in areas with lowest risk of flooding. Only water compatible uses are permitted in functional floodplain.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summary: Sequential approach should be applied to locate residential units in areas with lowest risk of flooding. Minimum finished floor levels set at 1 in 100 year with climate change flood level plus 300mm freeboard. Safe access &amp; egress routes likely to be available to north west of site, development should be configured to facilitate this. Level for level floodplain compensation required for any loss of storage volume due to ground raising. Only water compatible uses are permitted in the functional floodplain.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Flood depth & hazard information taken from Draft River Wandle model outputs, June 2008. Outputs are currently undergoing final review and may be subject to future changes. Consult Environment Agency for latest information.
### Table A.14

**Site Ref:** 14  
**Site Name:** Willow Land Industrial Estate

<table>
<thead>
<tr>
<th>Flood Zones</th>
<th>Flood Depth</th>
<th>Flood Hazard (based on depth only)</th>
</tr>
</thead>
</table>

**Proposed Use:** Industrial and Employment uses  
Industrial and employment development is appropriate within Flood Zones 1, 2 and 3a.  
8m setback distance from River Wandle required.  
Flood Defence Consent required for works within 8m zone.

Draft River Wandle model outputs show part of site lies within 1 in 100 year climate change flood outline with typical flood depths of 0.6m.  
Obtain R.Wandle modelled flood levels and confirm flood extents. Minimum finished floor levels should be set at 1 in 100 year with climate change levels plus 300mm freeboard.  
Floodplain compensation will be required on a level for level basis to the 1 in 100 year climate change any lost volume of flood storage.

Draft River Wandle flood outputs show part of site lies within 100 year climate change outline.  
The surrounding area to the north west of the site is dominated by medium hazard zones. Provision of safe access and egress through this area is therefore unlikely to be possible.  
However model outputs show area to east of site remains flood free therefore dry access should be available and development should be configured taking this into account.

**Summary:** Industrial and employment uses are appropriate within Flood Zones 1, 2 & 3a, although sequential approach should be applied to locate development in lowest possible flood risk areas.  
8m setback distance from River Wandle required.  
Finished floor levels should be set 300mm above 1 in 100 year climate change level where possible and level for level floodplain compensation provided to ensure no loss of flood storage.  
Safe access and egress route required to high ground outside the floodplain, which should be achievable to the east of the site.

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*Note: Flood zone, depth & hazard information taken from Draft River Wandle model outputs, June 2008. Outputs are currently undergoing final review and may be subject to future changes. Consult Environment Agency for latest information.*

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Table A.15

Site Ref: 15

Site Name: St Mark’s Academy

Proposed Use: Educational use

Educational establishments should be located in Flood Zones 1 or 2 where possible; Exception Test required for Flood Zone 3a.

8m setback distance from River Graveney required. Flood Defence Consent required for works within 8m zone.

No depth/hazard information available – the tributary is not included within the River Wandle model.

Summary: Educational establishments should be located in Flood Zones 1 & 2 although sequential approach should be applied to locate development in lowest possible flood risk areas. 8m setback distance from River Graveney required. No modelling information currently available. Finished floor levels should be set 300mm above 1 in 100 year climate change level, with floodplain compensation to ensure no loss of storage volume. Safe access and egress route required to high ground outside the floodplain, which is likely to be available from south west of the site.
Appendix B: Flood Risk Assessment Guidance Table
Appendix B: Flood Risk Assessment Guidance Table

<table>
<thead>
<tr>
<th>Development Type</th>
<th>Flood Zone 1</th>
<th>Flood Zone 3a</th>
<th>Flood Zone 3b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>Raising finished floor levels should be considered.</td>
<td>Raising finished floor levels should be considered.</td>
<td>Raising finished floor levels should be considered.</td>
</tr>
<tr>
<td></td>
<td>Floodproofing measures should be considered in an 'area at risk'.</td>
<td>Floodproofing measures should be considered.</td>
<td>Floodproofing measures should be considered.</td>
</tr>
<tr>
<td></td>
<td>Flooding management should be considered.</td>
<td>Flooding management should be considered.</td>
<td>Flooding management should be considered.</td>
</tr>
<tr>
<td></td>
<td>Where possible, building foundations and piling should be raised.</td>
<td>Where possible, building foundations and piling should be raised.</td>
<td>Where possible, building foundations and piling should be raised.</td>
</tr>
<tr>
<td></td>
<td>Incorporate Suds to limit runoff.</td>
<td>Incorporate Suds to limit runoff.</td>
<td>Incorporate Suds to limit runoff.</td>
</tr>
</tbody>
</table>

**LPA to set up flood warning service for developments at risk.**

**Test has been applied (and where required confirm Exception).**

**Where the necessary treatment of the underground drainage system could not be achieved through treatment on site, consideration should be given to the use of innovative measures.**

**Note:** For new developments, it is essential to incorporate suitable drainage systems and ensure that the development does not contribute to any downstream flood risk. For existing developments, it may be necessary to carry out a flood risk assessment to determine the extent of flood risk and to identify any necessary flood risk mitigation measures. It is important to consider the impact of any proposed development on the existing drainage system and to ensure that it does not contribute to any downstream flood risk.

**Figures 1-4:** See Level 1 SFRA Table.
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- Environment
- Natural Resources

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