AECOM Imagine it. Delivered.

Level 1 Strategic Flood Risk Assessment

London Borough of Wandsworth and London Borough of Merton

Project number: 60620167

November 2020

Quality information

Prepared by	Checked by	Verified by	Approved by
Lauren Lewis Water Consulting Apprentice Hannah Booth Graduate Consultant	Sarah Littlewood Principal Consultant	Emily Craven Associate	Sarah Littlewood Principal Consultant

Revision History

Revision	Revision date	Details	Authorized	Name	Position
1	May 2020	Draft Report	EC	Emily Craven	Associate
2	November 2020	Final Report including client and Environment Agency comments	EC	Emily Craven	Associate

Distribution List

# Hard Copies	PDF Required	Association / Company Name
0	Yes	London Borough of Wandsworth London Borough of Merton Environment Agency

Prepared for:

London Borough of Wandsworth and London Borough of Merton

Prepared by:

AECOM Limited
Midpoint, Alencon Link
Basingstoke
Hampshire RG21 7PP
United Kingdom

T: +44(0)1256 310200
aecom.com

Table of Contents

Figures

Tables

1. Introduction and User Guide

1.1 Overview

1.1.1 The National Planning Policy Framework[1] (NPPF) and associated Planning Practice Guidance for Flood Risk and Coastal Change (PPG)[2] set out the active role Local Planning Authorities (LPAs) should take to ensure that flood risk is understood and managed effectively and sustainably throughout all stages of the planning process. The NPPF outlines that Local Plans should be supported by a Strategic Flood Risk Assessment (SFRA) and LPAs should use the findings to inform strategic land use planning.

1.1.2 The purpose of the revised Level 1 SFRA, for the administrative area covered by London Borough of Wandsworth and London Borough of Merton, is to collate and analyse the most up to date readily available flood risk information for all sources of flooding, to provide an overview of flood risk issues across the study area. This will be used by London Boroughs of Wandsworth and Merton to inform the preparation of Local Plans, including the application of the Sequential Test to future site allocations. It is also intended that the revised Level 1 SFRA deliverables will assist prudent decision-making on flood risk issues by Development Management Officers on a day-to-day basis.

1.2 Updating the SFRA

1.2.1 SFRAs are intended to be living documents, that are kept up to date as information on flood risk management changes. The Environment Agency SFRA guidance available online[3] states that in order to remain up to date, it is necessary to update a SFRA to incorporate any changes to:

- the predicted impacts of climate change on flood risk;
- detailed flood modelling - such as from the Environment Agency or lead local flood authority;
- the local plan, spatial development strategy or relevant local development documents;
- local flood management schemes;
- flood risk management plans, shoreline management plans or local flood risk management strategies;
- national planning policy or guidance.

1.2.2 Table 1-1 provides a summary of the updates to the SFRAs for London Boroughs of Wandsworth and Merton since their first publication in 2008/2009.

Table 1-1 Schedule of updates to the SFRA

Date	Geographical Coverage	Comments
2008 - 2009	Level 1 and 2 SFRA for London Boroughs of Croydon, Merton, Sutton, and Wandsworth	First SFRA prepared for the area. The four London Boroughs opted to work together as they are all located within the Wandle catchment.
2016 – 2017	Level 1 and 2 SFRA for London Boroughs of Croydon, Merton, Sutton, and Wandsworth	SFRA updated as a result of: • New legislation including the Flood and Water Management Act and Flood Risk Regulations; • London Boroughs became Lead Local Flood Authorities; • Revised hydraulic modelling for the River Wandle published by the Environment Agency; • Revised hydraulic modelling of breach assessments along the Thames frontage; • Updated national surface water flood risk mapping; • Broadscale mapping of susceptibility to groundwater flooding purchased by the Councils from British Geological Survey (BGS).

[1] Department for Communities and Local Government. 2012. *National Planning Policy Framework*. Available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2
[2] Department for Communities and Local Government. 2014. *Planning Practice Guidance: Flood Risk and Coastal Change.* Available at: http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/
[3] https://www.gov.uk/guidance/local-planning-authorities-strategic-flood-risk-assessment

2020	Level 1 SFRA for London Boroughs of Wandsworth and Merton	SFRA updated with: • River Wandle Climate Change Modelling (August 2017); • London Thames Breach Assessment (May 2017); • Areas at risk of perched groundwater in Merton; • Further commentary on areas to safeguard for flood risk management, the cumulative impact of development, and opportunities to reduce the causes and impacts of flooding.

1.3 Study Area

1.3.1 The study area is defined by the administrative boundaries of the London Boroughs of Merton and Wandsworth in south west London. The study area is bordered to the north by the River Thames, to the east and south east by London Borough of Lambeth and London Borough of Croydon, to the south by London Borough of Sutton and to the west by Royal Borough of Kingston upon Thames and London Borough of Richmond upon Thames.

1.3.2 The study area is heavily developed, with interspersed open areas such as Battersea Park, Wimbledon Common, Tooting Bec Common, Clapham Common and Mitcham Common.

Topography and Hydrogeology

1.3.3 The northern edge of the study area comprises low lying land adjacent to the course of the River Thames and the floodplain of the River Wandle. Either side of the River Wandle, there are higher areas including Clapham Common located at approximately 22 m AOD (metres Above Ordnance Datum), and Putney Heath and Wimbledon Common, where elevations reach approximately 55 m AOD.

1.3.4 The rest of London Borough of Merton is lower lying at 20-35 m AOD, with gentle slopes associated with the floodplains of the River Wandle and Beverley Brook.

1.3.5 The Solid Geology across the study area is primarily Lambeth Group and London Clay. The Drift deposit geology is dominated by River Terrace Deposits, with Alluvium also present along the Wandle Valley.

Principal watercourses

1.3.6 There are a number of designated main rivers in the study area. Main rivers are watercourses shown on the statutory main river maps held by the Environment Agency and the Department for Environment, Food and Rural Affairs (Defra). The Environment Agency has permissive powers to carry out works necessary for flood defence purposes on these rivers. The overall responsibility for maintenance, however, lies with the riparian owner.

- The **River Wandle** catchment, which includes the River Graveney tributary, drains a total area of approximately 200 km^2. The Wandle flows from south to north through Merton and Wandsworth and discharges into the Thames at Bell Lane Creek in Wandsworth. The northern half of the catchment is underlain by London Clay with very limited permeability which can generate significant volumes of rapid surface water runoff during periods of heavy rainfall. The Wandle catchment is heavily urbanised and therefore generally responds rapidly to rainfall. The two sources of the Wandle are springs at Carshalton and Waddon, which rise at the junction between the Chalk and the overlying Clays and Gravels. The Carshalton and Waddon branches combine at Hackbridge then flow through Mitcham, where a short tributary called the Beddington Corner branch also joins the main channel. This branch carries discharge from Beddington Sewage Treatment Works (BSTW). Bunces Ditch and the Pickle are tributaries of the River Wandle within the London Borough of Merton.
- The **River Graveney** flows along the boundary between London Borough of Merton and London Borough of Wandsworth and joins the Wandle at Summerstown. The source of the River Graveney is located in the vicinity of Selhurst and the upper reaches are often referred to as the Norbury Brook. Figgs Marsh Ditch is a tributary of the River Graveney within the London Borough of Merton.
- The **Beverley Brook** catchment, which includes the Pyl Brook tributary, drains a total area of approximately 65km^2 and discharges into the Thames at Barn Elms, upstream of Putney. Flood relief culverts are located in the lower catchment, which discharge into the Thames at Barnes Bridge. The Beverley Brook rises in Cuddington Recreation Ground in Worcester Park and flows north through Motspur Park along the western boundary of the Borough of Merton. The Beverley Brook continues to

flow north along the western boundary of the Borough of Merton incorporating Wimbledon Common. In the lower reaches the Brook flows through Richmond Park, within the Borough of Richmond upon Thames, before turning northwest and flowing along the western boundary of the Borough of Wandsworth.

- The **Pyl Brook** rises in Sutton, at the junction between the Chalk and the overlying Clays. The Brook and its tributary, the East Pyl Brook, flows north east through Merton to the confluence with the Beverley Brook at Raynes Park.
- The **River Thames** defines the northern boundary of the London Borough of Wandsworth. The River Thames drains an extensive catchment (16,000 km^2), stretching from the Cotswolds in Gloucestershire, through Oxfordshire, Buckinghamshire and west London and from this point passing eastwards through central London to discharge into the Thames Estuary near Southend-on-Sea. The tidal limit of the Thames is situated at Teddington Weir approximately 20 km upstream of Wandsworth Bridge. This section of the River Thames benefits from an extensive network of flood defences that protects London to a 1 in 1000-year (0.1% AEP) standard of protection. The Thames Barrier, located in Woolwich Reach, lies approximately 25 km downstream of the study area and is the main structure of the Thames Tidal Defence system.

1.4 Partner Organisations

1.4.1 There are several organisations involved in development and flood risk management across the study area.

1.4.2 **London Boroughs of Merton and Wandsworth** are the Local Planning Authorities (LPAs) for the study area, responsible for long term strategic planning of future development through the preparation of Local Plans, as well as for determining planning applications within each Borough. Under the Flood and Water Management Act (FWMA) these Councils are also Lead Local Flood Authorities (LLFA) for the respective administrative areas and have a duty to take the lead on the management of local flood risk, which includes flood risk from surface water, groundwater and ordinary watercourses. Sustainable Drainage Systems (SuDS) are required for all major developments[4], where appropriate, in the London Boroughs of Merton and Wandsworth and through the use of planning conditions or planning obligations, clear arrangements are required to be in place for the ongoing maintenance of SuDS over the lifetime of the development.

1.4.3 The **Environment Agency** has a strategic overview role for flood risk management associated with main rivers in south west London (River Thames, River Wandle, River Graveney, Beverley Brook and Pyl Brook) and is a statutory consultee for any development proposed within Flood Zone 2 and 3 associated with these watercourses. The Environment Agency is continually improving and updating their flood map for main rivers and has permissive powers to carry out flood defence works, maintenance and operational activities for these main rivers. However, overall responsibility for maintenance lies with the riparian owner.

1.4.4 **Thames Water Utilities Ltd (TWUL)** has a duty as a statutory water undertaker to provide clean and wastewater services to the study area and is responsible for the management, maintenance and operation of flood control structures under their ownership. Water Companies are defined as a Risk Management Authority within the FWMA and are responsible for flood risk management functions in accordance with the Water Resources Act 1991 and the Land Drainage Act 1991. TWUL is responsible for surface water drainage from development via adopted sewers and for maintaining trunk sewers into which many of the highway drainage in the study area connects.

1.4.5 **Network Rail** operates the railway lines and associated infrastructure (signalling, bridges, embankments and tunnels) across the study area. Network Rail is an important stakeholder with regards to flood risk management, through ensuring Network Rail assets are protected from flooding, and that the operation and maintenance of railway assets and infrastructure does not increase the flood risk to neighbouring areas. Network Rail embankments, cuttings and drainage infrastructure have a significant impact on surface water drainage and flood risk in each borough.

1.4.6 **Transport for London (TfL)** has a responsibility under the Highways Act 1980 for the effectual drainage of surface water from adopted roads and along major roads (red routes) insofar as ensuring that drains, including kerbs, road gullies and ditches and the pipe network which connect to the sewers, are maintained.

[4] Developments of 10 dwellings or more; or equivalent non-residential or mixed development (as set out in Article 2(1) of the Town and Country Planning (Development Management Procedure) (England) Order 2010).

1.4.7 **South East Rivers Trust (SERT)** is an environmental charity dedicated to the conservation and restoration of rivers in south east England. Expanded from the Wandle Trust, the SERT seeks to achieve Good Ecological Status or Potential, and the management of their catchments to set international standards for urban and rural community-driven sustainability and environmental excellence in river rehabilitation and restoration. As such, the SERT are involved in the understanding of flood risk in the local area as well as the implementation of management and mitigation measures.

1.5 SFRA Content

1.5.1 This Level 1 SFRA is structured as follows.

- Section 1 Introduction and User Guide
- Section 2 Legislative and Policy Context
- Section 3 Level 1 SFRA Methodology and Datasets
- Section 4 Flood Risk in Merton
- Section 5 Flood Risk in Wandsworth
- Section 6 Policy and Development Management Recommendations
- Appendix A Mapping for London Borough of Wandsworth
- Appendix B Mapping for London Borough of Merton
- Appendix C Applying the Sequential Test
- Appendix D Managing and Mitigating Flood Risk
- Appendix E Site-specific Flood Risk Assessments

1.6 User Guide

1.6.1 It is anticipated that this SFRA will be used by a range of end users. Table 1-2 provides a summary of the expected users, how they might use the SFRA, the parts of the SFRA they may wish to refer to.

Table 1-2 SFRA User Guide

User	Purpose	Relevant Sections in this SFRA
Environment Agency	- to inform their advice to the LPA about the local plan or spatial development strategy.	Section 4 Flood Risk in Merton Section 5 Flood Risk in Wandsworth Appendix C Applying the Sequential Test Appendix D Management and Mitigating Flood Risk Section 6 Recommendations and Next Steps
Developers and flood risk consultants	- to inform their site-specific Flood Risk Assessments - as evidence to support the sequential and exception tests for individual applications - to find suggestions of how development could help to reduce the causes and impacts of flooding	Section 4 Flood Risk in Merton Section 5 Flood Risk in Wandsworth Appendix C.3 Sequential Test for Individual Applications Appendix D Managing and Mitigating Flood Risk Appendix E Site-specific FRAs
Emergency planners, the emergency services and local resilience forums	- understand the risk of flooding to existing and proposed communities, so they can plan for emergencies - advise on the impact of any proposed development on emergency planning, including any extra resources that may be needed - advise on measures which should be included in development to avoid or minimise further impacts on emergency planning	Section 4 Flood Risk in Merton Section 5 Flood Risk in Wandsworth Appendix D Management and Mitigating Flood Risk
Risk management authorities	- inform their assessment and management of sources of flood risk they're responsible for - identify opportunities where development may help to reduce the causes and impacts of the sources of flood risk that they're responsible for -	Section 4 Flood Risk in Merton Section 5 Flood Risk in Wandsworth Section 6 Recommendations
Other departments within your council	- to inform their work on, for example, highways, transport, public health and economic growth.	Section 4 Flood Risk in Merton Section 5 Flood Risk in Wandsworth Section 6 Recommendations
Neighbourhood planning bodies	- when considering whether neighbourhood planning areas may be appropriate for development.	Section 4 Flood Risk in Merton Section 5 Flood Risk in Wandsworth Section 6 Recommendations
Other local planning authorities	- to inform their SFRAs, particularly in relation to cross-border risks and opportunities.	Section 4 Flood Risk in Merton Section 5 Flood Risk in Wandsworth Section 6 Recommendations

2. Legislative and Policy Context

2.1 Introduction

2.1.1 This Section provides an overview of the legislative and national and local planning policy context for the LPAs with respect to flood risk. The information presented in the SFRA should be used by the Boroughs to establish robust policies in relation to flood risk as part of their emerging Local Plans.

2.2 Flood and Water Management Act

2.2.1 The Flood and Water Management Act 2010 (FWMA)[5] designates unitary authorities, such as the London Boroughs, as Lead Local Flood Authority (LLFA). As LLFAs, each London Borough has responsibilities to lead and co-ordinate local flood risk management, which is defined as the risk of flooding from surface water runoff, groundwater and ordinary watercourses. The FWMA also formalises the flood risk management roles and responsibilities for other organisations including the Environment Agency, water companies and highways authorities. The responsibility to lead and co-ordinate the management of tidal and fluvial flood risk remains that of the Environment Agency.

National Strategy for Flood and Coastal Erosion Risk Management

2.2.2 In accordance with the FWMA, the Environment Agency has developed a National Strategy for Flood and Coastal Erosion Risk Management (FCERM) in England[6] which sets out the long-term objectives for managing flood and coastal erosion risks and the measures proposed to achieve them.

2.2.3 The long term vision of the 2020 Strategy is for: a nation ready for, and resilient to, flooding and coastal change – today, tomorrow and to the year 2100. It has 3 long-term ambitions underpinned by evidence about future risk and investment needs. They are:

- **Climate resilient places:** working with partners to bolster resilience to flooding and coastal change across the nation, both now and in the face of climate change. Risk management authorities will work with partners to:
    - deliver practical and innovative actions that help to bolster resilience to flood and coastal change in local places
    - make greater use of nature-based solutions that take a catchment led approach to managing the flow of water to improve resilience to both floods and droughts
    - maximise opportunities to work with farmers and land managers to help them adapt their businesses and practices to be resilient to flooding and coastal change
    - develop adaptive pathways in local places that equip practitioners and policy makers to better plan for future flood and coastal change and adapt to future climate hazards
- **Today's growth and infrastructure resilient in tomorrow's climate:** making the right investment and planning decisions to secure sustainable growth and environmental improvements, as well as infrastructure resilient to flooding and coastal change. Risk management authorities will work with partners to:
    - put greater focus on providing timely and quality planning advice that helps avoid inappropriate development in areas at risk of flooding and coastal change
    - leave the environment in a better state by contributing to environmental net gain for new development proposals
    - ensure that spending on flood and coastal resilience contributes to job creation and sustainable growth in local places

[5] HMSO (2010) The Flood and Water Management Act 2010 http://www.legislation.gov.uk/ukpga/2010/29/contents
[6] Defra, Environment Agency (2020) The National Flood and Coastal Erosion Risk Management Strategy for England.

- mainstream property flood resilience measures and to 'build back better' after flooding to reduce damages and enable faster recovery for local communities
- provide expert advice on how infrastructure providers (road, rail, water and power supplies) can ensure their investments are more resilient to future flooding and coastal change avoiding disruption to peoples' lives and livelihoods

- **A nation ready to respond and adapt to flooding and coastal change**: ensuring local people understand their risk to flooding and coastal change and know their responsibilities and how to take action. Risk management authorities will work with partners to:
  - support communities to better prepare and respond to flooding and coastal change, including transforming how people receive flood warnings
  - ensure people and businesses receive the support they need from all those involved in recovery so they can get back to normal quicker after flooding
  - help support communities with managing the long-term mental health impacts from flooding and coastal change
  - develop the skills and capabilities needed to better support communities to adapt to future flooding and coastal change
  - become a world leader in the research and innovation of flood and coastal risk management to better protect current and future generations

2.2.4 The Environment Agency online guidance 'Flood risk assessments: climate change allowances'[7] sets out when and how local planning authorities, developers and their agents should use climate change allowances in flood risk assessments. It provides predictions of anticipated change for peak river flow, peak rainfall intensity, sea level rise and offshore wind speed and extreme wave height. It is essential that land use planning decisions consider the impact of a changing climate where appropriate to increase resilience to flooding.

Thames Catchment Flood Management Plan

2.2.5 The Thames Catchment Flood Management Plan (CFMP) was published in 2008 by the Environment Agency and sets out policies for the sustainable management of flood risk across the whole catchment over the long-term (50 to 100 years) taking climate change into account.

2.2.6 The study area for this SFRA is located within the CFMP sub-area 9 "London catchments". The CFMP notes that in this area, the risk of flooding from rivers is typically managed by conveying water in concrete channels through urban areas. This approach is reliant upon river structures including culverts and trash screens, and this approach will become increasingly ineffective against storms which are anticipated to become more frequent and intense in the future. The CFMP also identifies other sources of flooding including the overflow of surface drains, the inundation of sewers and large areas of impermeable surfaces. Often these types of flooding can occur simultaneously which can make it difficult to determine the source.

- The vision and preferred policy for this sub-area is Policy Option 4: Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change. The Environment Agency has set out the following proposed actions to implement the preferred policy:
  - We will continue to make sure the recommendations in SFRAs and Local Development Framework policies create the potential to reduce flood risk through regeneration.
  - We will play our part in adopting a strategic approach to planning so that wider community objectives as well as flood risk objectives can be met.
  - We will develop our emergency response planning to deal with extreme floods, including raising public awareness and working with key partners to identify critical infrastructure at flood risk.
  - We want to continue to maintain the existing flood defences and when redevelopment takes place, replace and improve them so that they are more effective against the impacts of climate

[7] Environment Agency (published 2016 and updated July 2020) Flood risk assessments: climate change allowances. https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

change. We will be looking to remove culverts and other structures that cause significant conveyance problems. An example of this is our work in the Ravensbourne catchment.

- With our partners, we will look for opportunities to reduce flood risk by recreating river corridors in urban areas. We will influence people who shape the urban environment and harness these opportunities, allowing space for water, habitat, wildlife and recreation.

Thames Estuary TE2100

2.2.7 The Environment Agency 'Thames Estuary 2100 Plan'[8] (TE2100) sets out the strategic direction for managing flood risk in the Thames estuary to the end of the century and beyond. The relevant policies for those areas within London Borough of Wandsworth are covered by the policy units for Barnes and Kew, and Wandsworth to Deptford. For both of these policy units the selected policy is P5; to take further action to reduce flood risk beyond that required to keep pace with climate change.

2.2.8 In these areas, a higher standard of protection will be provided by the Thames Barrier for tidal flood risk for the foreseeable future. Towards the end of the TE2100 appraisal demonstrates that given the commercial, economic and historic value of London, as well as the potential for loss of life in the unlikely event of a flood, a 1:10,000 year standard will be justified for P5 areas. In Wandsworth to Deptford, there may also be opportunities to set back defences and improve riverside amenity and habitats. Further detail about the proposed measures in these areas as part of the Thames Estuary 2100 Plan are included in Section 5.9.

Local Flood Risk Management Strategy

2.2.9 As LLFAs, the London Boroughs of Merton and Wandsworth each have a statutory duty to develop, maintain, apply and monitor a strategy for local flood risk management in their respective administrative areas. The London Boroughs, along with the Royal Borough of Kingston upon Thames and London Borough of Richmond upon Thames, each prepared a Local Flood Risk Management Strategy (LFRMS) in partnership in order to encourage collaboration and enable flood risk across South West London to be managed more effectively and holistically:

- London Borough of Merton adopted their LFRMS in 2015; and
- London Borough of Wandsworth modified their LFRMS in 2016 to account for national changes to Lead Local Flood Authority duties regarding the management of SuDS.

2.2.10 As part of the preparation of the LFRMS, and their wider role as LLFA, each of the London Boroughs undertook an exercise to collate records of historic flooding. These records have been used to inform the Level 1 SFRA.

Surface Water Management Plans

2.2.11 A Surface Water Management Plan (SWMP) is a framework to understand the causes of surface water flooding and agree the most cost-effective way of managing surface water flood risk. The main outputs are a co-ordinated Action Plan to prioritise projects to reduce surface water flood risk and detailed mapping of areas prone to surface water flood risk.

2.2.12 In 2010, the Greater London area was selected to receive UK Government funding to prepare SWMPs and Preliminary Flood Risk Assessments (PFRAs) for all 33 London Boroughs and develop on the ground solutions to surface water flooding across London. The Drain London project was established to deliver these tasks in a consistent and co-ordinated way across London, administered by the Greater London Authority (GLA).

2.2.13 London Borough of Merton published their SWMP in 2011, and London Borough of Wandsworth published their SWMP in February 2012. The flood risk mapping and records of historical flooding presented in the SWMPs for each of the boroughs have been used to inform this Level 1 SFRA. In addition, the Critical Drainage Areas (CDAs) identified within the SWMPs have been reviewed and revised to further improve the understanding and management of surface water flood risk in the study area.

[8] Environment Agency, November 2012, Thames Estuary 2100 Plan. https://www.gov.uk/government/publications/thames-estuary-2100-te2100

2.3 Flood Risk Regulations

2.3.1 As well as the duties under the Act to prepare a LFRMS, LLFAs have legal obligations under the EU Floods Directive[9], which was transposed into UK Law through the Flood Risk Regulations 2009[10] ('the Regulations') as follows.

Preliminary Flood Risk Assessment

2.3.2 Under the Regulations, all LLFAs were required to prepare a Preliminary Flood Risk Assessment (PFRA) to report to Europe. The PFRA is a high-level screening exercise to identify areas of significant risk as Indicative Flood Risk Areas across England where 30,00 people or more are at risk from flooding. The administrative area of Greater London as a whole is shown to be included in an Indicative Flood Risk Area.

2.3.3 As part of the Drain London project, PFRAs were prepared for all London Boroughs in 2011[11]. London Borough of Merton have subsequently updated their PFRA in 2017[12]. The PFRA provides a high-level overview of flood risk from local flood sources and includes flooding from surface water (i.e. rainfall resulting in overland flow), groundwater, ordinary watercourses (smaller watercourses and ditches) and canals. It excludes flood risk from main rivers, the sea and reservoirs, as these are assessed nationally by the Environment Agency. The PFRA report looks at past flooding and where future flooding might occur across the area and the consequences it might have to people, properties and the environment. The report provides a useful baseline for both London Boroughs to inform their LFRMS as well as informing this Level 1 SFRA.

Thames River Basin District Draft Flood Risk Management Plan

2.3.4 Under the EU Floods Directive and UK Flood Risk Regulations 2009 the Environment Agency is required to prepare FRMPs for all of England covering flooding from main rivers, the sea and reservoirs. As such, the Thames River Basin District FRMP[13] has been published for consultation by the Environment Agency and sets out the proposed measures to manage flood risk in the Thames River Basin District from 2015 to 2021 and beyond. This document draws on existing reports and plans which have been prepared in the past such as the Thames Catchment Flood Management Plan (CFMP) and the Thames Estuary 2100 Plan.

2.4 National Planning Policy Framework

2.4.1 The NPPF is a framework within which councils and local people can produce local and neighbourhood plans that reflect the needs and priorities of their communities. The NPPF is supported by the Planning Practice Guidance[2], and the overall approach of the NPPF to flood risk is broadly summarised in Paragraph 103:

> When determining planning applications, LPAs should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where, informed by a site-specific FRA following the Sequential Test, and if required the Exception Test, it can be demonstrated that:
>
> - within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location, and
> - development is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed, including by emergency planning; and it gives priority to the use of sustainable drainage systems."

2.4.2 Further detail regarding the Sequential and Exception Tests is included in Appendix C.

2.4.3 Sustainable Drainage Systems (SuDS) are an approach to managing rainwater and surface water that replicates natural drainage, the key objectives being to manage the flow rate and volume of runoff at source, in order to

[9] European Union (2007) EU Floods Directive http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32007L0060:EN:NOT
[10] HSMO (2009) The Flood Risk Regulations http://www.legislation.gov.uk/uksi/2009/3042/contents/made
[11] Greater London Authority, 2011, Preliminary Flood Risk Assessment for London Borough of Merton; Greater London Authority, 2011, Preliminary Flood Risk Assessment for London Borough of Wandsworth.
[12] Metis, London Borough of Merton 2017 Preliminary Flood Risk Assessment Update. Version 1.0.
[13] Environment Agency (October 2014) Thames River Basin District Consultation on the draft Flood Risk Management Plan https://consult.environment-agency.gov.uk/portal/ho/flood/draft_frmp/consult?pointId=3063510

reduce risk of flooding and to improve water quality. As LPAs, London Boroughs of Merton and Wandsworth are required to ensure that SuDS are incorporated in all major development plans where appropriate, and through the use of planning conditions or planning obligations, make sure that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.

2.4.4 LLFAs are statutory consultees for surface water drainage. As LLFAs, each local authority will need to be consulted on the drainage elements of planning applications for major development to ensure they take account of the Government's 'Sustainable Drainage Systems: Non-Statutory Technical Guidance'[14] .

2.5 London Plan

2.5.1 The current 2016 London Plan is still the adopted Development Plan for London. The 'Intend to Publish' (2019) London Plan[15] is a material consideration in planning decisions and it expected to be adopted in Winter 2020/21. It includes a number of policies of relevance to flood risk and drainage which are summarised in this section. The London Plan should be referred to for full details of the policies.

Policy G1 Green Infrastructure

2.5.2 Policy G1 Green Infrastructure sets out the need to protect and enhance the network of green and open spaces and green features in the built environment. Green infrastructure should be planned, designed and managed in an integrated way to achieve multiple benefits. Boroughs should prepare green infrastructure strategies and development proposals should incorporate appropriate elements of green infrastructure that are integrated into London's wider green infrastructure network.

Policy G5 Urban Greening

2.5.3 Under Policy G5 Urban Greening, major development proposals should include urban greening as a fundamental element of site and building design, and incorporate measures such as high quality landscaping (including trees), green roofs, green walls and nature-based sustainable drainage. Boroughs should develop an Urban Greening Factor (UGF) to identify the appropriate amount of urban greening required in new developments.

Policy SI 12 Flood risk management

2.5.4 Policy SI 12 sets out that current and expected flood risk from all sources should be managed in a sustainable and cost-effective way in collaboration with the Environment Agency, the Lead Local Flood Authorities, developers and infrastructure providers.

2.5.5 Development Plans should identify areas where particular and cumulative flood risk issues exist and develop actions and policy approaches aimed at reducing these risks. Development proposals should ensure that flood risk is minimised and mitigated, and that residual risk is addressed. Developments Plans and development proposals should contribute to the delivery of the measures set out in Thames Estuary 2100 Plan.

Policy SI 13 Sustainable drainage

2.5.6 Lead Local Flood Authorities should identify areas where there are particular surface water management issues and aim to reduce these risks. Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. There should also be a preference for green over grey features, in line with the following drainage hierarchy:

1) rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)

2) rainwater infiltration to ground at or close to source

3) rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)

4) rainwater discharge direct to a watercourse (unless not appropriate)

[14] Sustainable drainage systems: non-statutory technical standards - https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards
[15] The London Plan Intend to Publish, December 2019 https://www.london.gov.uk/sites/default/files/intend_to_publish_-_clean.pdf

5) controlled rainwater discharge to a surface water sewer or drain

6) controlled rainwater discharge to a combined sewer.

Sustainable Design and Construction SPG (April 2014)

2.5.7 The Sustainable Design and Construction SPG[16] provides guidance on the implementation of the current London Plan policy 5.3 - Sustainable Design and Construction, as well as a range of policies relating to environmental sustainability. It is a key supporting document for the management of flood risk in London and the implementation of SuDS.

2.5.8 To support the flood related policies in the current London Plan, the SPG includes guidance on:

- Surface water flooding and sustainable drainage, including Surface Water Management Plans (SWMP), Greenfield runoff rates, the multifunctional benefits of SuDS, management of SuDS and contributions;
- Flood resilience and resistance of buildings in flood risk areas;
- Flood risk management, including the design life of development, safety, and basements;
- Flood defences; and
- Other sources of flooding, including groundwater flooding, reservoir flooding and surface water flooding.

2.5.9 With regards to Greenfield runoff rates, the SPG states the following preferred standards:

2.5.10 “all developments on greenfield sites must maintain greenfield runoff rates. On previously developed sites, runoff rates should not be more than three times the calculated greenfield rate. The only exceptions to this, where greater discharge rates may be acceptable, are where a pumped discharge would be required to meet the standards or where surface water drainage is to tidal waters and therefore would be able to discharge at unrestricted rates provided unacceptable scour would not result”.

2.5.11 However, if it is not practical to achieve greenfield runoff rates, the essential standards for runoff requires a minimum of 50% attenuation of the site’s (prior to re-development) surface water runoff at peak times. Developers are required to demonstrate and justify why greenfield runoff rate cannot be achieved and identify which methods/opportunities have been used to minimise final site runoff, as close to greenfield rate as practical. This should be done using calculations and drawings appropriate to the scale of the application.

2.6 Local Planning Policy

Merton Local Planning Policy

2.6.1 London Borough of Merton is currently preparing a New Local Plan[17] to provide a sound basis for planning decisions. The Plan includes a number of policies relevant to drainage and flood risk management including:

- Policy O8.2 Open Space and Green Infrastructure
- Policy F8.7 How to manage flood risk
- Policy F8.8 Sustainable drainage systems (SuDS)
- Policy CC8.12 Sustainable design and construction
- Policy CC8.14 Adaptable development for a changing climate

2.6.2 The London Borough of Merton have two Supplementary Planning Documents (SPDs) that support and give further guidance to Merton’s Local Plan policies:

- Sustainable Drainage Design and Evaluation Guide[18] (known as the SuDS SPD).

[16] Mayor of London, 2014, Sustainable Design and Construction SPG, London Plan 2011 Implementation Framework. https://www.london.gov.uk/sites/default/files/gla_migrate_files_destination/Sustainable%20Design%20%26%20Construction%20SPG.pdf
[17] London Borough of Merton, New Local Plan https://www.merton.gov.uk/planning-and-buildings/planning/local-plan/newlocalplan
[18] London Borough of Merton, Sustainable Drainage Design and Evaluation Guide, 2018. https://www.merton.gov.uk/assets/Documents/2019%20Merton%20SuDS%20DesignEvaluation%20Guide%20Final.pdf

- Basement and Subterranean SPD[19].

Wandsworth Local Planning Policy

2.6.3 London Borough of Wandsworth are undertaking a full review of the adopted Local Plan[20] to ensure that the local policies and site allocations are still relevant and achieving the outcomes required. The Local Plan Core Strategy and Development Management Policies Document (DMPD), adopted in March 2016 and under review, include a number of policies relevant to drainage and flood risk management including:

- Policy PL2: Flood Risk
- Policy PL9: River Thames and the riverside
- Policy PL10: The Wandle Valley
- Policy IS 2: Sustainable design, low carbon development and renewable energy
- Policy IS 4: Protecting and enhancing environmental quality
- Policy DMS5: Flood risk management
- Policy DMS6: Sustainable Drainage Systems
- Policy DMS7: Consultation with the Environment Agency

River Wandle Catchment Plan

2.6.4 The River Wandle Catchment Plan (2014)[21] has been developed by the Wandle Trust in partnership with the Environment Agency, Natural England, WWF-UK, Thames Water, Sutton & East Surrey Water, London Boroughs of Wandsworth, Merton, Sutton and Croydon, London Wildlife Trust, National Trust (Morden Hall Park), Wandle Valley Regional Park Trust, Beddington Farmlands, The Angling Trust, and The Rivers Trust. It follows the Environment Agency's catchment-based approach for river management and is intended to help the Wandle to achieve 'Good Ecological Potential' in order to meet the UK's obligations under the EU Water Framework Directive (2000/60/EC).

2.6.5 The River Wandle Catchment Plan has identified the following aims for sustainably improving the health of the Wandle, and its value to local people:

- Water: the river's water should be plentiful and clean, and varied in its flow speeds, widths and depths.
- Habitat and wildlife: the river should support a mosaic of habitats with high biodiversity.
- Good access: local people should be able to access sympathetically managed pathways along the whole river.
- Engagement: everyone in the catchment should be aware of the river, and knows how their actions can affect it, with councils, businesses, government agencies and the public working together to improve the river.

2.7 Guidance Documents

2.7.1 There are a number of guidance documents that are of importance to flood risk management that are referenced within the SFRA. These are summarised in Table 2-1.

[19] London Borough of Merton, Basement and Subterranean Planning Guidance, Design SPD, March 2017 https://www.merton.gov.uk/Documents/yes_basement_andsubterranean_planing_guidance_2017.pdf
[20] London Borough of Wandsworth Local Plan Core Strategy and DMPD, Adopted March 2016 https://www.wandsworth.gov.uk/planning-and-building-control/planning-policy/local-plan/about-the-local-plan/
[21] The Wandle Trust (2014) River Wandle Catchment Plan https://www.wandletrust.org/about-us/community-catchment-plan/

Table 2-1 Guidance and Reference Documents

Source / Document	Description and Location
Planning Practice Guidance – Flood Risk and Coastal Change	Describes the planning approach to development within areas at risk of flooding from all sources. http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/
Environment Agency Standing Advice	Guidance on information to be included within robust site-specific Flood Risk Assessments (FRAs). https://www.gov.uk/guidance/flood-risk-assessment-standing-advice
Flood Risk Assessments: Climate Change Allowances (2016) – Revised July 2020.	The guidance provides climate change allowance to consider in flood risk assessments in order to demonstrate how flood risks will managed over the design life of the development. https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances
Improving the Flood Performance of New Buildings: Flood Resilient Construction (DCLG 2007)	Guidance to developers and designers on how to improve the resilience of new properties in low or residual flood areas. https://www.gov.uk/government/publications/flood-resilient-construction-of-new-buildings
Flood Risks to People: Phase 2 – FD2321/TR2 (DEFRA/EA 2006)	Guidance on a methodology for assessing and mapping the risk of serious harm caused by flooding. https://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjsqp2GygzrAhVRURUIHbY_AycQFjABegQIAxAB&url=http%3A%2F%2Frandd.defra.gov.uk%2FDocument.aspx%3FDocument%3DFD2321_3438_PR.pdf&usg=AOvVaw1D-isSRD4loi-PdtAtrJK1
BS 8533 Assessing and Managing Flood Risk in Development – Code of Practice (BSI 2017)	The standard gives recommendations and guidance on the appropriate assessment and management of flood risk in developments. https://shop.bsigroup.com/ProductDetail?pid=000000000030350005
ADEPT/EA Flood Risk Emergency Plans for New Development (2019)	A guide for planners: How to consider emergency plans for flooding as part of the planning process. Created by the Association of Directors of Environment, Economy, Planning and Transport (ADEPT). https://www.adeptnet.org.uk/floodriskemergencyplan
Thames Estuary 2100 Plan	Sets out the strategic direction for managing flood risk in the Thames estuary to the end of the century and beyond and defines policies for specific areas along the Thames frontage. https://www.gov.uk/government/publications/thames-estuary-2100-te2100

2.8 Summary

2.8.1 Figure 2-1 identifies that the main driver for the SFRA is the NPPF, and that the documents and plans prepared by both the Environment Agency and each of the London Boroughs under the requirements of the FWMA and the Flood Risk Regulations help to inform the preparation of the SFRA. The purpose of the SFRA is then to inform Local Plan policy by London Boroughs of Merton and Wandsworth, the application of the Sequential Test to site allocations and development management measures.

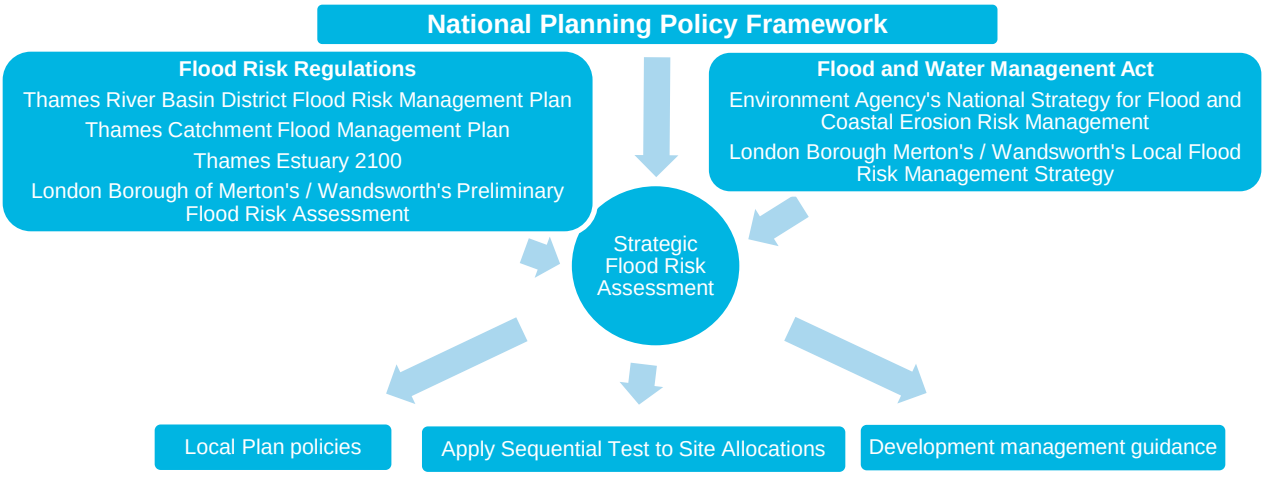


Figure 2-1 Drivers and purpose of the SFRA

3. Level 1 SFRA Methodology

3.1 Overview

3.1.1 The Level 1 SFRA is a desk-based study, using readily available existing information and datasets to enable the application of the Sequential Test and to identify where the Exception Test may be required. The main tasks in preparing the Level 1 SFRA are described below.

3.2 Stakeholder consultation

3.2.1 Over the course of SFRA preparation for London Boroughs of Merton and Wandsworth, a number of organisations have been engaged. This is summarised in Table 3-1.

Table 3-1 Record of stakeholder engagement

SFRA Version	Stakeholder engagement
2016 – 2017	A stakeholder workshop was held to facilitate relationships between the project team, the client group, and third party stakeholders. Representatives from the following organisations were in attendance; London Boroughs of Croydon, Merton, Sutton and Wandsworth, the Environment Agency, Network Rail, SES Water, and the Wandle Trust. The purpose of the meeting was to aid collaborative working and the free exchange of available information and datasets. AECOM provided an overview of the current planning context with respect to the preparation of the SFRA and the main flood risk issues in the area were identified and discussed. Discussions were also held with representatives of TWUL, and the British Geological Survey at the project start-up phase to enable information held by these organisations to be included in the study. The SFRA report was issued to the Environment Agency for review and comment prior to finalisation.
2016 – 2017	A second stakeholder workshop was help with representatives from AECOM, the London Boroughs and the Environment Agency. The purpose of the workshop was to confirm an appropriate approach for the definition and use of Critical Drainage Areas and Drainage Catchments within the SFRA; to agree a methodology for applying the Sequential Test considering all sources of flooding; and to determine an appropriate definition of Flood Zone 3b across the study area.
Jan 2020	A meeting was held with London Boroughs of Merton and Wandsworth and the Environment Agency to discuss the scope of the SFRA update including: - Revised flood risk datasets required to update the SFRA: River Thames (breach modelling); River Wandle (climate change modelling) and Beverley Brook (revised model). - Approach to development management issues faced by the Councils; - Approaches to reduce the causes and impacts of flooding in the study area.
June 2020	A meeting was held with London Boroughs of Merton and Wandsworth and the Environment Agency to agree: - Definitions of Flood Zone 3b (no changes proposed to last SFRA issue); - Approach for Sequential Test considering all sources of flooding; - Approach to applying the Sequential Test to individual applications; - Identifying cumulative impact of development and land-use change; - Identifying further opportunities to reduce the causes and impact of flooding.

3.3 Gathering data and analysing it for suitability

3.3.1 Under Section 10 of NPPF, the risk of flooding from all sources must be considered as part of a Level 1 SFRA, including flooding from tidal sources, rivers (fluvial), land (overland flow and surface water), groundwater, sewers and artificial sources.

3.3.2 In order to provide this assessment of all sources of flooding in the study area, an extensive dataset was provided or relicensed for use. This information was subject to a quality review and gap analysis by the project team to determine the best datasets for inclusion in the Level 1 SFRA update. This Section provides further detail on each of the datasets provided, their uses and limitations and how they have been used within the Level 1 SFRA.

3.4 Producing strategic flood risk maps, GIS deliverables and a technical report

3.4.1 London Borough of Merton have opted to present their strategic flood risk maps online. The mapping can be found at via their website. the following location:

3.4.2 For London Borough of Wandsworth, a series of GIS maps have been produced using the data gathered during the initial part of the study. The maps are in **Appendix A** and summarised in Table 3-2.

Table 3-2 Strategic Flood Risk Maps

Figure Number	Figure Title and Content
Figure 1	Flood Zones, Watercourses, Areas Benefitting Defences, Flood Defences, Emergency Rest Centres, Records of River Flooding
Figure 2	Modelled Flood Extents for the River Wandle including Climate Change, Watercourses, Flood Defences
Figure 3	Modelled Flood Extents for the Beverley Brook
Figure 4A – 4B	Thames Breach Modelling – Maximum Flood Depth (2100)
Figure 5A – 5B	Thames Breach Modelling – Maximum Flood Hazard (2100)
Figure 6A – 6B	Thames Breach Modelling – Maximum Flood Level (2100)
Figure 7	Flood Warning Areas, Emergency Rest Centres
Figure 8A – 8C	Risk of Flooding from Surface Water mapping, Drainage Catchments (DCs), Critical Drainage Areas (CDAs), Records of Surface Water Flooding.
Figure 9	BGS Susceptibility to Groundwater Flooding, Records of Groundwater Flooding
Figure 10	Sewer Flooding Records
Figure 11	Opportunities for reducing the causes and impacts of flooding

3.4.3 Sections 4 and 5 form the Level 1 strategic assessment of flood risk for London Borough of Wandsworth and London Borough of Merton respectively.

3.5 Providing suitable guidance

3.5.1 The SFRA also provides the following:

- Identifying opportunities to reduce the causes and impacts of flooding;
- Guidance for the London Boroughs on the application of the Sequential Test;
- Guidance for applicants applying the Sequential Test to individual planning applications;
- Measures to manage and mitigate flood risk;
- Guidance for preparation of site-specific FRAs;
- Recommendations for policy and development management.

4. Flood Risk in Merton

4.1 Overview

4.1.1 This Section provides the strategic assessment of flood risk across the London Borough of Merton from each of the sources of flooding outlined in the NPPF. For each source of flooding, details of any historical incidents are provided, and where appropriate, the impact of climate change on the source of flooding is described. This Section should be read with reference to **Merton SFRA Online Map.**

4.2 Flooding from Rivers

Watercourses

4.2.1 The Environment Agency 'Detailed River Network' dataset has been used to identify the watercourses in the study area and their designation (i.e. main river or ordinary watercourse). The River Wandle flows north through the Borough and is joined by the River Graveney at Summerstown. The Beverley Brook rises in Cuddington Recreation Ground in Worcester Park in Sutton and flows north through Motspur Park along the western boundary of the Borough of Merton. The Beverley Brook continues to flow north along the western boundary of the Borough of Merton adjacent to Wimbledon Common. The Pyl Brook and its tributary, the East Pyl Brook, flows north east through Merton to the confluence with the Beverley Brook at Raynes Park.

Historic Records

4.2.2 The Environment Agency Historic Flood Map indicates that extensive flooding occurred in Merton in 1968 in the south west of the Borough around West Barnes, along the banks of the Pyl Brook and the Beverley Brook. Prior to this, flooding occurred in 1937. This flood event affected small areas along the Beverley Brook and relatively small patches of flooding occurred in proximity to Marina Avenue and Burlington Road.

4.2.3 In 2007 extensive flooding occurred as a result of high-water levels in the Beverley Brook and Pyl Brook, blocking outfalls and causing water to back up in the road drainage system and flood. This occurred in what is presently Raynes Park High School, along with areas south of Malden Way and down towards West Barnes Lane and along the Pyl Brook from Lower Morden Lane towards Raynes Park High School. Hatfield Primary School experienced flooding of approximately 300mm depth as a result of overtopping of the Pyl Brook and the East Pyl Brook flowed out of bank where it flows through the south-west end of Morden Park up towards Camborne Road. Less extensive flooding associated with the Pyl Brook occurred between Lower Morden Lane and the southern boundary of Merton.

4.2.4 There are two point records of fluvial flooding noted in the study area. One is thought to be associated with the culverted section of the River Graveney in Colliers Wood. The other is associated with the Pyl Brook adjacent to Lower Morden Lane. More recently, flooding has been recorded from the River Wandle on June 24th 2016, and June 10th 2019.

Flood Zones

4.2.5 The risk of flooding is a function of the probability that a flood will occur and the consequence to the community or receptor as a direct result of flooding. The NPPF seeks to assess the probability of flooding from rivers by categorising areas within the fluvial floodplain into zones of low, medium and high probability, as defined in Table 4-1.

4.2.6 The Flood Map for Planning (Rivers and Sea) is available online[22] and is the main reference for planning purposes as it contains Flood Zones 1, 2 and 3 which are referred to in the NPPF. The 'Flood Map for Planning (Rivers and the Sea)' provides information on the areas that would flood if there were no flood defences or buildings in the "natural" floodplain.

[22] https://flood-map-for-planning.service.gov.uk/

Table 4-1 Flood Zones (PPG Table 1[23])

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability (0.1% AEP) of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3).
Zone 2 Medium Probability	Land having between a 1 in 100 (1% AEP) and 1 in 1,000 annual probability (0.1% AEP) of river flooding; or land having between a 1 in 200 (0.5% AEP) and 1 in 1,000 annual probability (0.1% AEP) of sea flooding. (Land shown in light blue on the Flood Map).
Zone 3a High Probability	Land having a 1 in 100 (1% AEP) or greater annual probability of river flooding; or Land having a 1 in 200 (0.5% AEP) or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map).
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. LPAs should identify in their SFRAs areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map). Refer to paragraphs 4.2.19 – 4.2.20 for the definition of Functional Floodplain in London Borough of Merton.

4.2.7 The 'Flood Map for Planning (Rivers and Sea)' also identifies areas which, in the event of a river flood with a 1% AEP, or a tidal flood with a 0.5% AEP, would be protected from flooding by the presence of flood defences. These areas are described as 'Areas Benefitting from Defences' (ABD).

4.2.8 The 'Flood Map for Planning (Rivers and Sea)' was first developed in 2004 using national generalised modelling (JFLOW) and is now routinely updated and revised using the results from the Environment Agency's programme of catchment studies, entailing topographic surveys and hydrological and/or hydraulic modelling as well as previous flood events. Most recently, a remodelling study for the River Wandle has just been completed and provided for use within this Level 1 SFRA.

4.2.9 It should be noted that the scope of these modelling studies typically covers flooding associated with main rivers, and therefore ordinary watercourses that form tributaries to the main rivers may not always be included in the model. Modelling of ordinary watercourses available on the 'Flood Map for Planning (Rivers and Sea)' may be the result of the national generalised JFLOW modelling carried out by the Environment Agency and may need to be refined when determining the probability of flooding for an individual site and preparing a site-specific FRA. Further detail regarding the scope of site specific FRAs is provided in Appendix E.

4.2.10 Flood Zones 1 and 2 have been provided by the Environment Agency for the study area. Approximately 91% of the London Borough of Merton is defined as Flood Zone 1 Low Probability of flooding from rivers. 5.2% is defined as Flood Zone 2 Medium Probability, 1.9% as Flood Zone 3a High Probability, and 1.7% as Flood Zone 3b Functional Floodplain.

4.2.11 The River Wandle flows in a roughly south-east to north-west direction through the borough. Areas of Flood Zone 2 and 3 associated with the River Wandle include properties around the Eagle Trading Estate in the south of the borough; Watermeads Nature Reserve, Ravensbury Park and Morden Hall Park; properties between Ravensbury Park and Morden Hall Park; areas around Brangwyn Crescent and to the west of Merantun Way; a number of properties along Runnymead and Liberty Avenue and Homefield Gardens; Wandle Park and Wandle Meadow Nature Park in Colliers Wood; Wimbledon Stadium and properties located to the south; and properties in the north-east of the Borough surrounding Brooklands Avenue.

4.2.12 The River Graveney is a tributary of the River Wandle. The watercourse originates as the Norbury Brook, before becoming the River Graveney to the east of Merton. The River Graveney flows in an approximately east to west direction along the northern boundary of Merton. The area to the north east of Mitcham Eastfields railway station is defined as Flood Zone 2 associated with the River Graveney, extending towards Oakleigh Way Recreation Ground and the northern part of Figge's Marsh.

4.2.13 The Beverley Brook flows in an approximately south-north direction along the western boundary of Merton and eventually discharges into the River Thames at Barnes. There are areas of Flood Zone 3 in Beverley Park, and adjacent to Aboyne Drive, and areas of Flood Zone 2 in Beverley Meads Recreation Ground and Fishponds Wood Nature Reserve.

[23] https://www.gov.uk/guidance/flood-risk-and-coastal-change#flood-zone-and-flood-risk-tables

4.2.14 The Pyl Brook is a tributary of the Beverley Brook. The Pyl Brook rises to the south of Sutton Common train station before flowing in an approximately south-east to northwest direction through Merton and connecting to the Beverley Brook in Beverley Park on the western boundary of Merton. An approximately 600m section of the Pyl Brook running adjacent to West Barnes Lane is culverted between Kingsway and Raynes Park High School. The Derwent Road Flood Storage Area provides additional storage from the Pyl Brook during periods of high flow. Areas surrounding Raynes Park High School, Memorial Ground, Westway and West Barnes Lane are defined as Flood Zone 3 associated with the Pyl Brook. Areas surrounding Cannon Hill Lane and Lower Morden Road are defined as Flood Zone 2.

River Modelling

4.2.15 The Environment Agency has undertaken modelling of flooding associated with the main river watercourses in the study area; River Wandle (including River Graveney) and Beverley Brook (including Pyl Brook).

Table 4-2 Modelling Studies

Watercourse	Modelling Study
River Wandle and River Graveney	June 2015, JBA Consulting on behalf of the Environment Agency, River Wandle Remodelling Study. Outputs include: • Defended flood event information for the following events: 20%, 5%, 2%, 1.33%, 1%, 1% (plus a 20% increase in flow allowance for climate change), 0.4% and 0.1% AEP events. • Undefended flood event information for the following events: 5%, 1%, 1% (plus a 20% increase in flow allowance for climate change) and 0.1% AEP events. August 2017, JBA Consulting on behalf of the Environment Agency, River Wandle Climate Change Modelling. Outputs include: • Defended flood event information for the following events: 1% AEP event including 25%, 35% and 70% increases in flow allowances for climate change. • Undefended flood event information for the following events: 1% AEP event including 25%, 35% and 70% increases in flow allowances for climate change.
Beverley Brook and Pyl Brook	2008/2009, Royal Haskoning on behalf of the Environment Agency, Beverley Brook Flood Risk Mapping Study. Outputs include: • Defended flood event information for the following events: 20%, 5%, 2%, 1%, 1% (plus a 20% increase in flow allowance for climate change) and 0.1% AEP events. • Undefended flood event information for the 1% AEP event.

Position Statement November 2020: The Beverley Brook is currently being remodelled on behalf of the Environment Agency. Outputs are not yet available to include in the SFRA. When they are received the SFRA will be updated. Outputs are expected to include the following events as a minimum: 5%, 1% and 0.1% AEP, as well as the 1% AEP event including 25%, 35% and 70% increases in flow allowances for climate change.

Functional Floodplain

4.2.16 As noted in Table 4-1, the Functional Floodplain (Flood Zone 3b) is defined as 'land where water has to flow or be stored in times of flood' and is not separately distinguished from Flood Zone 3a on the Flood Map for Planning (Rivers and Sea). The SFRA is the place where LPAs should identify areas of Functional Floodplain in discussion with the Environment Agency.

4.2.17 The PPG states that the identification of Functional Floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. However, land which would naturally flood with an annual probability of 1 in 20 (5% AEP) or greater in any year or is designed to flood (such as a flood attenuation scheme) in an extreme (0.1% annual probability) flood, should provide a starting point for consideration. The guidance goes on to say that 'areas which would naturally flood with an annual probability of 1 in 20 or greater but are

prevented from doing so by existing infrastructure or solid buildings will not normally be defined as functional floodplain'.

4.2.18 Modelled outlines for the 5% AEP event, including the presence of flood defences, for the River Wandle and Beverley Brook have been used by London Borough of Merton as the starting point to define Functional Floodplain associated with these watercourses. The following criteria have then been applied to remove selected buildings from the Functional Floodplain:

- All residential and school buildings removed
- Commercial (i.e. less vulnerable) buildings which have less than 50% coverage of the 5% (1 in 20 year) AEP outline have been removed.

4.2.1 The remaining outline forms Flood Zone 3b Functional Floodplain for London Borough of Merton. This can largely be summarised as the areas of:

- Wandle Meadow Nature Park;
- Wandle Park;
- Morden Hall Park;
- Ravensbury Park;
- Watermeads Nature Reserve and Imperial Sports Ground.

4.2.2 In addition, the Flood Storage Area on the Pyl Brook adjacent to the Morden Cemetery has been included in the Flood Zone 3b Functional Floodplain definition. These approaches have been discussed with and agreed by the Environment Agency. The extent of Flood Zone 3b is shown within the **Merton SFRA Online Map.**

Position Statement November 2020: The Beverley Brook is currently being remodelled on behalf of the Environment Agency. Outputs are not yet available to include in the SFRA. When they are received the SFRA will be updated.

Climate Change

4.2.3 A considerable amount of research is being carried out worldwide in an endeavour to quantify the impacts that climate change is likely to have on flooding in future years. Climate change may increase peak rainfall intensity and river flow, which could result in more frequent and severe flood events. Climate change is perceived to represent an increasing risk to low lying areas of England, and it is anticipated that the frequency and severity of flooding will change measurably within our lifetime.

4.2.4 The Environment Agency's online guidance 'Flood risk assessments: climate change allowances'[7] sets out the climate change allowances for peak river flows for each river basin district (as shown in Table 4-3) and provides advice on applying climate change projections when preparing flood risk assessments.

Table 4-3 Peak river flow allowances by river basin district

River basin district	Allowance category (as defined by NPPF)	Total potential change in peak river flow anticipated for the '2020s' (2015 to 2039)	Total potential change in peak river flow anticipated for the '2050s' (2040 to 2069)	Total potential change in peak river flow anticipated for the '2080s' (2070 to 2115
Thames	Upper end	25%	35%	70%
	Higher central	15%	25%	35%
	Central	10%	15%	25%

4.2.5 As noted in Table 4-2, as part of the hydraulic modelling of the River Wandle simulations have been run for the 1% AEP event including 25%, 35% and 70% climate change allowances. These model runs include the presence of defences. The current available modelling for the Beverley Brook includes a 20% allowance for climate change.

4.2.6 The flood extents are included on the **Merton SFRA Online Map** and Appendix C.2. The mapping shows that in the future the extent of flooding from the River Wandle associated with the 1% AEP event is anticipated to increase in the following locations:

- In the north of the Borough flood extents are shown to increase marginally in Wimbledon Park School grounds and the Recreation Ground; as well as Summerley Street to the east of the railway line;
- There are large increases in flood extent on the east bank of the Wandle throughout Garret Lane, Wimbledon Stadium Business Centre in Summerstown;
- In Collier's Wood, increases are shown to the east of Wandle Park, along the High Street and Christchurch Road;
- In Merton and Merton Abbey, increases in flood extent are shown on the east bank of the Wandle on Holmfield Gardens, as well as on the west bank, marked Deen City Farm on the OS mapping.
- There are marginal increases in flood extents throughout Morden Hall Park and Ravensbury Park, however these increase to the east of Ravensbury Park to affect London Road, Crescent Grove, Rawnsley Avenue and Heatherdene Close;
- In the south of the Borough, flood extents are modelled to increase significant across the Eagle Trading Estate extending to Wates Way, Ellis Road, Beck Road and Willow Lane.
- Flood extents along the course of the River Graveney are shown to increase on the south bank of the watercourse, affecting properties along Seely Road, Cromer Road, Boscombe Road and Vectis Road.

4.2.7 Currently available modelling for the Beverley Brook (including the Pyl Brook) uses a 20% allowance on the 1% AEP event. The results show a minimal increase in the extent of flooding around Cannon Hill Lane associated with the Pyl Brook. There is no significant increase in flood extent associated with the Beverley Brook.

Position Statement November 2020: The Beverley Brook is currently being remodelled on behalf of the Environment Agency. Outputs are not yet available to include in the SFRA. When they are received the SFRA will be updated. Outputs are expected to include the following events as a minimum: 5%, 1% and 0.1% AEP, as well as the 1% AEP event including 25%, 35% and 70% increases in flow allowances for climate change.

Ordinary Watercourses

4.2.8 In total there is approximately 69 km of ordinary watercourse in Merton, approximately 5km of which is culverted. The majority of watercourses are located in Wimbledon Common, Mitcham Common, Raynes Park, Cannon Hill Common and Wimbledon Park. A number of these are small ditches located in Council managed parks and adjacent to roads.

4.2.9 Trash screens and culverts have the potential to become blocked by items such as plant debris and rubbish. Blockages restrict the natural flow of water, increasing the chance of water flowing out of bank and causing local flooding due to the reduced flow of the associated watercourse.

4.2.10 Merton Council is aware of a number of areas with known flooding problems associated with ordinary watercourses, including:

- The watercourse adjacent to Meadowsweet Close, which has a history of flooding due to overgrown vegetation and blockage of the trash screen. This can impact the culverted section of watercourse upstream which runs along the rear of the properties along Grand Drive.
- The watercourse flowing through Kings College School Sports Ground in Raynes Park. A section flows eastward, connecting to the Pyl Brook, whilst a section flows westward and is culverted underneath Arthur Road. Flooding has been reported when the culvert and associated trash screen has become blocked.

Flood Defences

4.2.11 Flood defences are structures which affect flow in times of flooding in order to reduce the risk water entering property. They generally fall into one of two categories; 'formal' or 'informal'.

4.2.12 A ‘formal’ flood defence is a structure which has been specifically built to control floodwater. It is maintained by its owner or statutory undertaker so that it remains in the necessary condition to function. In accordance with the FWMA, the Environment Agency has powers to construct and maintain defences to help against flooding.

4.2.13 An ‘informal’ defence is a structure that has not necessarily been built to control floodwater and is not maintained for this purpose. This includes road and rail embankments and other linear infrastructure (buildings and boundary walls) which may act as water retaining structures or create enclosures to form flood storage areas in addition to their primary function.

4.2.14 A study of informal flood defences has not been made as part of this assessment. Should any changes be planned in the vicinity of road or railway crossings over rivers in the study area it would be necessary to assess the potential impact on flood risk to ensure that flooding is not made worse either upstream or downstream. Smaller scale informal flood defences should be identified as part of site specific FRAs and the residual risk of their failure assessed.

4.2.15 In accordance with the scope of a Level 1 SFRA, a high-level review of formal flood defences has been carried out using data from the Environment Agency Asset Information Management System (AIMS). This dataset contains details of flood defence assets associated with main rivers and provides a good starting point for identifying significant local defences and potential areas benefiting from defences, but the quantity and quality of information provided differs considerably between structures. The AIMS is intended to provide a reasonable indication of the condition of an asset and should not be considered to contain consistently detailed and accurate data (this would be undertaken as part of a Level 2 SFRA or site-specific FRA where the need arises).

4.2.16 Extracts from the Environment Agency Asset Information Management System (AIMS) provided to inform the Level 1 SFRA show that the River Wandle is predominantly defended by high ground along its course. There are culverted sections along Merantun Way and an embankment and flood defence wall along the right bank of the River Wandle between the railway line and Plough Lane (TQ 23506 67396). The River Graveney is also partially culverted along High Street Colliers Wood.

4.2.17 The Beverley Brook is partially culverted along its course in London Borough of Merton. There is a short length of flood defence wall to the south of the station at Motspur Park. The remainder of its course it is protected by high ground. The Derwent Road flood storage area is located on the Pyl Brook (TQ 23506 67396).

4.2.18 The AIMS dataset is shown on the **Merton SFRA Online Map.**

Flood Warning Areas

4.2.19 The Environment Agency provides a free Flood Warning Service[24] for many areas at risk of flooding from rivers and the sea. In some parts of England, the Environment Agency may be able to provide warnings when flooding from groundwater is possible. The Environment Agency has provided a GIS layer of Flood Warning Areas in the study area. There are 10 Environment Agency Flood Warning Areas in London Borough of Merton, identified on the **Merton SFRA Online Map** as follows:

- Beverley Brook at Wimbledon Common and Richmond Park
- Beverley Brook at Raynes Park
- Beverley Brook at West Barnes
- Pyl Brook at West Barnes
- Pyl Brook at North Cheam
- East Pyl Brook at Morden Park
- River Wandle at Morden
- River Wandle at Wimbledon
- River Wandle at Wandsworth
- River Graveney at Tooting and Colliers Wood

[24] https://flood-warning-information.service.gov.uk/warnings

Emergency Rest Centres

4.2.20 Each of the London Boroughs has provided details of the emergency rest centres within their administrative areas which are designated in the Multi-Agency Flood Plan. Emergency rest centres designated by London Borough of Merton are mapped on the **Merton SFRA Online Map** and summarised in Table 4-4.

Table 4-4 Emergency Rest Centres in London Borough of Merton

Emergency Rest Centre	Address	Easting	Northing
Canons Leisure Centre	Madeira Road CR4 4HD	528004	168342
Christ the King	The Crescent SW19 8AJ	525395	172147
Cottenham Park Pavilion	Melbury Gardens SW19 1LA	525476	170004
Dundonald Park Pavilion	Fairlawn Road SW19 3QH	524690	170139
King George's Pavilion	Tudor Drive SM4 4NP	523564	166946
Kings College School	Southside SW19 4TT	523447	170678
Morden Park Assembly hall	Tudor Drive SM4 4PJ	523872	167108
Morden Baptist church	Crown Lane SM4 5BL	525576	168522
New Horizons,	South Lodge Avenue, Pollards Hill, Mitcham. CR4 1LT	530134	168422
Phipps Bridge Youth centre	Cobham Court, Haslemere Avenue CR4 3PR	526566	169159
Pollards Hill Youth Centre	South Lodge Avenue, CR4 1LT	530134	168422
Raynes Park High School	Bushey Road SW20 0JL	522579	168610
Raynes Park Pavilion	Off Taunton Avenue West Barnes Lane SW20 0BH	522723	169186
Sir Joseph Hood Memorial Playing Fields Pavilion	Marina Avenue KT3 6NE	522744	167553
South Mitcham Community Centre	Cobham Court, Haslemere Avenue CR4 3PR	526566	169159
St Luke's Church hall	Strathmore Road SW19 8BZ	525312	172312
Vestry Hall	336 – 338 London Road CR4 3UD	527522	168602

4.3 Flooding from Surface Water

4.3.1 Overland flow and surface water flooding typically arise following periods of intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems. It can run quickly off land and result in localised flooding. The PPG states that an SFRA should identify areas at risk from surface water flooding and drainage issues, taking account of the surface water flood risk published by the Environment Agency as well other available information.

Risk of Flooding from Surface Water Mapping

4.3.2 The Environment Agency has undertaken modelling of surface water flood risk at a national scale and produced mapping identifying those areas at risk of surface water flooding during three annual probability events: 1 in 30 year (3.33% annual probability), 1 in 100 year (1% annual probability) and 1 in 1,000 year (0.1% annual probability). The extents of the latest version of the mapping have been made available for the Level 1 SFRA as GIS layers. This mapping is referred to as 'Risk of Flooding from Surface Water' (ROFSW) and is also available online on the Long Term Flood Risk Map[25].

4.3.3 The ROFSW mapping provides all relevant stakeholders, such as the Environment Agency, LPAs and the public access to information on surface water flood risk which is consistent across England and Wales. The modelling helps the Environment Agency take a strategic overview of flooding and assists LLFAs in their duties relating to management of surface water flood risk. For the purposes of this SFRA, the mapping allows an improved understanding of areas within the study area which may have a surface water flood risk.

[25] https://flood-warning-information.service.gov.uk/long-term-flood-risk

4.3.4 It should be noted that this national mapping has the following limitations:

- Use of a single drainage rate for all urban areas,
- It does not show the susceptibility of individual properties to surface water flooding,
- The mapping has significant limitations for use in flat catchments,
- No explicit modelling of the interaction between the surface water network, the sewer systems and watercourses,
- In a number of areas, modelling has not been validated due to a lack of surface water flood records, and
- As with all models, the ROFSW mapping is affected by a lack of, or inaccuracies, in available data.

4.3.5 The ROFSW mapping on the **Merton SFRA Online Map** supports many of the records of flooding and illustrates how surface water ponds in the flat low-lying areas within the Borough, within the floodplains of the primary watercourses and adjacent to railway embankments. As part of the Level 1 SFRA, 19 Drainage Catchments (DC) have been identified in Merton in order to better understand and manage the risk from surface water flooding. These Drainage Catchments follow the topography and watercourse catchments within the Borough but are also influenced by the presence of railway embankments, which cut through the Borough from New Malden to Earlsfield and create barriers to overland flow. It is intended that these DCs will be useful for identifying the natural drainage patterns in the local area when considering new development and future regeneration in the study area.

Further Modelling Updates

4.3.6 London Borough of Merton have secured funding for further refinements to the surface water modelling for West Merton, which covers much of their administrative area. This modelling is currently underway and future updates to the ROFSW mapping will be incorporated into London Borough of Merton's online mapping and future revisions of the Level 1 SFRA.

Climate Change

4.3.7 The Environment Agency's online guidance 'Flood risk assessments: climate change allowances'[7] sets out the climate change allowances for peak rainfall intensity (as shown in Table 4-5) and provides advice on applying climate change projections when preparing flood risk assessments.

Table 4-5 Peak rainfall intensity allowances in small and urban catchments (1961-1990 baseline)

Applies across all of England Allowance Category	Total potential change in peak river flow anticipated for the '2020s' (2015 to 2039)	Total potential change in peak river flow anticipated for the '2050s' (2040 to 2069)	Total potential change in peak river flow anticipated for the '2080s' (2070 to 2115
Upper end	10%	20%	40%
Central	5%	10%	20%

4.3.8 The ROFSW does not include a specific scenario to determine the impact of climate change on the risk of surface water flooding. However, a range of three annual probability events have been undertaken, 3.3%, 1% and 0.1% and therefore it is considered appropriate to use the 0.1% AEP event as a substitute dataset to provide a worst-case scenario and an indication of the implications of climate change.

Drainage Catchments

4.3.9 As part of the Level 1 SFRA, Drainage Catchments (DCs) have been determined across the study area. Drainage catchments outline the area of the land that influences the surface water drainage at a certain point. The scale of a drainage catchment varies depending on the point of interest. The extent of a natural drainage catchment follows peaks in the local topography that surface water will drain from. The DCs determined in this study are based on the natural catchments and watersheds that cover the four boroughs, which are provided within the Flood Estimation Handbook CD-ROM and have then been amended using local knowledge to account for significant infrastructure within the study area that could impact on drainage such as railway lines.

4.3.10 Using this method, 39 DCs have been identified covering the study area. In some cases, the DCs cross the Borough boundaries; 19 cover the London Borough of Merton and 20 cover the London Borough of Wandsworth.

4.3.11 It is intended that these DCs will be useful for identifying the natural drainage patterns in the local area when considering new development and future regeneration in the study area. The potential for implementing new approaches and requirements for surface water management can be considered by each of the London Boroughs within the context of specific DCs. For example, local topography could be used to determine flow paths within each DC, which could highlight potential areas to focus surface water management techniques.

Historic Records

4.3.12 Historic flooding records from local residents and businesses, Network Rail, Transport for London and the Environment Agency have been gathered by each of the London Boroughs as part of the preparation of the PFRA, SWMP and the LFRMS. These records have been obtained and used to inform this Level 1 SFRA Where possible, the source of the flooding has been identified.

4.3.13 London Borough of Merton has experienced a number of surface water flood events, the most notable of which was on 20th July 2007, when heavy rainfall caused flooding from surface water, rivers and sewers to combine to impact properties across the Borough, particularly within the areas of Raynes Park, West Barnes, Colliers Wood and South Wimbledon. Table 4-6 summarises surface water flood events.

Table 4-6 Records of Surface Water Flooding

Flood Event	Description
23rd June 2005 (Surface Water Flooding)	Thunderstorms occurred across London, with particularly heavy rain and hail in Wimbledon, resulting in overland flow and flash flooding
20th June 2007 (Surface Water Flooding)	Intense periods of rainfall caused flash floods and the capacity of the existing drainage system to be exceeded in several locations across the Borough. This caused overland flow and ponding in low lying areas and impacted residents, businesses and the Council. 50.8mm of rainfall was recorded in 24 hours, the majority of this fell in the first 12 hour period.
	Merton Borough Council reported significant flooding in the areas of West Barnes, Morden, Mitcham, Colliers Wood, Tooting Graveney and Summerstown.
	London Underground records report the closure of Colliers Wood and Morden Stations due to surface water flooding. Colliers Wood Station was closed for 9 hours.
	Over 120 roads in the Borough (approximately 65,000m2 of public highway) were impacted by the surface water flooding, with over 140 calls received by the Environment and Regeneration team advising of flooding and requesting sandbags.
	Approximately 30 residential council properties, 1 youth centre, 3 libraries, 10 leisure and recreation properties and 6 corporate buildings were flooded.
	23 schools, 20 primary, 1 special school and 1 high school were affected to varying degrees by the flooding, with one school requiring an extra three days to finalise repairs over the summer holidays.
	The High Street in Colliers Wood was flooded. This is one of the busiest roads in Merton and is the main route to St. Georges Hospital and the National Blood Service, which uses this route for most of the hospitals in Surrey, Kent and Sussex. St George's Hospital car park was flooded. High Street Colliers Wood is a red-route and comes under the responsibility of TfL.
24th June 2016	Property flooding upstream of Bishopsford Road Bridge on London Road. Reports of garden flooding on Hengelo Gardens near Ravensbury Park.
10th June 2019	Property and garden flooding from surface water. Flooding also occurring as surface water unable to discharge to River Wandle.
Regular Flooding (Surface Water & Sewer Flooding)	The West Barnes / Raynes Park area is known to flood during heavy rainfall and result in overland flow / surface water flooding and sewer flooding, due to an overloaded drainage system during significant rainfall events.

4.3.14 The PFRA and SWMP identify parts of Merton to be particularly susceptible to surface water flooding, including West Barnes / Raynes Park, Colliers Wood and East Mitcham, particularly in the area of Manor Road / Manor Way. 276 records of surface water flooding have been provided by the Council and mapped on the **Merton SFRA Online Map**. Specific episodes of surface water flooding are recorded in the following locations:

- West Barnes,
- Raynes Park,

- Morden,
- St Helier and
- Colliers Wood

4.3.15 The SWMP for London Borough of Merton identifies 13 CDAs, as summarised in Table 4-7. The Environment Agency defines a Critical Drainage Area (CDA) as an area within Flood Zone 1 which has “critical drainage issues”. However, within the SWMPs for each of the London Boroughs, CDAs were delineated based on the following 'working definition': ‘a discrete geographic area (usually within an urban setting) where there may be multiple and interlinked sources of flood risk and where severe weather is known to cause flooding of the area thereby affecting people, property or local infrastructure’. Therefore, the CDAs for the London Boroughs are not restricted to Flood Zone 1.

Table 4-7 SWMP CDAs in London Borough of Merton

CDA ID	CDA Name	CDA ID	CDA Name
Group7_001	West Barnes	Group7_008	Wimbledon
Group7_002	Raynes Park	Group7_009	Haydon
Group7_003	Hillcross	Group7_010	East Merton
Group7_004	Cottenham Park North	Group7_011	Collier's Wood
Group7_005	Cottenham Park South	Group7_012	East Mitcham
Group7_006	Glastonbury Road	Group7_013	Ascot Road [Merton]
Group7_007	North St. Helier		

4.4 Flooding from Groundwater

4.4.1 Groundwater flooding usually occurs in low lying areas underlain by permeable rock and aquifers that allow groundwater to rise to the surface through the permeable subsoil following long periods of wet weather. Low lying areas may be more susceptible to groundwater flooding because the water table is usually at a much shallower depth and groundwater paths tend to travel from high to low ground.

Historic Records

4.4.2 Over the last few years, information on historical flooding in the study area has been gathered by each of the London Boroughs in accordance with their duties as LLFAs, and as part of the preparation of the PFRA, SWMP and most recently the LFRMS. Where possible, the source of the flooding has been identified. It should be noted that there has not been a statutory obligation to record incidences of groundwater flooding in the past and therefore it is likely that the groundwater flooding incidents recorded are not exhaustive.

4.4.3 The Council have records of 34 incidents of groundwater flooding in the Borough which are shown on the **Merton SFRA Online Map**. These incidents are dispersed across the Borough, including West Barnes, north of Cottenham Park, Colliers Wood, Wimbledon and Morden.

4.4.4 The most notable groundwater flooding event occurred during late 2000 / early 2001 after a particularly wet period which resulted in both surface and groundwater flooding incidents in a number of locations across the country.

Susceptibility to Groundwater Flooding

4.4.5 In response to the need for more information on groundwater flooding, BGS has produced the first national dataset on the susceptibility of groundwater flooding. Based on geological and hydrogeological information, the digital data can be used to identify areas where geological conditions could enable groundwater flooding to occur and where groundwater may come close to the ground surface. Note, it is a susceptibility set, it does not indicate hazard or risk, i.e. it does not provide any information on the depth to which groundwater flooding occurs or the likelihood of the occurrence of an event of a particular magnitude.

4.4.6 The ‘Susceptibility to Groundwater Flooding’ dataset is divided into three classes – High, Medium and Low risk as follows:

- High – areas with the potential for groundwater flooding to occur at the surface;
- Medium – areas which may experience groundwater flooding of property situated below the ground surface i.e. basements;
- Low – areas with limited potential for groundwater flooding to occur.

4.4.7 The BGS state that the dataset is suitable for use for regional or national planning purposes where the groundwater flooding information will be used along with a range of other relevant information to inform land-use planning decisions. It might also be used in conjunction with a large number of other factors, e.g. records of previous incidence of groundwater flooding, rainfall, property type, and land drainage information, to establish relative, but not absolute, risk of groundwater flooding at a resolution of greater than a few hundred metres. The susceptibility data should not be used on its own to make planning decisions at any scale, and, in particular, should not be used to inform planning decisions at the site scale. The susceptibility data cannot be used on its own to indicate risk of groundwater flooding.

4.4.8 The Susceptibility to Groundwater Flooding dataset provided by the BGS can be used to identify areas where geological conditions could enable groundwater flooding to occur and where groundwater may come close to the ground surface.

4.4.9 The areas identified to be most susceptible to groundwater flooding across the Borough are located in those areas with permeable superficial deposits (which usually consist of sediments such as gravel, sand, silt and clay) which are typically associated with river valleys. These cover a wide area in Merton and include the following areas:

- From Mitcham north towards Collier’s Wood,
- Sections of West Barnes and Raynes Park, and
- An area of central Merton from South Wimbledon west towards Cottenham Park.

4.4.10 Smaller areas, where there is potential for groundwater flooding of property situated below ground level, are located in Mitcham, Collier’s Wood and South Wimbledon, whilst Wimbledon Common and areas in close proximity to this are identified to have limited potential for groundwater flooding to occur. However, it should be noted that the Susceptibility to Groundwater Flooding dataset provides a high-level assessment of potential risk across the Borough and incidents may occur outside these areas depending on the local geological conditions.

4.4.11 Due to the licence requirements, the BGS susceptibility to groundwater flooding dataset cannot be mapped on the **Merton SFRA Online Map.** A hard copy map is therefore included in **Appendix B Figure 1**.

Areas of Perched Groundwater

4.4.12 London Borough of Merton are aware of areas at risk of perched groundwater in the north west of the Borough. The geology of this area is characterised by Black Members underlain by the London Clay. The ‘Wimbledon Hill’ slope, in particular, is an area with this unique geology, where below ground development has the potential to impact on groundwater flows. This area is shown on London Borough of Merton’s online mapping and in Figure 4-1.

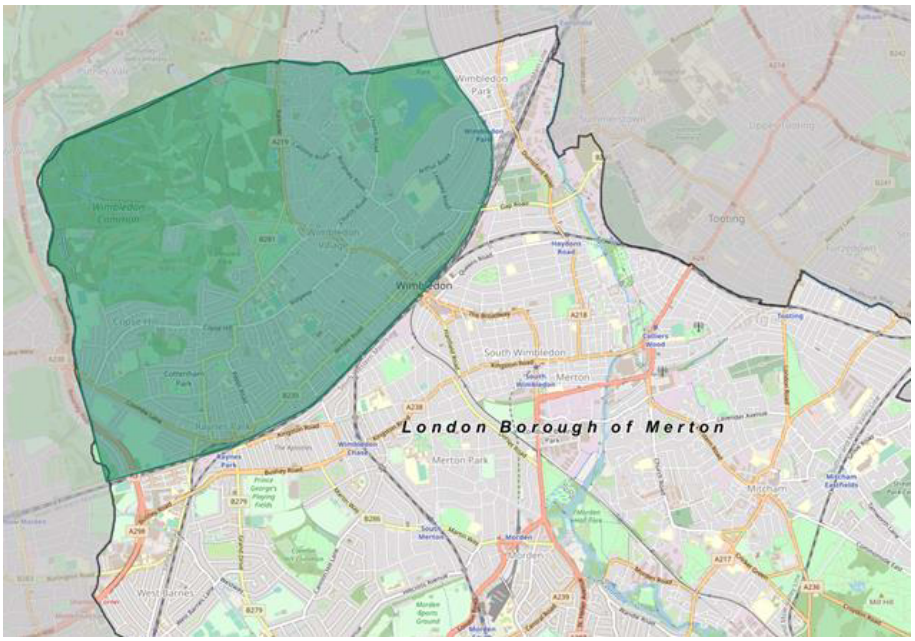


Figure 4-1 Areas at risk of perched groundwater in London Borough of Merton

South London groundwater situation report

4.4.13 The Environment Agency monitor groundwater levels in south London and provide situation report updates online[26]. The reports are updated as regularly as the prevailing conditions require. The situation report sets out the current groundwater levels, the forecast of flooding, the steps the Environment Agency are currently taking and when the next update is anticipated.

4.5 Flooding from Sewers

4.5.1 During heavy rainfall, flooding from the sewer system may occur if:

i. The rainfall event exceeds the capacity of the sewer system/drainage system: Sewer systems are typically designed and constructed to accommodate rainfall events with a 3.3% AEP or less. Therefore, rainfall events with a return period of frequency greater than 3.3% AEP would be expected to result in surcharging of some of the sewer system. While TWUL, as the sewerage undertaker for the study area, recognise the impact that more extreme rainfall events may have, it is not cost beneficial to construct sewers that could accommodate every extreme rainfall event.

ii. The system becomes blocked by debris, sediment or fat: Over time there is potential that road gullies and drains become blocked from fallen leaves, build-up of sediment and debris (e.g. litter). Fat build up within the main sewer system is also a contributing factor of sewer flooding.

iii. The system surcharges due to high water levels in receiving watercourses: Within the study area there is potential for surface water outlets to become submerged due to high river levels. When this happens, water is unable to discharge. Once storage capacity within the sewer system itself is exceeded, the water will overflow into streets and potentially into houses. Where the local area is served by 'combined' sewers i.e. containing both foul and storm water, if rainfall entering the sewer exceeds the capacity of the combined sewer and storm overflows are blocked by high water levels in receiving watercourses, surcharging and surface flooding may again occur but in this instance floodwaters will contain untreated sewage.

Historic Records

4.5.2 TWUL has provided an extract from their DG5 Flood Register for the study area, which records historic internal and external sewer flooding events. Due to data protection requirements the data has not been provided at

[26] https://www.gov.uk/government/publications/mole-and-south-london-groundwater-situation

individual property level; rather the register comprises the number of properties within four digit postcode areas that have experienced flooding either internally or externally within the last 10 years.

4.5.3 It should be noted that records only appear on the DG5 register where they have been reported to TWUL, and as such they may not include all instances of sewer flooding. Furthermore, given that TWUL target these areas for maintenance and improvements, areas that experienced flooding in the past may no longer be at greatest risk of flooding in the future.

4.5.4 The majority of Merton is served by separate foul and surface water sewers, with the exception of combined sewers in north of the Borough. The surface water sewers typically designed to accommodate a rainfall event with a 1 in 30 chance of occurring in any given year or less. During larger, more intense rainfall events when the capacity of the surface water sewer system is insufficient, many of the sewer systems in the south west of the Borough discharge directly, or via some degree of attenuation on new development sites, into the natural watercourses in the Raynes Park area. These discharges can locally increase water levels and potential for flooding.

4.5.5 The London Borough of Merton PFRA states that the West Barnes, Raynes Park and Colliers Wood areas in particular are known to experience sewer flooding during heavy rainfall.

4.5.6 **Appendix B Figure 2** shows the DG5 Register that has been supplied by TWUL. It highlights sewer flooding incidents throughout London Borough of Merton; however, it should be noted that TWUL focus their efforts on removing properties from the DG5 register and therefore this information may not accurately represent those properties currently at risk.

Climate Change

4.5.7 Climate change is anticipated to increase the potential risk from sewer flooding as summer storms become more intense and winter storms more prolonged. This combination is likely to increase the pressure on the existing efficiency of sewer systems, thereby reducing their design standard and leading to more frequent localised flooding incidents. Any sewer flooding that may occur could be exacerbated as a result of surface water runoff during extreme rainfall events. However, as the majority of the Borough is served by separate foul and surface water sewers the risk from sewer flooding in the London Borough of Merton is considered to be low.

4.5.8 TWUL continue to monitor the risk of sewer flooding and put plans in place to manage the risk, as required, based on their business plan and priorities. London Borough of Merton can work with TWUL to identify flooding hotspots and locations of known sewer capacity issues where risk could be exacerbated. TWUL prioritise investment for potential flood alleviation schemes depending on the severity and frequency of flooding, but this can only be identified where affected property owners report the incident to the water company.

Consulting with Thames Water Utilities Ltd

4.5.9 As part of their Sites Allocation process, London Borough of Merton and Wandsworth will consult with Thames Water to determine any areas with sewer capacity issues.

4.6 Flooding from Other Sources

Risk of Flooding from Reservoirs

4.6.1 The failure of a reservoir has the potential to cause catastrophic damage due to the sudden release of large volumes of water. The PPG encourages LPAs to identify any impounded reservoirs and evaluate how they might modify the existing flood risk in the event of a flood in the catchment it is located within, and / or whether emergency draw-down of the reservoir will add to the extent of flooding.

4.6.2 There have been no recorded incidents of reservoir flooding within London Borough of Merton. The Environment Agency dataset ‘Risk of Flooding from Reservoirs’ available on the Long Term Flood Risk Map identifies that if Wimbledon Park Lake were to fail there is the potential for wide-scale flooding downstream. Flood waters would flow north-east from Wimbledon Park Lake into the River Wandle and into the London Borough of Wandsworth, and subsequently northwards towards the River Thames.

Table 4-8 Areas at risk of flooding from reservoirs

Name	Owner	Local Authority	Grid Ref	Areas affected
Wimbledon Park Lake	London Borough of Merton	London Borough of Merton	524874, 172403	Drains north east towards Durnsford Road and Earlsfield. Follows the course of the River Wandle into King George's Park in London Borough of Wandsworth.

4.6.3 Reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs must be inspected and supervised by reservoir panel engineers on a yearly basis. As the enforcement authority for the Reservoirs Act 1975 in England, the Environment Agency are responsible for ensuring that reservoirs are inspected regularly, and essential safety work is carried out. These reservoirs therefore present a managed risk. As the undertaker for Wimbledon Park Lake, London Borough of Merton is required to ensure that inspections are carried out by a qualified panel engineer and that necessary safety work is completed as required to reduce the likelihood of any failure. London Borough of Merton is responsible for working with members of the Local Resilience Forum (LRF) to develop emergency plans for reservoir flooding and ensuring communities are well prepared.

4.7 Cumulative impacts of development and land-use change

4.7.1 There is potential for development and land-use change across a given study area to have a cumulative impact on the risk of flooding. For example, the Environment Agency SFRA guidance available online[27] notes that impacts may arise collectively as a result of strategically planned development, windfall development, permitted development, significant changes in land use, such as paving over domestic gardens or reforestation of uplands.

4.7.2 The following issues have been identified as having the potential to result in a cumulative impact on flood risk in London Borough of Merton:

- Strategically planned development: Crossrail 2 is set to deliver a large area of redevelopment in the north west of the Borough predominately in Wimbledon and Raynes Park. This new transport infrastructure is likely to act as a catalyst for major developments. In addition, there are proposals for a new Tramlink, known as 'Sutton Link', intended to provide a new direct and quicker transport link between Sutton and Merton. Indicative routes for these transport networks are included in Figure 4-2. Cumulatively, the works associated with these strategic transport links as well as the development that will result from them over time, has the potential to impact the urban environment, and thereby the risk of flooding.
- Replacing soft landscaping within gardens to provide off street parking, or lower maintenance outside space, has an effect on the rate of surface water runoff to receiving surface water drainage systems and watercourses when considered cumulatively across the Borough. Given the position of London Borough of Merton part way down the catchments of the River Wandle and the Beverley Brook, it is also receiving the cumulative impact of changes made upstream in the catchment (as well as passing on the cumulative effects to those areas downstream in London Boroughs of Richmond and Wandsworth).
- Permitted development includes alterations to properties that are limited in their extent, and therefore do not require planning permission. These types of alterations have the potential to result in increase in surface water runoff and therefore, cumulatively, affect the risk of flooding to the local area.
- Policies G1 and G5 within the Intend to Publish London Plan promote the use of green infrastructure and urban greening throughout urban design. The aspiration is that cumulatively these measures will improve the ability of the urban environment to store and reuse rainwater, thereby reducing surface water runoff. This in turn has the potential to reduce localised surface water flooding and rates of runoff to receiving waterbodies.

[27] https://www.gov.uk/guidance/local-planning-authorities-strategic-flood-risk-assessment

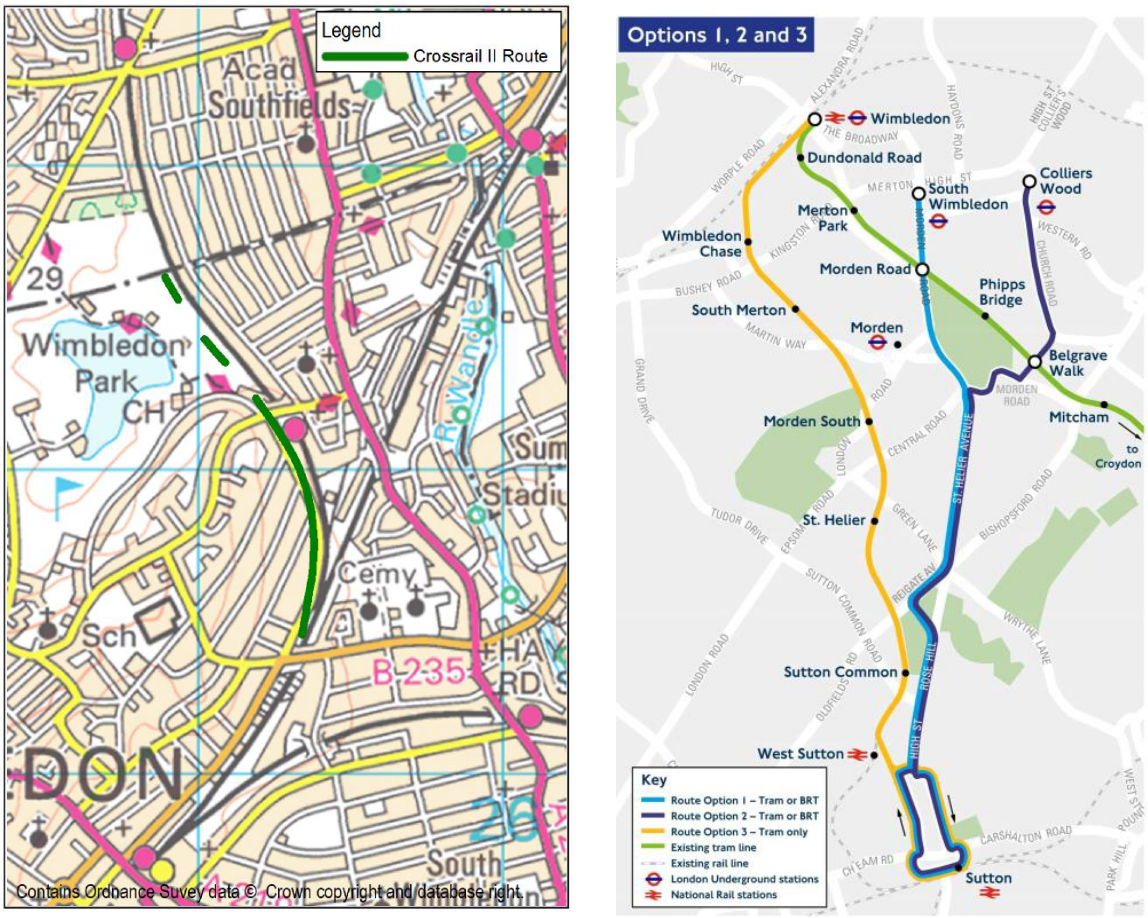


Figure 4-2 Indicative plans for Crossrail 2[28] and Sutton Link[29]

4.8 Opportunities to reduce the causes and impacts of flooding

4.8.1 New development and strategic plans developed by different Risk Management Authorities present opportunities to reduce the causes and impacts of flooding. This section describes some of the opportunities identified. Reference should also be made to Appendix D Managing and Mitigating Flood Risk for details of measures that can be implemented at the site planning and building design level to reduce the impacts of flooding.

Thames Catchment Flood Management Plan

4.8.2 The vision and preferred policy for this sub-area is Policy Option 4: Areas of low, moderate or high flood risk where the flood risk is being managed effectively but where further actions may be needed to keep pace with climate change. The Environment Agency has set out the following proposed actions to implement the preferred policy:

- We will continue to make sure the recommendations in SFRAs and Local Development Framework policies create the potential to reduce flood risk through regeneration.
- We will play our part in adopting a strategic approach to planning so that wider community objectives as well as flood risk objectives can be met.
- We will develop our emergency response planning to deal with extreme floods, including raising public awareness and working with key partners to identify critical infrastructure at flood risk.

[28] https://www.merton.gov.uk/assets/Documents/what_you_need_to_know_about_crossrail2_safeguarding_nov14.pdf
[29] Transport for London, April 2019, Sutton Link Consultation Report. https://consultations.tfl.gov.uk/trams/sutton-link/user_uploads/sutton-link-consultation-report.pdf

- We want to continue to maintain the existing flood defences and when redevelopment takes place, replace and improve them so that they are more effective against the impacts of climate change. We will be looking to remove culverts and other structures that cause significant conveyance problems. An example of this is our work in the Ravensbourne catchment.
- With our partners, we will look for opportunities to reduce flood risk by recreating river corridors in urban areas. We will influence people who shape the urban environment and harness these opportunities, allowing space for water, habitat, wildlife and recreation.

Environment Agency River Wandle Project

4.8.3 The River Wandle Modelling Study (2015) indicates that there are approximately 3500 residential properties at risk of flooding in events up to and including the 1% AEP (1 in 100 year) flood event throughout the catchment. The Environment Agency are in the early stages of a project on the River Wandle catchment working with Local Authorities and other Risk Management Authorities to reduce flood risk to communities on the River Wandle. The Environment Agency has approved a catchment action plan for the River Wandle that will deliver on the objectives of the new Draft FCERM Strategy. Subject to business case approval, the action plan will reduce flood risk and improve resilience throughout the catchment by maintaining existing assets, delivering new flood risk schemes, improving community resilience and strengthening emergency plans. The plan prioritises actions that will mitigate increased river flows resulting from climate change.

Graveney Siphon De-Silting

4.8.4 The Environment Agency's current 6-year flood and coastal erosion risk management (FCERM) investment programme[30] runs from 1 April 2015 to 31 March 2021. A scheme to de-silt the Graveney Siphon south of Collier's Wood High Street off Waterfall Terrace is was completed in October 2019, improving the standard of protection to 116 residential properties. The project removed accumulated urban debris from the siphon system which was causing a flow restriction. The project was carried out sensitively with the successful relocation of hundreds of eels and fish.

Strategic Transport Improvements

4.8.5 Proposals for Crossrail 2 and the Sutton Link TramLink will entail significant works within London Borough of Merton and once the infrastructure is complete, large parcels of land may come forward for redevelopment. Both these schemes provide key opportunities to influence how the built environment is designed and ensure that flood risk management measures are applied.

4.8.6 Parts of the routes for these transport networks are identified to be at risk of surface water flooding on the ROFSW. Opportunities to address the surface water flooding mechanisms and provide large scale improvements to the local area should be sought as part of the development proposals.

Working with Natural Processes

4.8.7 Compared to flood defences and flood storage, floodplain restoration represents the most sustainable form of strategic flood risk solution, by allowing watercourses to return to a more naturalised state, and by creating space for naturally functioning floodplains working with natural processes. Although the restoration of floodplain is difficult in previously developed areas where development cannot be rolled back, the following measures are methods that could be implemented to help catchment and floodplain restoration:

- Promoting existing and future brownfield sites that are adjacent to watercourses to naturalise banks as much as possible.
- Buffer areas around watercourses provide an opportunity to restore parts of the floodplain.
- Removal of redundant structures to reconnect the river and the floodplain.
- Avoid placing new development within the floodplain.

[30] https://www.gov.uk/government/publications/programme-of-flood-and-coastal-erosion-risk-management-schemes

4.8.8 A review of the mapping outputs from the Environment Agency led research project 'Working with Natural Processes' has been used to identify potential locations for Working with Natural Processes (WWNP) in the Borough[31]. Four of these layers are included in the **Merton SFRA Online Map** and summarised below:

- WWNP Floodplain Reconnection Potential – best estimate of locations where it may be possible to establish reconnection between a watercourse and its natural floodplain, especially during high flows. The dataset is designed to support signposting of areas where there is currently poor connectivity such that flood waters are constrained to the channel and flood waves may therefore propagate downstream rapidly.
- WWNP Floodplain Woodland Potential – best estimate of locations where tree planting on the floodplain may be possible, and effective to attenuate flooding. The dataset is designed to support signposting of areas of floodplain not already wooded.
- WWNP Riparian Woodland Potential – best estimate of locations where tree planting may be possible on smaller floodplains close to flow pathways, and effective to attenuate flooding. The dataset is designed to support signposting of riparian areas not already wooded.
- WWNP Wider Catchment Woodland Potential – best estimate of locations where there are slowly permeable soils, where scrub and tree planting may be most effective to increase infiltration and hydrological losses. The dataset is designed to support signposting of areas not already wooded.

4.8.9 In Merton, opportunities for floodplain reconnection are identified along the Wandle through Summerstown, Morden Hall Park, adjacent to Morden Hall Road and Ravensbury Park. Opportunities for floodplain, riparian and wider catchment woodland potential are identified in Wimbledon Common, adjacent to the Beverley Brook and the Kingston Bypass, along the edge of the Garfield Recreation Ground, Wandle Meadow Nature Park, Bushey Mead, adjacent to the Pyl Brook in West Barnes and Mitcham Common.

Green infrastructure and urban greening plans

4.8.10 Policies G1 and G5 in the London Plan within the Intend to Publish London Plan place an emphasis on the use of green infrastructure and urban greening throughout urban design. The incorporation of these elements into the future redevelopment of parts of Merton has the potential to reduce the causes and impacts of flooding.

4.8.11 As London Borough of Merton develop their Green Infrastructure, Biodiversity and Open Space Strategy, this provides a key opportunity to maximise opportunities to reduce the causes of surface water flooding and their associated impacts. It is recommended that the Green Infrastructure, Biodiversity and Open Space Strategy takes account of the Critical Drainage Areas and ROFSW mapping within the SFRA to inform the future plans for provision of green infrastructure.

Coordinated area-wide SUDS Schemes

4.8.12 Where plots identified for development come forward collectively, opportunities should be taken to provide coordinated area-wide SUDS schemes. A review of the initial pool of sites identified by London Borough of Merton for further analysis has identified locations where sites are clustered together.

- Sites Wi3(N), Wi3(M) and Wi3(S) on Church Road, Somerset Road and Wimbledon Road in Wimbledon;
- Sites Wi9, Wi10, Wi13 and Wi14, St Georges Road, Wimbledon;
- Sites Wi5, Wi11 on Hartfield Road and Victoria Crescent, Wimbledon;
- Sites RP2 and RP3 on Burlington Road, Raynes Park.

[31] Further information on the Working with Natural Processes project, including a mapping user guide, can be found in the reports published here: https://www.gov.uk/government/publications/working-with-natural-processes-to-reduce-flood-risk

5. Flood Risk in Wandsworth

5.1 Overview

5.1.1 This Section provides the strategic assessment of flood risk across the London Borough of Wandsworth from each of the sources of flooding outlined in the NPPF. For each source of flooding, details of any historical incidents are provided, and where appropriate, the impact of climate change on the source of flooding is described. This Section should be read with reference to the figures in **Appendix A.**

5.2 Tidal Flooding

5.2.1 The River Thames forms the northern boundary of London Borough of Wandsworth. This area is protected from flooding by the presence of the Thames Tidal Defences (TTD), comprising raised defences along the Thames frontage as well as the operation of the Thames Barrier further downstream. This area is therefore at residual risk of tidal flooding associated with the River Thames in the event of a failure or overtopping of the existing defences.

Historic Records

5.2.2 The Environment Agency Historic Flood Map, shown in **Appendix A Figure 0**, presents historic river flood extents from 1928, 1937 and 1968. Of these years, flooding from rivers only impacted Wandsworth in 1928. The flooding was limited to areas In Battersea, Nine Elms and Wandsworth that are adjacent to the River Thames.

5.2.3 Of the flood records provided for the Level 1 SFRA, there is only 1 record of tidal flooding, which is on Putney Embankment.

Flood Zones

5.2.4 The River Thames forms the northern boundary of the London Borough of Wandsworth. At this point along its course, the water levels in the River Thames are tidally influenced. Flood Zone mapping included in **Appendix A Figure 1** identifies that a large area covering Battersea and Clapham Junction and smaller areas to the north of Wandsworth and Putney are in Flood Zone 3 associated with the River Thames, which is defined as land that would be expected to flood during a flood event with a 0.5% AEP, when excluding the presence of defences.

5.2.5 In the London Borough of Wandsworth, areas of Flood Zone 3 associated with the River Thames are also defined as ‘Areas Benefitting from Defences’ (ABD), i.e. they are shown to benefit from the presence of flood defences during a 0.5% AEP flood event. The Thames Tidal Defence (TTD) system includes both the raised flood defence walls along the River Thames frontage, as well as the Thames Barrier located downstream at Woolwich.

5.2.6 The risk of tidal flooding to these northern parts of Wandsworth is therefore a residual risk, in the event of a breach or overtopping of the flood defences.

Flood Defences

5.2.7 London benefits from the Thames Tidal Defences (TTD), comprising raised defences along the Thames frontage as well as the operation of the Thames Barrier further downstream. Extracts from the Environment Agency Asset Information Management System (AIMS) provided to inform the Level 1 SFRA show that the River Thames is predominantly defended by the presence of flood walls, as well as a section of embankment at Wandsworth Park. The AIMS dataset is shown in **Appendix A Figure 2 and Figure 3**.

5.2.8 The TE2100 Plan states that the policy for this area of Wandsworth is ‘P5’ – to take further action to reduce flood risk beyond that required to keep pace with climate change. The Plan states that a higher standard of protection will be provided by the Thames Barrier for tidal flood risk for the foreseeable future. Towards the end of the century major investment will be required and the TE2100 appraisal demonstrates that given the commercial, economic and historic value of London, as well as the potential for loss of life in the unlikely event of a flood, a 1:10,000 year standard will be justified for P5 areas. In the Wandsworth to Deptford Thames embayment area there may also be opportunities to set back defences and improve riverside amenity and habitats.

Residual Risk – Breach Modelling

5.2.9 In May 2017, Atkins on behalf of the Environment Agency, undertook the London Thames Breach Assessment which simulated breaches in the flood defences to cover the entire extent between Teddington Weir and the Thames Barrier, totalling 5679 breach locations.

5.2.10 In this location upstream of the Thames Barrier, water levels are a function of the maximum tide level allowed through the Barrier as defined by the barrier closure rule / matrix. Three combinations of flow and tide are modelled to create 'maximum likely water levels' for each model node between Teddington Weir (node 2.1) and the Thames Barrier (node 2.49). This approach considers the imposition of the barrier closure rule, which effectively limits the maximum water level that will be achieved upriver of the Thames Barrier. The three combinations of flow and tide are:

- Upstream of node 2.7 only; a 736 cumec flow with a 2.95mAOD tide at Southend.
- Downstream of 2.7 but upstream of the Thames Barrier; a 421 cumec flow with a 3.55m AOD tide.
- Downstream of 2.7 but upstream of the Thames Barrier a; 52 cumec flow with a 3.85m AOD tide.

5.2.11 The three combinations are chosen because they are at the limit of the flow and tide conditions that would dictate closure of the Barrier and have been shown by previous modelling to generate an aggregate maximum water level profile that is very close to the maximum water level profile produced by previous probabilistic methods.

5.2.12 For future scenarios (i.e. 2065 and 2100) the present day 2005 boundaries are used again, but scaled to fit with higher peaks, in accordance with the levels defined for each node by TE2100.

5.2.13 **Appendix A Figure 4, Figure 5 and Figure 6** show the outputs from the breach modelling for the 2110 epoch in the form of mapping showing maximum flood depth, maximum flood hazard rating and maximum water level information.

5.2.14 Flood hazard categorises the danger to people for different combinations of flood water depth and velocity. The derivation of these categories is based on the methodology set out by Defra in Flood Risks to People FD2320[32] using the following equation:

*Flood Hazard Rating = ((v+0.5)*D) + DF*

Where v = velocity (m/s), D = depth (m), DF = debris factor

Table 5-1 Hazard categories based on FD2320, Defra and Environment Agency, 2005

Flood Hazard		Description
Low	HR < 0.75	Caution: Flood zone with shallow flowing water or deep standing water.
Moderate	0.75 ≥ HR ≤ 1.25	Dangerous for some (i.e. children): Danger: Flood zone with deep or fast flowing water
Significant	1.25 > HR ≤ 2.0	Dangerous for most people: Danger: Flood zone with deep fast flowing water.
Extreme	HR > 2.0	Dangerous for all: Extreme danger: Flood zone with deep fast flowing water.

5.2.15 **Appendix A Figures 4A and 4B** show the maximum flood depths during a potential breach event for the year 2100 vary from 0-2.5 m. Deeper flooding is noted in the lower lying areas of Battersea Park, the area to the west of Albert Bridge Road Nine Elms, Fownes Street adjacent to the railway line to the north east of Clapham Junction, and the area south west of Heathbrook Park including Thackeray Road and the adjoining roads.

5.2.16 **Appendix A Figures 5A and 5B** show that the corresponding hazard ratings for the 2100 epoch are predominantly 'Significant' i.e. danger for most people.

5.2.17 The maximum water levels during these modelled scenarios are shown in **Appendix A Figures 6A and 6B.** In the Wandle delta maximum water levels are ≤6 m AOD. Further east, the levels remain similar along the frontage, but reduce inland. Maximum water levels of ≤5 m AOD to the west of Albert Bridge Road and across Nine Elms. Within Battersea Park, New Covent Garden and further south, the levels are ≤4 m AOD.

[32] Defra and Environment Agency 2005, FD2320 Flood Risks to People

5.3 Flooding from Rivers

Watercourses

5.3.1 The Environment Agency 'Detailed River Network' dataset has been used to identify the watercourses in the study area and their designation (i.e. main river or ordinary watercourse).

5.3.2 The **River Wandle** catchment, which includes the River Graveney tributary, drains a total area of approximately 200 km^2. The Wandle flows from south to north through Merton and Wandsworth and discharges into the Thames at Bell Lane Creek in Wandsworth. The northern half of the catchment is underlain by London Clay with very limited permeability which can generate significant volumes of rapid surface water runoff during periods of heavy rainfall. The Wandle catchment is heavily urbanised and therefore generally responds rapidly to rainfall.

5.3.3 The **River Graveney** follows the boundary between London Borough of Merton and London Borough of Wandsworth and joins the Wandle at Summerstown.

5.3.4 The **Beverley Brook** catchment, which includes the Pyl Brook tributary, drains a total area of approximately 65km^2 and discharges into the Thames at Barn Elms, upstream of Putney. Flood relief culverts are located in the lower catchment, which discharge into the Thames at Barnes Bridge. In the lower reaches the Brook flows through Richmond Park, within the Borough of Richmond upon Thames, before turning northwest and flowing along the western boundary of the Borough of Wandsworth.

Historic Records

5.3.5 Over the last few years, information on historical flooding in the study area has been gathered as part of the preparation of the PFRA, SWMP and most recently the LFRMS. Incidents of property and highway flooding have been provided to Councils from local residents and businesses, Network Rail, Transport for London as well as the Environment Agency. Where possible, the source of the flooding has been identified.

5.3.6 As well as some point data, the Environment Agency has provided an extract from the 'Recorded Flood Outlines' and 'Historic Flood Map' datasets for the study area[33].

5.3.7 Of the records of flooding provided by the stakeholders as part of the Level 1 SFRA, there are two records of fluvial flooding. These records are shown in **Appendix A Figure 1** and are associated with the River Wandle near Earlsfield railway station, and the River Graveney near the borough boundary in Tooting Graveney.

Flood Zones

5.3.8 The risk of flooding is a function of the probability that a flood will occur and the consequence to the community or receptor as a direct result of flooding. The NPPF seeks to assess the probability of flooding from rivers by categorising areas within the fluvial floodplain into zones of low, medium and high probability, as defined in Table 5-2.

Table 5-2 Flood Zones (PPG Table 1[34])

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability (0.1% AEP) of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3).
Zone 2 Medium Probability	Land having between a 1 in 100 (1% AEP) and 1 in 1,000 annual probability (0.1% AEP) of river flooding; or land having between a 1 in 200 (0.5% AEP) and 1 in 1,000 annual probability (0.1% AEP) of sea flooding. (Land shown in light blue on the Flood Map).
Zone 3a High Probability	Land having a 1 in 100 (1% AEP) or greater annual probability of river flooding; or Land having a 1 in 200 (0.5% AEP) or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map).

[33] The Environment Agency 'Recorded Flood Outlines' dataset identifies flood extents associated with specific flood events. The 'Historic Flood Map' shows the greatest extent of past flooding and does not identify individual flood events.
[34] https://www.gov.uk/guidance/flood-risk-and-coastal-change#flood-zone-and-flood-risk-tables

Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map). Refer to Section 5.3.17 for a definition of Functional Floodplain in London Borough of Wandsworth.

5.3.9 The 'Flood Map for Planning (Rivers and Sea)' is available online[35] and is the main reference for planning purposes as it contains Flood Zones 1, 2 and 3 which are referred to in the NPPF. The 'Flood Map for Planning (Rivers and the Sea)' provides information on the areas that would flood if there were no flood defences or buildings in the "natural" floodplain. Flood Zones 1 and 2 have been provided by the Environment Agency for the study area.

5.3.10 The 'Flood Map for Planning (Rivers and Sea)' also identifies areas which, in the event of a river flood with a 1% AEP, or a tidal flood with a 0.5% AEP, would be protected from flooding by the presence of flood defences. These areas are described as 'Areas Benefitting from Defences' (ABD).

5.3.11 The 'Flood Map for Planning (Rivers and Sea)' was first developed in 2004 using national generalised modelling (JFLOW) and is now routinely updated and revised using the results from the Environment Agency's programme of catchment studies, entailing topographic surveys and hydrological and/or hydraulic modelling as well as previous flood events. Most recently, a remodelling study for the River Wandle has just been completed and provided for use within this Level 1 SFRA.

5.3.12 It should be noted that the scope of these modelling studies typically covers flooding associated with main rivers, and therefore ordinary watercourses that form tributaries to the main rivers may not always be included in the model. Modelling of ordinary watercourses available on the 'Flood Map for Planning (Rivers and Sea)' may be the result of the national generalised JFLOW modelling carried out by the Environment Agency and may need to be refined when determining the probability of flooding for an individual site and preparing a site-specific FRA. Further detail regarding the scope of site specific FRAs is provided in Appendix E.

5.3.13 The River Wandle enters Wandsworth from the south, near Summerstown, and flows northwards through the centre of the Borough, before discharging into the River Thames. The river splits in two in the vicinity of Wandle Recreation Ground and Armoury Way, and is culverted in sections, including beneath the Southside Shopping Centre. **Appendix A Figure 1** shows that Wandsworth Town, King George's Park, Southfields, Earlsfield and Summerstown have areas in Flood Zone 2 and 3 associated with the River Wandle,

5.3.14 The River Graveney is a tributary of the River Wandle which defines the south eastern boundary of Wandsworth and joins the River Wandle to the south Wandsworth in the London Borough of Merton. It is culverted in several sections and divides in the vicinity of Tooting, where the northern boundary runs along the Wandsworth boundary before joining the River Wandle. **Appendix A Figure 1** shows that areas to the south of Tooting Graveney are in Flood Zone 2 associated with the River Graveney.

5.3.15 The Beverley Brook flows from south to north through Putney Vale, to the west of Roehampton and Putney Lower Common before joining the River Thames. **Appendix A Figure 1** shows that this is right on the borough boundary and there is very little area within the Borough defined as Flood Zone 2 and 3 associated with the Beverley Brook.

River Modelling

5.3.16 The Environment Agency has undertaken modelling of flooding associated with the main river watercourses in the study area; River Thames, River Wandle (including River Graveney) and Beverley Brook (including Pyl Brook).

Table 5-3 Modelling Studies

Watercourse	Modelling Study
River Wandle and River Graveney	June 2015, JBA Consulting on behalf of the Environment Agency, River Wandle Remodelling Study. Outputs include: • Defended flood event information for the following events: 20%, 5%, 2%, 1.33%, 1%, 1% (plus a 20% increase in flow allowance for climate change), 0.4% and 0.1% AEP events.

[35] https://flood-map-for-planning.service.gov.uk/

	• Undefended flood event information for the following events: 5%, 1%, 1% (plus a 20% increase in flow allowance for climate change) and 0.1% AEP events. August 2017, JBA Consulting on behalf of the Environment Agency, River Wandle Climate Change Modelling. Outputs include: • Defended flood event information for the following events: 1% AEP event including 25%, 35% and 70% increases in flow allowances for climate change. • Undefended flood event information for the following events: 1% AEP event including 25%, 35% and 70% increases in flow allowances for climate change.
Beverley Brook and Pyl Brook	2008/2009, Royal Haskoning on behalf of the Environment Agency, Beverley Brook Flood Risk Mapping Study. Outputs include: • Defended flood event information for the following events: 20%, 5%, 2%, 1%, 1% (plus a 20% increase in flow allowance for climate change) and 0.1% AEP events. • Undefended flood event information for the 1% AEP event. **Position Statement November 2020:** The Beverley Brook is currently being remodelled on behalf of the Environment Agency. Outputs are not yet available to include in the SFRA. When they are received the SFRA should be updated. Outputs are expected to include the following events as a minimum: 5%, 1% and 0.1% AEP, as well as the 1% AEP event including 25%, 35% and 70% increases in flow allowances for climate change.

5.3.17 Modelled outlines for the River Wandle and Beverley Brook are shown in **Appendix A Figure 2 and Figure 3.** The 1% AEP present day defended scenario is shown, as well as the available modelled outlines for the 1% AEP including allowances for the impacts of climate change.

5.3.18 It is noted that the flood extent along the River Wandle for the 1% AEP defended scenario is larger than that for the undefended scenario (and Flood Zone 3, as shown in Appendix A Figure 1). Floodwater is shown to come out of bank north of the railway line at Earlsfield, where it is suggested that maintaining water in-channel in the defended case due to the presence of defences upstream of Plough Lane leads to increased flows and flood extents further downstream due to bank exceedance (JBA, June 2015). Areas of increased flooding under the defended case are less marked in the 5% and 0.1% AEP events.

Functional Floodplain

5.3.19 As noted in Table 5-2, the Functional Floodplain (Flood Zone 3b) is defined as ‘land where water has to flow or be stored in times of flood’ and is not separately distinguished from Flood Zone 3a on the Flood Map for Planning (Rivers and Sea). Rather the SFRA is the place where LPAs should identify areas of Functional Floodplain in discussion with the Environment Agency.

5.3.20 The PPG states that the identification of Functional Floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. However, land which would naturally flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood (such as a flood attenuation scheme) in an extreme (0.1% annual probability) flood, should provide a starting point for consideration and discussions to identify the Functional Floodplain.

5.3.21 Modelled outlines for the 5% AEP event for the River Wandle, River Graveney and Beverley Brook have been used by London Borough of Wandsworth to define Functional Floodplain associated with these watercourses. The modelling shows that these watercourses largely remain ‘in bank’ during the 5% AEP modelled event, and no alterations to these outlines are proposed by the London Borough of Wandsworth. For the River Thames, the functional floodplain is defined as land riverward of the Thames Tidal Flood Defences, excluding the Wandsworth Delta Island.

5.3.22 The outline of Flood Zone 3b Functional Floodplain for the London Borough of Wandsworth and has been mapped in **Appendix A Figure 1.**

Position Statement November 2020: The Beverley Brook is currently being remodelled on behalf of the Environment Agency. Outputs are not yet available to include in the SFRA. When they are received the SFRA should be updated.

Climate Change

5.3.23 A considerable amount of research is being carried out worldwide in an endeavour to quantify the impacts that climate change is likely to have on flooding in future years. Climate change may increase peak rainfall intensity and river flow, which could result in more frequent and severe flood events. Climate change is perceived to represent an increasing risk to low lying areas of England, and it is anticipated that the frequency and severity of flooding will change measurably within our lifetime.

5.3.24 The Environment Agency's online guidance 'Flood risk assessments: climate change allowances'[7] sets out the climate change allowances for peak river flows for each river basin district (as shown in Table 5-4) and provides advice on applying climate change projections when preparing flood risk assessments.

Table 5-4 Peak river flow allowances by river basin district

River basin district	Allowance category (as defined by NPPF)	Total potential change in peak river flow anticipated for the '2020s' (2015 to 2039)	Total potential change in peak river flow anticipated for the '2050s' (2040 to 2069)	Total potential change in peak river flow anticipated for the '2080s' (2070 to 2115
Thames	Upper end	25%	35%	70%
	Higher central	15%	25%	35%
	Central	10%	15%	25%

5.3.25 As noted in Table 5-3, as part of the hydraulic modelling of the River Wandle simulations have been run for the 1% AEP event including 25%, 35% and 70% climate change allowances. These model runs include the presence of defences. The current available modelling for the Beverley Brook includes a 20% allowance for climate change. The flood extents are included in **Appendix A Figure 2 and Figure 3** as well as more detailed figures in **Appendix C.1**.

5.3.26 The mapping shows that in the future the extent of flooding from the River Wandle associated with the 1% AEP event is anticipated to increase in the following locations:

- Significant increase in the extent of flooding in the River Wandle delta in the north of the Borough, extending from King George's Park north to the railway embankment;
- To the south east of King George's Park, flooding is shown to increase in the future on the eastern bank of the Wandle, affecting the area between the River Wandle and Garrat Lane and across to the railway embankment;
- Flooding is also shown to occur in the future on the western bank of the River Wandle, affecting current open land in Southfields.

5.3.27 There is very minimal increase in flooding shown along the Beverley Brook.

Position Statement November 2020: The Beverley Brook is currently being remodelled on behalf of the Environment Agency. Outputs are not yet available to include in the SFRA. When they are received the SFRA should be updated. Outputs are expected to include the following events as a minimum: 5%, 1% and 0.1% AEP, as well as the 1% AEP event including 25%, 35% and 70% increases in flow allowances for climate change.

Ordinary Watercourses

5.3.28 There are a number of ordinary watercourses in the Borough which are tributaries of the main rivers, as shown in **Appendix A Figure 1**. The majority of the ordinary watercourses are located in the Putney Heath and Putney Vale area in the southwest of the borough and are tributaries of the Beverley Brook. A further ordinary

watercourse is located in the Summertown area and is a tributary of the River Wandle. The head of the watercourse is located in the vicinity of Lambeth Cemetery and flows northwest through Summerstown to discharge to the River Wandle northwest of Garratt Park; the watercourse is culverted between Wimbledon Road and the River Wandle.

5.3.29 Within Wandsworth, 1.9 km of ordinary watercourse is culverted. Trash screens at the entrances to culverts and culverts themselves have the potential to become blocked by items such as plant debris and rubbish. Blockages can restrict the natural flow of water, increasing the chance of water flowing out of bank and causing local flooding due to the reduced conveyance potential of the associated watercourse. The risk of flooding from ordinary watercourses can therefore be very localised. Effective management is dependent on adopting appropriate inspection and maintenance regimes to ensure this risk is minimised where possible. Within Wandsworth, the most significant risk from culverted ordinary watercourses is in Summerstown in the vicinity of Lambeth Cemetery. London Borough of Lambeth Council own and maintain the ordinary watercourses within Lambeth Cemetery.

5.3.30 The maintenance of ordinary watercourses that are not owned by the LLFA is the responsibility of the riparian owner. Further details of the responsibilities of the riparian owners are stated in the LFRMS for London Borough of Wandsworth.

5.3.31 There are no historic recorded incidents of ordinary watercourse flooding within Wandsworth. Often, where blocked ditches or streams have been reported as being the cause of flooding this has been reported as occurring with other sources, e.g. sewer or surface water runoff, and therefore will have been reported as multiple sources of flooding in the dataset.

5.3.32 No modelling of the flood risk from ordinary watercourses has been undertaken to date across Wandsworth. Therefore, future flood risk is based on the potential risk that might arise based on knowledge of know flooding hotspots and potential mechanisms for flooding.

Flood Defences

5.3.33 Flood defences are structures which affect flow in times of flooding in order to reduce the risk water entering property. They generally fall into one of two categories; ‘formal’ or ‘informal’.

5.3.34 A ‘formal’ flood defence is a structure which has been specifically built to control floodwater. It is maintained by its owner or statutory undertaker so that it remains in the necessary condition to function. In accordance with the FWMA, the Environment Agency has powers to construct and maintain defences to help against flooding.

5.3.35 An ‘informal’ defence is a structure that has not necessarily been built to control floodwater and is not maintained for this purpose. This includes road and rail embankments and other linear infrastructure (buildings and boundary walls) which may act as water retaining structures or create enclosures to form flood storage areas in addition to their primary function.

5.3.36 A study of informal flood defences has not been made as part of this assessment. Should any changes be planned in the vicinity of road or railway crossings over rivers in the study area it would be necessary to assess the potential impact on flood risk to ensure that flooding is not made worse either upstream or downstream. Smaller scale informal flood defences should be identified as part of site specific FRAs and the residual risk of their failure assessed.

5.3.37 In accordance with the scope of a Level 1 SFRA, a high level review of formal flood defences has been carried out using data from the Environment Agency Asset Information Management System (AIMS). This dataset contains details of flood defence assets associated with main rivers and provides a good starting point for identifying significant local defences and potential areas benefiting from defences, but the quantity and quality of information provided differs considerably between structures. The AIMS is intended to provide a reasonable indication of the condition of an asset and should not be considered to contain consistently detailed and accurate data (this would be undertaken as part of a Level 2 SFRA or site specific FRA where the need arises).

5.3.38 Extracts from the Environment Agency Asset Information Management System (AIMS) included in **Appendix A Figure 2 and Figure 3** show that the River Wandle is protected by high ground for most of its course throughout London Borough of Wandsworth. There is a culverted section beneath the shopping centre in Wandsworth Town

and the upstream extent north of Wandsworth High Street as well as the Bell Lane Creek are defended by flood defence walls which form part of the Thames Tidal Defence (TTD) system.

Flood Warning Areas

5.3.39 The Environment Agency provides a free Flood Warning Service[36] for many areas at risk of flooding from rivers and the sea. In some parts of England, the Environment Agency may be able to provide warnings when flooding from groundwater is possible. The Environment Agency has provided a GIS layer of Flood Warning Areas in the study area. There are 7 Environment Agency Flood Warning Areas in Wandsworth; 3 for tidal flooding associated with the River Thames, and 4 for fluvial flooding. These are identified in **Appendix A Figure 7** as follows:

- Tidal Thames from Putney Bridge to Mortlake High Street East
- Tidal Thames from Wandsworth Bridge to Putney Bridge
- Tidal Thames from Deptford Creek to Wandsworth Bridge
- River Wandle at Wandsworth
- River Wandle at Wimbledon
- River Graveney at Tooting and Colliers Wood
- Beverley Brook at Wimbledon Common and Richmond Park

Emergency Rest Centres

5.3.40 Each of the London Boroughs has provided details of the emergency rest centres within their administrative areas which are designated in the Multi-Agency Flood Plan. Designated emergency rest centres for London Borough of Wandsworth are mapped in **Appendix A Figure 7** and summarised in Table 5-5.

Table 5-5 Emergency Rest centres in London Borough of Wandsworth

Rest Centre	Address	Post Code	Easting	Northing
Ackroydon Hall	26 Montfort Place	SW19 6QL	523912	173494
Alton Community Hall	1 Petersfield Rise	SW15 4AE	522524	173482
Ashburton Youth Office	Westleigh Avenue	SW15 6XD	523027	174503
Derinton Road Clubroom	101a/b Derinton Road	SW17 8HZ	527978	171855
Devas Youth Club	2A Stormont Road	SW11 5EN	528147	175606
Dimson Lodge	141 Battersea Church Road	SW11 3NR	526881	176870
Roehampton Library	2 Danebury Avenue	SW15 4HD	522250	173780
Salvation Army Congress Hall	38 Balham High Road	SW12 9AH	528714	173719
Kambala Clubroom	125 Fawcett Close	SW11 2LU	526989	176053
York Gardens Library	34 Lavender Road	SW11 2UG	526671	175816
The Venue (aka Park Court Clubroom)	Battersea Park Road	SW11 4LE	528620	176796
Wilditch Community Centre	48 Culvert Road	SW11 5BB	527925	176360
Northcote Library	155e Northcote Road	SW11 6HW	527638	174504
Balham Library	16 Ramsden Road	SW12 8QY	528512	173445
Dryburgh Hall (Putney Leisure Centre)	Dryburgh Road	SW15 1BL	523138	175375
Putney Library	5/7 Disraeli Road	SW15 2DR	524033	175149
Focus Hall Clubroom	Minstead Gardens	SW15 4EB	521725	173874
Roehampton Sport & Fitness Centre	Laverstoke Gardens	SW15 4JB	522168	173716
Lola Jones Hall & Tooting Leisure Centre	Greaves Place	SW17 0NE	527041	171597
Earlsfield Library	276 Magdalen Road	SW18 3NY	526117	173051
Wandle Recreation Centre	Mapleton Road	SW18 4DN	525673	174198
Southfields Library	300 Wimbledon Park Road	SW19 6NL	524588	173139
R.O.S.E. (Residents of Savona Estate)	Ascalon Street	SW8 4DL	529095	177016
Manresa Pensioners Clubroom	Fontley Way	SW15 4LY	522272	173493
Ashburton Sheltered Housing Clubroom	280-308 Cortis Road	SW15 6XQ	523211	174403
Carey Gardens Clubroom	234 Carey Gardens	SW8 4HW	529507	176670

[36] https://flood-warning-information.service.gov.uk/warnings

Pearson House Clubroom	Horne Way	SW15 1HY	523242	176173
Latchmere Leisure Centre	Burns Road	SW11 5AD	527618	176267

5.4 Flooding from Surface Water

5.4.1 Overland flow and surface water flooding typically arise following periods of intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems. It can run quickly off land and result in localised flooding. The PPG states that an SFRA should identify areas at risk from surface water flooding and drainage issues, taking account of the surface water flood risk published by the Environment Agency as well other available information.

Risk of Flooding from Surface Water Mapping

5.4.2 The Environment Agency has undertaken modelling of surface water flood risk at a national scale and produced mapping identifying those areas at risk of surface water flooding during three annual probability events: 1 in 30 year (3.33% annual probability), 1 in 100 year (1% annual probability) and 1 in 1,000 year (0.1% annual probability). The extents of the latest version of the mapping have been made available for the Level 1 SFRA as GIS layers. This mapping is referred to as 'Risk of Flooding from Surface Water' (ROFSW) and is also available online on the Long Term Flood Risk Map[37].

5.4.3 The ROFSW mapping provides all relevant stakeholders, such as the Environment Agency, LPAs and the public access to information on surface water flood risk which is consistent across England and Wales. The modelling helps the Environment Agency take a strategic overview of flooding and assists LLFAs in their duties relating to management of surface water flood risk. For the purposes of this SFRA, the mapping allows an improved understanding of areas within the study area which may have a surface water flood risk.

5.4.4 It should be noted that this national mapping has the following limitations:

- Use of a single drainage rate for all urban areas,
- It does not show the susceptibility of individual properties to surface water flooding,
- The mapping has significant limitations for use in flat catchments,
- No explicit modelling of the interaction between the surface water network, the sewer systems and watercourses,
- In a number of areas, modelling has not been validated due to a lack of surface water flood records, and
- As with all models, the ROFSW mapping is affected by a lack of, or inaccuracies, in available data.

5.4.5 The recorded incidents of surface water flooding held by London Borough of Wandsworth are supported by the ROFSW mapping. The mapping is included in **Appendix A Figures 8A – 8C** and shows that there is high probability of flooding along Northcote Road (B226) and Oldridge Road in the east of the Borough, as well as throughout Clapham adjacent to the railway lines and along the course of the former Falcon Brook in Battersea. The mapping shows a large area of flooding in King George's Park where the topography is low, and in the north of Putney in the west of the Borough.

Climate Change

5.4.6 The Environment Agency's online guidance 'Flood risk assessments: climate change allowances'[7] sets out the climate change allowances for peak rainfall intensity (as shown in Table 5-6) and provides advice on applying climate change projections when preparing flood risk assessments.

Table 5-6 Peak rainfall intensity allowances in small and urban catchments (1961-1990 baseline)

Applies across all of England Allowance Category	Total potential change in peak river flow anticipated for the '2020s' (2015 to 2039)	Total potential change in peak river flow anticipated for the '2050s' (2040 to 2069)	Total potential change in peak river flow anticipated for the '2080s' (2070 to 2115
Upper end	10%	20%	40%

[37] https://flood-warning-information.service.gov.uk/long-term-flood-risk

Central	5%	10%	20%

5.4.7 The ROFSW does not include a specific scenario to determine the impact of climate change on the risk of surface water flooding. However, a range of three annual probability events have been undertaken, 3.3%, 1% and 0.1% and therefore it is considered appropriate to use the 0.1% AEP event as a substitute dataset to provide a worst case scenario and an indication of the implications of climate change.

Drainage Catchments

5.4.8 As part of the Level 1 SFRA, Drainage Catchments (DCs) have been determined across the London Borough of Wandsworth in order to better understand and manage the risk from surface water flooding. Drainage catchments outline the area of the land that influences the surface water drainage at a certain point. The DCs are based on the natural catchments and watersheds provided within the Flood Estimation Handbook CD-ROM which have then been amended using local knowledge to account for significant infrastructure within the study area that could impact on drainage such as railway lines. It is intended that these DCs will be useful for identifying the natural drainage patterns in the local area when considering new development and future regeneration in the study area. 20 Drainage Catchments (DC) have been identified in Wandsworth, as shown in **Appendix A Figures 8A – 8C.**

Historic Records

5.4.9 Historic flooding records from local residents and businesses, Network Rail, Transport for London and the Environment Agency have been gathered by each of the London Boroughs as part of the preparation of the PFRA, SWMP and the LFRMS. These records have been obtained and used to inform this Level 1 SFRA Where possible, the source of the flooding has been identified.

5.4.10 London Borough of Wandsworth has experienced a number of surface water flood events, the most notable of which was the 20th July 2007 where intense periods of rainfall caused flash floods and the capacity of the existing drainage system to be exceeded in several locations across the Borough. This caused overland flow and ponding in low-lying areas and impacted residents, businesses and the transport network across the Borough. Table 5-7 provides an overview of other surface water flooding events that have occurred in London Borough of Wandsworth.

Table 5-7 Past surface water flood events in London Borough of Wandsworth, SWMP

Flood Event*	Description
7th August 2002 *(Source unknown)*	• Flooding incidents were recorded by the London Fire Brigade across the London Borough of Wandsworth. The exact source of these incidents in unknown.
20th July 2007 *(Surface water)*	• Intense periods of rainfall caused flash floods and the capacity of the existing drainage system to be exceeded in several locations across the Borough. This caused overland flow and ponding in low lying areas and impacted residents, businesses and the Council. The equivalent of three months of rain fell in just two hours. • London Underground records report Tooting Bec (3.5 hours) and Tooting Broadway (8 hours) railway stations being closed due to flooding during 20th July 2007. • The Council depot site containing technical services equipment flooded with around 18 inches of flood water at the gate running up close to council buildings. Damage was incurred to council equipment and vehicles. • The emergency response centre took over 400 calls from the public. • The total costs of repairs for the Council amounted to over £400,000, much of which was covered by insurance. Schools, public buildings, residential properties and the transport network, and council vehicles all suffered damage.
20th July 2009 *(Surface water)*	• Heavy rainfall event reported to have impacted the London Borough of Wandsworth. Southside Shopping Centre in Wandsworth and South Thames College were evacuated, with significant disruptions to transport and other damage caused, as a result of torrential downpours.

Regular Flooding *(Surface Water)*	• Runoff from the highway onto the railway track between Clapham Junction and Battersea Rise stations causes surface water flooding (Network Rail) • Three foot of flooding has been recorded at Armoury Way (junction with Wandsworth Plain) during heavy rainfall. • 300mm flooding has been recorded at Frogmore during heavy rainfall. • Gullies can become blocked providing insufficient capacity for surface water along Latchmere Road (under rail bridge). • Putney Bridge Road (under rail bridge near Point Pleasant) frequently floods (up to 1.5m) during rainfall events. • Surface water ponding during heavy rainfall has been reported by Wandsworth Borough Council at: – Siward Road / Maskell Road area – Stag Lane (underpass) – Summerstown (junction with Wimbledon Road) – Swandon Way (under rail bridge) • Underpasses throughout the Borough are prone to flooding due to insufficient gully capacity
Regular Flooding *(Combined Sources)*	• Surface water ponding and potential backing up of sewers during heavy rainfall have been reported by Wandsworth Borough Council at: – Battersea Park Road – Battersea Rise (junction with Northcote Road) – Besley Street – Northcote Road • Back up of sewers during heavy rainfall can cause flooding along Latchmere Road. • Surface water ponding and potential fluvial flooding from River Graveney during heavy rainfall have been reported by Wandsworth Borough Council along Kenlor Road. • Surface water ponding and potential fluvial flooding from River Wandle during heavy rainfall have been reported in the Wandle Valley.

*Notes: * Where the source of flooding is known this has been indicated*

5.4.11 As part of the SWMP for London Borough of Wandsworth, 11 CDAs were identified across the Borough, as presented in Table 5-8.

Table 5-8 SWMP Critical Drainage Areas in London Borough of Wandsworth

CDA ID	CDA Name	CDA ID	CDA Name
Group7_014	Putney Heath	Group7_020	South Balham
Group7_015	King Georges Park	Group7_021	Clapham Junction South
Group7_016	Trinity Road	Group7_022	Clapham Junction
Group7_017	St Georges Hospital	Group7_023	Lavender Hill
Group7_018	Summerstown	Group7_024	Tooting Bec
Group7_019	Earlsfield		

5.4.12 A large part of the surface water flooding that takes place in London Borough of Wandsworth occurs along the route of the 'lost' Falcon Brook, which runs north to south through the east of the Borough (Group7_022 (Clapham Junction) CDA). Significant ponding of surface water is shown to impact Summerstown, Nine Elms, Lavender Hill, Earlsfield, Balham and St. George's Hospital, with the Falcon Road (Clapham Junction area), South Balham and Lavender Hill areas historically flooded during heavier rainfall events. The Falcon Road, Tooting Bec and Nine Elms areas are impacted from upstream surface water flows from neighbouring London Borough of Lambeth.

5.5 Flooding from Groundwater

5.5.1 Groundwater flooding usually occurs in low lying areas underlain by permeable rock and aquifers that allow groundwater to rise to the surface through the permeable subsoil following long periods of wet weather. Low lying areas may be more susceptible to groundwater flooding because the water table is usually at a much shallower depth and groundwater paths tend to travel from high to low ground.

Historic Records

5.5.2 Over the last few years, information on historical flooding in the study area has been gathered by each of the London Boroughs in accordance with their duties as LLFAs, and as part of the preparation of the PFRA, SWMP and most recently the LFRMS. Where possible, the source of the flooding has been identified. It should be noted that there has not been a statutory obligation to record incidences of groundwater flooding in the past and therefore it is likely that the groundwater flooding incidents recorded are not exhaustive.

5.5.3 There have been 52 records of reported historic flooding from groundwater (**Appendix A Figure 9**). Instances of groundwater flooding have been reported in a number of areas in Wandsworth, with the majority clustering in the areas of Putney, south east of Wandsworth Town, Balham, Battersea and Upper Tooting.

5.5.4 As noted in the SWMP for London Borough of Wandsworth, the historical records show that many of the reported incidents refer to the flooding of cellars / basements, which is a common outcome of a rising water table following a period of heavy or consistent rainfall, particularly in shallow aquifers often associated with superficial deposits.

5.5.5 Some flooding incidents in Battersea and near Tooting Bec Common are located over the London Clay Formation, where it is overlain by Langley Silt Member, or there are no known overlying superficial deposits. The London Clay Formation is an aquiclude and does not permit groundwater flow (and the Langley Silt Member is an aquitard). Therefore, based on the available information, these incidents are possibly related to poor drainage and surface water flooding i.e. they are not true groundwater flooding incidents. However, it is conceivable that a portion of the surface water is derived from springs / seepages associated with a nearby aquifer outcrop.

Susceptibility to Groundwater Flooding

5.5.6 In response to the need for more information on groundwater flooding, BGS has produced the first national dataset on the susceptibility of groundwater flooding. Based on geological and hydrogeological information, the digital data can be used to identify areas where geological conditions could enable groundwater flooding to occur and where groundwater may come close to the ground surface. Note, it is a susceptibility set, it does not indicate hazard or risk, i.e. it does not provide any information on the depth to which groundwater flooding occurs or the likelihood of the occurrence of an event of a particular magnitude.

5.5.7 The ‘Susceptibility to Groundwater Flooding’ dataset is divided into three classes – High, Medium and Low risk as follows:

- High – areas with the potential for groundwater flooding to occur at the surface;
- Medium – areas which may experience groundwater flooding of property situated below the ground surface i.e. basements;
- Low – areas with limited potential for groundwater flooding to occur.

5.5.8 The BGS state that the dataset is suitable for use for regional or national planning purposes where the groundwater flooding information will be used along with a range of other relevant information to inform land-use planning decisions. It might also be used in conjunction with a large number of other factors, e.g. records of previous incidence of groundwater flooding, rainfall, property type, and land drainage information, to establish relative, but not absolute, risk of groundwater flooding at a resolution of greater than a few hundred metres. The susceptibility data should not be used on its own to make planning decisions at any scale, and, in particular, should not be used to inform planning decisions at the site scale. The susceptibility data cannot be used on its own to indicate risk of groundwater flooding.

5.5.9 The Susceptibility to Groundwater Flooding dataset provided by the BGS can be used to identify areas where geological conditions could enable groundwater flooding to occur and where groundwater may come close to the ground surface.

5.5.10 **Appendix A Figure 9** indicates that there is potential for groundwater flooding to occur at surface along the River Wandle corridor (Wandsworth Town southwards to Summerstown), to the west in Putney and along the Beverly Brook corridor, and to the east from Streatham Park to Balham and in Battersea.

5.5.11 There are areas shown to have potential for groundwater flooding to occur below ground level to the east of the River Wandle, Wandsworth Common, Clapham Common, areas of Balham, Tooting Graveney, and along the riverside of the River Thames.

5.5.12 Areas with limited potential for groundwater flooding to occur include to the west of Clapham Common, a corridor either side of the A214 from Wandsworth Common southwards to Upper Tooting and Furzedown, southwest of Wandsworth Town and areas within Putney Heath.

5.5.13 The susceptibility to groundwater flooding in the London Borough of Wandsworth may change as a result of climate change, or changes to water management. One of the climate change predictions includes an increase of high rainfall events. This could lead to further groundwater flooding in the study area due to increased perched groundwater levels and associated spring flows. It is also noted that a shift in drainage policy, with increased infiltration SUDS, may also lead to increased incidents of groundwater flooding. The small perched superficial deposit aquifers will be sensitive to increased recharge due to their limited storage capacity.

South London groundwater situation report

5.5.14 The Environment Agency monitor groundwater levels in south London and provide situation report updates online[38]. The reports are updated as regularly as the prevailing conditions require. The situation report sets out the current groundwater levels, the forecast of flooding, the steps the Environment Agency are currently taking and when the next update is anticipated.

5.6 Flooding from Sewers

5.6.1 During heavy rainfall, flooding from the sewer system may occur if:

i. The rainfall event exceeds the capacity of the sewer system/drainage system: Sewer systems are typically designed and constructed to accommodate rainfall events with a 3.3% AEP or less. Therefore, rainfall events with a return period of frequency greater than 3.3% AEP would be expected to result in surcharging of some of the sewer system. While TWUL, as the sewerage undertaker for the study area, recognise the impact that more extreme rainfall events may have, it is not cost beneficial to construct sewers that could accommodate every extreme rainfall event.

ii. The system becomes blocked by debris, sediment or fat: Over time there is potential that road gullies and drains become blocked from fallen leaves, build-up of sediment and debris (e.g. litter). Fat build up within the main sewer system is also a contributing factor of sewer flooding.

iii. The system surcharges due to high water levels in receiving watercourses: Within the study area there is potential for surface water outlets to become submerged due to high river levels. When this happens, water is unable to discharge. Once storage capacity within the sewer system itself is exceeded, the water will overflow into streets and potentially into houses. Where the local area is served by ‘combined’ sewers i.e. containing both foul and storm water, if rainfall entering the sewer exceeds the capacity of the combined sewer and storm overflows are blocked by high water levels in receiving watercourses, surcharging and surface flooding may again occur but in this instance floodwaters will contain untreated sewage.

Historic Records

5.6.2 As part of the SWMP, TWUL provided information (through their DG5 register) on the total number of properties affected by and at risk of sewer flooding (both internally and externally) based on historic flooding over the previous 10 years. The information presented within the SWMP highlights the wards of Balham, Thamesfield, and Latchmere as having experienced a greater number of sewer flooding incidents than the rest of the Borough.

5.6.3 **Appendix A Figure 10** shows the DG5 Register that has been supplied by TWUL for the SFRA. It should be noted that TWUL focus their efforts on removing properties from the DG5 register and therefore this information may not accurately represent those properties currently at risk.

Climate Change

5.6.4 Climate change is anticipated to increase the potential risk from sewer flooding as summer storms become more intense and winter storms more prolonged. This combination is likely to increase the pressure on the existing

[38] https://www.gov.uk/government/publications/mole-and-south-london-groundwater-situation

efficiency of sewer systems, thereby reducing their design standard and leading to more frequent localised flooding incidents.

5.6.5 TWUL will monitor the risk of sewer flooding and put plans in place to manage this, as required, based on their business plan and priorities. London Borough of Wandsworth will work with TWUL to identify flooding hotspots and locations of known sewer capacity issues where risk could be exacerbated. TWUL prioritise investment for potential flood alleviation schemes depending on the severity and frequency of flooding, but this can only be identified where affected property owners report the incident to the water company.

Consulting with Thames Water Utilities Ltd

5.6.6 As part of their Sites Allocation process, London Borough of Merton and Wandsworth will consult with Thames Water to determine any areas with sewer capacity issues.

5.7 Flooding from Other Sources

Risk of Flooding from Reservoirs

5.7.1 The failure of a reservoir has the potential to cause catastrophic damage due to the sudden release of large volumes of water. The PPG encourages LPAs to identify any impounded reservoirs and evaluate how they might modify the existing flood risk in the event of a flood in the catchment it is located within, and / or whether emergency draw-down of the reservoir will add to the extent of flooding.

5.7.2 There have been no recorded incidents of reservoir flooding within London Borough of Wandsworth. The Environment Agency dataset 'Risk of Flooding from Reservoirs' available on the Long Term Flood Risk Map identifies that if Wimbledon Park Lake were to fail there is the potential for wide-scale flooding downstream. Flood waters would flow north-east from Wimbledon Park Lake into the River Wandle and into the London Borough of Wandsworth, and subsequently northwards towards the River Thames.

Table 5-9 Areas at risk of flooding from reservoirs

Name	Owner	Local Authority	Grid Ref	Areas affected
Wimbledon Park Lake	London Borough of Merton	London Borough of Merton	524874, 172403	Drains north east towards Durnsford Road and Earlsfield. Follows the course of the River Wandle into King George's Park in London Borough of Wandsworth.

5.7.3 Reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs must be inspected and supervised by reservoir panel engineers on a yearly basis. As the enforcement authority for the Reservoirs Act 1975 in England, the Environment Agency are responsible for ensuring that reservoirs are inspected regularly, and essential safety work is carried out. These reservoirs therefore present a managed risk. As the undertaker for Wimbledon Park Lake, London Borough of Merton Council is required to ensure that inspections are carried out by a qualified panel engineer and that necessary safety work is completed as required to reduce the likelihood of any failure. London Borough of Wandsworth is responsible for working with members of the Local Resilience Forum (LRF) to develop emergency plans for reservoir flooding and ensuring communities are well prepared.

Artificial sources

5.7.4 Additional waterbodies in the borough include lakes and ponds in Battersea Park, Clapham Common, Wandsworth Common, Roehampton Golf Course, Tooting Bec Common, Tooting Graveney Common, King Georges Park and Roehampton University. These are however smaller in volume and therefore are not classified as reservoirs.

5.8 Cumulative impact of development or land-use change

5.8.1 There is potential for development and land-use change across a given study area to have a cumulative impact on the risk of flooding. For example, the Environment Agency SFRA guidance available online[39] notes that impacts may arise collectively as a result of strategically planned development, windfall development, permitted development, significant changes in land use, such as paving over domestic gardens or reforestation of uplands.

5.8.2 The following issues have been identified as having the potential to result in a cumulative impact on flood risk in London Borough of Wandsworth:

- Strategically planned development – Crossrail 2 is set to pass through the Borough from Merton, through Tooting and Balham and on to Clapham Junction. An indicative route is shown in Figure 5-1. This new transport infrastructure is likely to act as a catalyst for further development. Cumulatively, the works associated with strategic transport links as well as the ongoing development that will result over time, has the potential to impact the urban environment, and thereby the risk of flooding.
- Replacing soft landscaping within gardens to provide off street parking, or lower maintenance outside space, has an effect on the rate of surface water runoff to receiving surface water drainage systems and watercourses when considered cumulatively across the Borough. Given the position of London Borough of Wandsworth at the lower end of the catchments of the River Wandle and the Beverley Brook, it is also receiving the cumulative impact of changes made upstream in the catchment.
- Permitted development includes alterations to properties that are limited in their extent, and therefore do not require planning permission. These types of alterations have the potential to result in increase in surface water runoff and therefore, cumulatively, affect the risk of flooding to the local area.
- Policies G1 and G5 within the Intend to Publish London Plan promote the use of green infrastructure and urban greening throughout urban design. The aspiration is that cumulatively these measures will improve the ability of the urban environment to store and reuse rainwater, thereby reducing surface water runoff. This in turn has the potential to reduce localised surface water flooding and rates of runoff to receiving waterbodies.

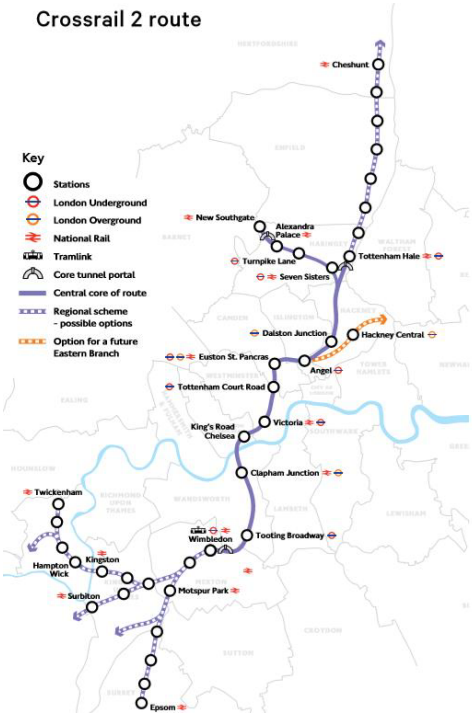


Figure 5-1 Indicative plans for Crossrail 2[40]

[39] https://www.gov.uk/guidance/local-planning-authorities-strategic-flood-risk-assessment
[40] https://www.merton.gov.uk/assets/Documents/what_you_need_to_know_about_crossrail2_safeguarding_nov14.pdf

5.9 Opportunities to reduce the causes and impacts of flooding

5.9.1 New development and plans underway by different Risk Management Authorities present opportunities to reduce the causes and impacts of flooding. This section describes some of the opportunities identified. Reference should also be made to Appendix D Managing and Mitigating Flood Risk for details of measures that can be implemented at the site planning and building design level to reduce the impacts of flooding.

Improving defences – Thames Estuary 2100 Plan

5.9.2 The Thames Estuary 2100 Plan sets out how the Environment Agency and their partners can work together to manage tidal flood risk, from now until the end of the century. London Borough of Wandsworth is in the policy units for Wandsworth to Deptford and Barnes to Kew. The policy in both policy units is P5 to take further action to reduce flood risk beyond that required to keep pace with climate change. Therefore, the standard of flood defence against tidal flooding will be increased in the future.

- Future raising of the flood defence levels by up to 0.5 m in 2065 and an additional 0.5 m in 2100.
- Corridors of land of 16 m width along the existing flood defences should be safeguarded. This should include space for maintaining, replacing and improving the flood defences.

5.9.3 There are also a number of drainage outfalls with tidal flap gates to prevent flow from the Thames into the drainage systems. The drainage outfalls into the Thames may require improvement as the sea level rises and storm rainfall increases, because drainage of the floodplains will become more difficult.

Thames Catchment Flood Management Plan

5.9.4 The vision and preferred policy for this sub-area is Policy Option 4: Areas of low, moderate or high flood risk where the flood risk is being managed effectively but where further actions may be needed to keep pace with climate change. The Environment Agency has set out the following proposed actions to implement the preferred policy:

- We will continue to make sure the recommendations in SFRAs and Local Development Framework policies create the potential to reduce flood risk through regeneration.
- We will play our part in adopting a strategic approach to planning so that wider community objectives as well as flood risk objectives can be met.
- We will develop our emergency response planning to deal with extreme floods, including raising public awareness and working with key partners to identify critical infrastructure at flood risk.
- We want to continue to maintain the existing flood defences and when redevelopment takes place, replace and improve them so that they are more effective against the impacts of climate change. We will be looking to remove culverts and other structures that cause significant conveyance problems. An example of this is our work in the Ravensbourne catchment.
- With our partners, we will look for opportunities to reduce flood risk by recreating river corridors in urban areas. We will influence people who shape the urban environment and harness these opportunities, allowing space for water, habitat, wildlife and recreation.

Environment Agency River Wandle Project

5.9.5 The River Wandle Modelling Study (2015) indicates that there are approximately 3500 residential properties at risk of flooding in events up to and including the 1% AEP (1 in 100 year) flood event throughout the catchment. The Environment Agency are in the early stages of a project on the River Wandle catchment working with Local Authorities and other Risk Management Authorities to reduce flood risk to communities on the River Wandle. The Environment Agency has approved a catchment action plan for the River Wandle that will deliver on the objectives of the new Draft FCERM Strategy. Subject to business case approval, the action plan will reduce flood risk and improve resilience throughout the catchment by maintaining existing assets, delivering new flood risk schemes, improving community resilience and strengthening emergency plans. The plan prioritises actions that will mitigate increased river flows resulting from climate change.

Strategic Transport Improvements

5.9.6 Proposals for Crossrail 2 will entail significant works within London Borough of Wandsworth and once the infrastructure comes forward, areas of land may come forward for redevelopment. There works provide key opportunities to influence how the built environment is designed, and how future development is brought forward.

5.9.7 Parts of the routes for these transport networks are identified to be at risk of surface water flooding on the ROFSW. Opportunities to address the surface water flooding mechanisms and provide large scale improvements to the local area should be sought as part of the development proposals.

Working with Natural Processes

5.9.8 Compared to flood defences and flood storage, floodplain restoration represents the most sustainable form of strategic flood risk solution, by allowing watercourses to return to a more naturalised state, and by creating space for naturally functioning floodplains working with natural processes. Although the restoration of floodplain is difficult in previously developed areas where development cannot be rolled back, the following measures are methods that could be implemented to help catchment and floodplain restoration:

- Promoting existing and future brownfield sites that are adjacent to watercourses to naturalise banks as much as possible.
- Buffer areas around watercourses provide an opportunity to restore parts of the floodplain.
- Removal of redundant structures to reconnect the river and the floodplain.
- Avoid placing new development within the floodplain.

5.9.9 A review of the mapping outputs from the Environment Agency led research project 'Working with Natural Processes' has been used to identify potential locations for Working with Natural Processes (WWNP) in the Borough[41]. Four of these layers are included in **Appendix A Figure 11** and summarised below:

- WWNP Floodplain Reconnection Potential – best estimate of locations where it may be possible to establish reconnection between a watercourse and its natural floodplain, especially during high flows. The dataset is designed to support signposting of areas where there is currently poor connectivity such that flood waters are constrained to the channel and flood waves may therefore propagate downstream rapidly.
- WWNP Floodplain Woodland Potential – best estimate of locations where tree planting on the floodplain may be possible, and effective to attenuate flooding. The dataset is designed to support signposting of areas of floodplain not already wooded.
- WWNP Riparian Woodland Potential – best estimate of locations where tree planting may be possible on smaller floodplains close to flow pathways, and effective to attenuate flooding. The dataset is designed to support signposting of riparian areas not already wooded.
- WWNP Wider Catchment Woodland Potential – best estimate of locations where there are slowly permeable soils, where scrub and tree planting may be most effective to increase infiltration and hydrological losses. The dataset is designed to support signposting of areas not already wooded.

5.9.10 In Wandsworth, opportunities for floodplain reconnection are identified in small pockets along the Wandle throughout Summerstown, Earlsfield and Wandsworth town. Opportunities for floodplain, riparian and wider catchment woodland potential are identified adjacent to the Beverley Brook in Putney Vale, throughout Putney Heath and the in north west of the Borough where the Beverley Brook flows into the Thames.

Green infrastructure and urban greening plans

5.9.11 Policies G1 and G5 in the London Plan within the Intend to Publish London Plan place an emphasis on the use of green infrastructure and urban greening throughout urban design. The incorporation of these elements into the future redevelopment of parts of Merton has the potential to reduce the causes and impacts of flooding.

5.9.12 As London Borough of Wandsworth develop their Green Infrastructure, Biodiversity and Open Space Strategy, this provides a key opportunity to maximise opportunities to reduce the causes of surface water flooding and their

[41] Further information on the Working with Natural Processes project, including a mapping user guide, can be found in the reports published here: https://www.gov.uk/government/publications/working-with-natural-processes-to-reduce-flood-risk Attribution statement: © Environment Agency copyright and/or database right 2015. All rights reserved.

associated impacts. It is recommended that the Green Infrastructure, Biodiversity and Open Space Strategy takes account of the Critical Drainage Areas and ROFSW mapping within the SFRA to inform the future plans for provision of green infrastructure.

Coordinated area-wide SUDS Schemes

Where plots identified for development comes forward collectively, opportunities should be taken to provide coordinated SUDS schemes. One such example in London Borough of Wandsworth is the SUDS scheme for Nine Elms whereby new development will increase the capture and storage of rainwater, to enable increased evapotranspiration before redirecting to a surface water network and subsequently the Thames.

6. Policy and development management recommendations

6.1 Overview

6.1.1 The purpose of this Section is to present recommendations consistent with the NPPF and PPG for consideration by the London Boroughs of Merton and Wandsworth when developing flood risk management policies. It should be noted that it is ultimately the responsibility of the LPAs to formally formulate and implement these policies.

6.2 Policy considerations

6.2.1 It is recommended that the following flood risk objectives are taken into account during the policy making process. Guidance on how these objectives can be met throughout the development management process for individual development sites is included within Appendix D.

Seeking Flood Risk Reduction through Spatial Planning and Site Design

- Use the Sequential Test to locate new development in areas of lowest risk, giving highest priority to areas within Flood Zone 1.
- Use the Sequential Test within development sites to inform site layout by locating the most vulnerable elements of a development in the lowest risk areas. For example, the use of low-lying ground in waterside areas for recreation, amenity and environmental purposes can provide an effective means of flood risk management as well as providing connected green spaces with consequent social and environmental benefits.
- Avoid development immediately downstream of flood storage areas and reservoirs which will be at high hazard areas in the event of failure.
- Seek opportunities for new development to achieve reductions to wider flood risk issues where possible, e.g. larger developments may be able to make provisions for flow balancing within new attenuation SuDS features.
- Identify long-term opportunities to remove development from the floodplain through land swapping.
- Develop Green Infrastructure Plans to realise opportunities for flood risk reduction.
- Build resilience into a site's design (e.g. flood resistant or resilient design, raised floor levels).
- Ensure development is 'safe'. For residential developments to be classed as 'safe', dry pedestrian egress out of the floodplain and emergency vehicular access should be possible. Dry pedestrian access/egress should be possible for the 1 in 100 year return period event including an allowance for climate change associated with fluvial flooding. In the defended tidal floodplain in Wandsworth, safe access should also be provided during the MLWL including an allowance for climate change over the lifetime of the proposed development.

Reducing Surface Water Runoff from New Developments

- Reference should be made to the London Borough of Merton Sustainable Drainage Design and Evaluation Guide[42] (known as the SuDS SPD).
- Development proposals should aim to achieve greenfield runoff rates and ensure that surface water is managed as close to its source as possible.
- Space should be specifically set aside for SuDS and used to inform the overall layout of development sites. Where appropriate, preference should be given to above ground surface water storage features, rather than solely below ground storage tanks.

[42] London Borough of Merton, Sustainable Drainage Design and Evaluation Guide, 2018. https://www.merton.gov.uk/assets/Documents/2019%20Merton%20SuDS%20DesignEvaluation%20Guide%20Final.pdf

- Surface water drainage proposals should follow the London Plan Intend to Publish drainage hierarchy (Section 2.5) and have a clear plan for the long term maintenance and adoption of the systems, prior to approval of any planning permission in line with national planning policy.
- Drainage should be designed and implemented in ways that promote multiple benefits including increased water use efficiency, improved water quality, enhanced biodiversity, urban greening, amenity and recreation.
- Large potential development areas with a number of new allocation sites should look to develop a strategy for providing a joint SuDS scheme. This should be on an integrated and strategic scale and where necessary would require the collaboration of all developers involved in implementing a specific expansion area or site.
- The Drainage Catchment areas should be considered for development sites that are not directly at risk of surface water flooding, to identify flow paths to areas downstream that are at risk from surface water flooding and could be impacted by the development. Mitigation measures, such as attenuation measures, should be used in the upper catchment areas to prevent increased risk to the downstream sites.

Enhancing and Restoring the River Corridor

- An assessment of the condition of existing assets (e.g. bridges, culverts, river walls) should be made. Refurbishment and/or renewal of the asset should ensure that the design life is commensurate with the design life of the development. Developer contributions should be sought for this purpose.
- Those proposing development should look for opportunities to undertake river restoration and enhancement and implement natural flood management measures as part of a development to make space for water. Enhancement opportunities should be sought when renewing assets (e.g. de-culverting, the use of bio-engineered river walls, raising bridge soffits to take into account climate change).
- Avoid further culverting and building over culverts. Where practical, all new developments with culverts running through their site should seek to de-culvert rivers for flood risk management and conservation benefit. Any culverting or works affecting the flow of a watercourse requires the prior written consent of either the Environment Agency (for main rivers), or London Borough (for ordinary watercourses) under the terms of the Land Drainage/Water Resources Act 1991 and Flood and Water Management Act 2010. These regulatory bodies seek to avoid culverting, and their consent for such works will not normally be granted except as a means of access.
- Set development back from rivers, seeking an 8 metre wide undeveloped buffer strip for development by fluvial watercourses and 16m undeveloped buffer strip for development by tidal watercourses, including those where the Flood Zone does not exist. Under the terms of the Water Resources Act 1991 and the Land Drainage Byelaws, the prior written consent of the Environment Agency or London Borough is required for any proposed works or structures in, under, over or within 8m of a main river, 16m of the Thames Tidal defence (Wandsworth) or within 8m of ordinary watercourse asset or structure. This is to allow easy maintenance of the water course, and includes consent for fencing, planting and temporary structures.

Protecting and Promoting Areas for Future Flood Defence and Alleviation Schemes

- For sites immediately adjacent to the Thames Tidal Defences, it is the riparian landowner's responsibility to carry out defence raisings in line with the Thames Estuary 2100 crest level guidance. For planning applications that fall within the boundary of a flood defence it is important to consider the lifetime of the development and the status of current flood defence crest levels in the FRA. This will form part of the Exception Test as to whether a development is made safe for its lifetime.
- Flood risk assessments will be required to demonstrate either how the flood defences will be raised now or a plan of how the flood defence will be raised in the future to meet the demands of climate change.
- Protect greenfield functional floodplain from future development (our greatest flood risk management asset) and reinstate areas of functional floodplain which have been developed (e.g. reduce building footprints or relocate to lower flood risk zones).

- Develop appropriate flood risk management policies for the areas within Flood Zone 3b Functional Floodplain that are currently developed, focusing on risk reduction measures, such as:
    - Reducing the land use vulnerability wherever possible;
    - Not permitting proposals for the change of use or conversion to a use with a higher vulnerability classification;
    - Seeking opportunities to ensure there is no increase or achieve a reduction in the number of people at risk (e.g. avoiding conversions and rebuilds of properties that result in an increase in the number of residential dwellings);
    - Maintaining or reducing built footprint;
    - Raising finished floor levels;
    - Increasing floodplain storage capacity and creating space for flooding to occur by restoring functional floodplain;
    - Reducing impedance to floodwater flow and restoring flood flow paths;
    - Incorporating flood resilient and/or resistance measures;
    - Ensuring development remains safe for users in time of flood (this may refer to the timely evacuation of properties prior to the onset of flooding in accordance with an individual Flood Warning and Evacuation Plan for the site).
- Identify sites where developer contributions could be used to fund future flood risk management schemes or can reduce risk for surrounding areas.
- Seek opportunities to make space for water to accommodate climate change.

Promoting the Use of Green Infrastructure

- Opportunities should be sought to combine surface water flood management options with green infrastructure corridors and Blue Ribbon Network of rivers and waterways, in line with the London Plan Intend to Publish approach to the provision, enhancement and management of green infrastructure. The All London Green Grid (ALGG)[43] SPG should be referenced when promoting the design and delivery of green infrastructure across London.

Improving Flood Awareness and Emergency Planning

- Seek to improve the emergency planning process using the outputs from the SFRA.
- Encourage all those within existing Flood Zone 3a and 3b (residential and commercial occupiers) to sign up to Flood Warning Service operated by the Environment Agency.
- Ensure robust emergency (evacuation) plans are implemented for new developments.

6.3 Development Management Considerations

Flood Zone 3b Functional Floodplain

6.3.1 The Functional Floodplain has been defined by London Boroughs of Merton and Wandsworth in this SFRA. These areas should be safeguarded from development, with exemptions where development could reduce flood risk overall or improve floodplain storage.

6.3.2 Only Water Compatible developments are permitted in Flood Zone 3b, and Essential Infrastructure developments require the Exception Test (see Table C-3). Where Water Compatible or Essential Infrastructure development cannot be located elsewhere, it must:

- Remain operational and safe for users in times of flood;
- Result in no net loss of flood storage;
- Not impede water flows; and

[43] Mayor of London (2012) Green Infrastructure and Open environments: The All London Green Grid Supplementary Planning guidance.

- Not increase flood risk elsewhere.

6.3.3 Proposals for the change of use or conversion to a use with a higher vulnerability classification should not be permitted. Basements, basements extensions, conversions of basements to a high vulnerability classification or self-contained units should not be permitted.

6.3.4 Where minor development (refer to Section C.2) is proposed, schemes should not affect floodplain storage or flow routes through the incorporation of the following mitigation measures in line with CIRIA guidance on SuDS:

- Raised finished floor levels;
- Voids and where possible;
- Direct or indirect floodplain compensation;
- Flood resilience measures;
- The removal of other non-floodable structures;
- Replacement of impermeable surfaces with permeable;
- Improved surface water drainage through the implementation of SuDS features such as water butts/rainwater harvesting;
- Living roofs;
- Infiltration trenches/soakaways; and
- Below ground attenuation tanks.

6.3.5 Within the outline of the 5% annual probability (1 in 20 year) defended flood extent there are areas of existing development which are prevented from flooding by the presence of existing infrastructure or solid buildings. In these developed areas, existing built footprints, where it can be demonstrated that they exclude floodwater, should not be defined as ‘Functional Floodplain’. The undeveloped land surrounding these buildings are important flow paths and flood storage areas and properties within these areas will be subject to frequent flooding; therefore, care must be given to the future sustainability of any development.

6.3.6 The consideration of whether a site is ‘developed’ or ‘undeveloped’ should be considered on a case-by-case basis as part of the planning application process, having regard to the presence of existing buildings on the site and the existing routing of floodwater through the site during times of flood.

6.3.7 Where redevelopment is proposed in developed areas, schemes should not increase the vulnerability classification of the site. All schemes must result in a net reduction in flood risk and ensure that floodplain storage and flow routes are not affected. This can be achieved through a combination of on and off-site measures including:

- Reducing the land use vulnerability;
- Seeking opportunities to ensure there is no increase or achieve a reduction in the number of people at risk (e.g. avoiding conversions and rebuilds of properties that result in an increase in the number of residential dwellings);
- Maintaining or reducing the built footprint
- Raising finished floor levels;
- Reducing surface water runoff rates and volumes from the site;
- Increasing floodplain storage capacity and creating space for flooding to occur by restoring functional floodplain;
- Reducing impedance to floodwater flow and restoring flood flow paths;
- Incorporating flood resilient and/or resistance measures;
- Ensuring development remains safe for users in time of flood (this may refer to the timely evacuation of properties prior to the onset of flooding in accordance with an individual Flood Warning and Evacuation Plan for the site).

Flood Zone 3a High Probability – River flooding

6.3.8 Flood Zone 3a High Probability comprises land having a 1% (1 in 100 year) annual probability or greater of river flooding. Water Compatible and Less Vulnerable developments are permitted in Flood Zone 3a; Essential Infrastructure and More Vulnerable developments require the Exception Test and Highly Vulnerable development is not permitted in this flood zone (see Table C-3). Where development is proposed opportunities should be sought to:

- Relocate existing development to land in zones with a lower probability of flooding;
- Reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage techniques;
- Create space for flooding to occur by restoring natural floodplain and flood flow paths and by identifying, allocating and safeguarding open space for flood storage;
- Set finished floor levels for all new development 300mm above the design flood level (1% AEP) including an allowance for climate change over the lifetime of the development;
- Provide safe refuge above the 1% AEP fluvial flood level (including climate change) or safe access and egress at Low Hazard rating;
- Basements, basement extensions and basement conversions must have safe access threshold levels and internal staircases provided to access floors above the 1% AEP flood level including climate change;
- Self-contained residential basements and bedrooms at basement level will not be permitted.

Areas at residual tidal flood risk

London Borough of Wandsworth:

6.3.9 Large areas defined as Flood Zones 3a in London Borough of Wandsworth are protected from tidal flooding by tidal flood defences. They are therefore at residual risk of flooding in the event of a breach in tidal flood defences. In these areas, proposed development should be designed to ensure it remains safe for users in the event of a flood:

- Floor levels for more vulnerable development with a sleeping element must be raised above the appropriate extreme water level (including climate change) as advised by the Environment Agency ;
- Safe refuge above the appropriate extreme water level (including climate change) as advised by the Environment Agency or safe access and egress at Low Hazard rating is required;
- All basements, basement extensions and basement conversions must have safe access threshold levels and internal staircases provided to access floors above the appropriate extreme water level (including climate change) as advised by the Environment Agency.
- Self-contained residential basements and bedrooms at basement level will not be permitted.

Flood Zone 2 Medium Probability

6.3.10 Flood Zone 2 Medium Probability comprises land having between a 1% (1 in 100 year) and 0.1% (1 in 1000 year) annual probability of river flooding. Water Compatible, Essential Infrastructure, Less Vulnerable and More Vulnerable developments are permitted in the Flood Zone 2, and Highly Vulnerable development requires the Exception Test (see Table C-3). Where development is proposed in areas of Flood Zone 2, the planning policy approach is similar to Flood Zone 3a. Opportunities should be sought to:

- Relocate existing development to land in zones with a lower probability of flooding;
- Reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage techniques;
- Ensure it remains safe for users in times of flood; and
- Create space for flooding to occur by restoring natural floodplain and flood flow paths and by identifying, allocating and safeguarding open space for flood storage.

Flood Zone 1 Low Probability

6.3.11 Flood Zone 1 Low Probability comprises land having a less than 0.1% (1 in 1000 year) annual probability of flooding from fluvial watercourses. All development vulnerability classifications are permitted in Flood Zone 1 (see Table C-3). Where development over 1 ha is proposed or there is evidence of flooding from another localised source in areas of Flood Zone 1, opportunities should be sought to:

- Ensure that the management of surface water runoff from the site is considered early in the site planning and design process;
- Ensure that proposals achieve an overall reduction in the level of flood risk to the surrounding area, through the appropriate application of sustainable drainage techniques.

Cumulative Impact of Minor and Permitted Development

6.3.12 The PPG advises that minor developments (as defined in Section C.2) are unlikely to result in significant flood risk issues unless:

- they would have an adverse effect on a watercourse, floodplain or its flood defences;
- they would impede access to flood defence and management facilities; or
- where the cumulative impact of such developments would have a significant impact on local flood storage capacity or flood flows.

6.3.13 In parts of the study area there is potential for both minor development as well as permitted development to be considered to be having a cumulative impact on flood risk in the local area as a result of impacts on local flood storage capacity and flood flows. Given the small scale of the development in the context of the wider fluvial catchments it is not possible to undertake modelling to confirm the impact of such development.

6.3.14 There is opportunity for LPAs to consider making an Article 4 direction[44] to remove national permitted development rights for developed areas of land within Flood Zone 3b where cumulative impact is considered to be a problem. The removal of permitted development rights will ensure that a planning application and site-specific FRA will be required for any development in these areas.

6.3.15 FRAs for all minor development within Flood Zone 3 should demonstrate that the proposal is safe and will not increase flood risk elsewhere by not impeding the flow of flood water, reducing storage capacity of the floodplain. Details of flood mitigation measures to reduce the impact of flooding on the proposed development and ensure that the proposed development does not result in an increase in maximum flood levels within adjoining properties should be provided. This may be achieved by ensuring (for example) that the existing building footprint is not increased, that overland flow routes are not truncated by buildings and/or infrastructure, hydraulically linked compensatory flood storage is provided within the site (or upstream), and/or the incorporation of floodable voids (more information will be provided in the Level 2 SFRA). It is acknowledged that full compensation may not be possible on all minor developments, however, an applicant must be able to demonstrate that every effort has been made to achieve this and provide full justification where this is not the case.

Changes of Use

6.3.16 Where a development undergoes a change of use and the vulnerability classification of the development changes, there may be an increase in flood risk. For example, changing from industrial use to residential use will increase the vulnerability classification from Less to More Vulnerable (Table C-2).

6.3.17 For change of use applications in Flood Zone 2 and 3, applicants must submit a FRA with their application. This should demonstrate how the flood risks to the development will be managed so that it remains safe through its lifetime including provision of safe access and egress and preparation of Flood Warning and Evacuation Plans where necessary. Further guidance will be provided within the Level 2 SFRA Report.

6.3.18 As changes of use are not subject to the Sequential or Exception Tests, the London Boroughs should consider when formulating policy what changes of use will be acceptable, having regard to paragraph 157 (6th bullet) of the NPPF: “identify areas where it may be necessary to limit freedom to change the uses of buildings, and

[44] An article 4 direction is a direction under article 4 of the General Permitted Development Order which enables the Secretary of State or the local planning authority to withdraw specified permitted development rights across a defined area.

support such restrictions with a clear explanation" and taking into account the findings of this SFRA. This is likely to depend on whether developments can be designed to be safe and that there is safe access and egress.

Basement Development

6.3.19 Basement development may involve either the extension of an existing habitable basement under a house, or the construction of a completely new basement. London boroughs, especially Wandsworth and Merton, have experienced an increase of basement and subterranean developments over the last 10 years. It is becoming increasingly popular to construct basements which extend beyond the footprint of the host property and under the amenity area.

6.3.20 The following restrictions are in place:

- Basements, basement extensions, conversions of basements to a higher vulnerability classification or self-contained units are not acceptable in Flood Zone 3b.
- Self-contained dwellings or bedrooms at basement level in Flood Zone 3 should not be permitted due to the vulnerability of users.
- In areas of Flood Zone 3 associated with fluvial flooding, all basements, basement extensions and basement conversions must have safe access threshold levels and internal staircases provided to access floors 300 mm above the 1% annual probability (1 in 100 year) flood level including an allowance for climate change.
- In areas at residual risk of tidal flooding, i.e. along the Thames in London Borough of Wandsworth, all basements, basement extensions and basement conversions must have safe access threshold levels and internal staircases provided to access floors above the appropriate extreme water level (including climate change) as advised by the Environment Agency. The only exception to this is where the applicant has demonstrated that a permanent fixed barrier is in place to prevent floodwater from entering any sleeping accommodation that is located below the extreme water level.
- In areas at risk of surface water flooding, basements, basement extensions and basement conversions must be protected by raising thresholds. Basements should not be permitted in areas of high surface water risk without appropriate mitigation.

6.3.21 The BGS Susceptibility to Groundwater Flooding maps provided in **Appendix A and Merton SFRA Online Map.** should be used to help assess the suitability of potential basement developments. Basement dwelling are not considered appropriate in areas that have 'potential for groundwater to occur at the surface'. However, it should be made clear that the Susceptibility to Groundwater Flooding maps are high level strategic maps and even though there are areas of no risk is mapped it does not mean that there is no risk present. Therefore, it is recommended that ground investigations and groundwater monitoring should be undertaken at each potential basement development site.

6.3.22 Basement development may affect groundwater flows, and even though the displaced water will find a new course around the area of obstruction this may have other consequences for nearby receptors e.g. buildings, trees. If basement development is located within an aquifer corridor, it may lead to localised elevations in groundwater and increase flood levels. An FRA must provide details of an appropriate sustainable urban drainage system for the site and investigation to determine whether a perimeter drainage system or other suitable measure is necessary to ensure any existing sub-surface water flow regimes are not interrupted.

6.3.23 The FRA must also address the impact of the proposed extension on the ability of the floodplain to store floodwater during the 1% annual probability (1 in 100 year) event including allowance for climate change and where necessary provide compensatory floodplain storage on a level for level, volume for volume basis.

Basement Impact Assessments:

6.3.24 Basement Impact Assessments (BIA) are required to be undertaken for any basement application. These are to be informed by ground investigations (boreholes/trial pits) to assess groundwater level/flow, land and structural stability and recommend monitoring is undertaken post approval. The BIA should be prepared by a structural engineering or hydrology firm that is fully accredited by the main professional institute(s) and therefore whose advice the Council could accept as independent.

6.3.25 London Borough of Merton has produced a Basement and Subterranean SPD[45] which provides guidance on the planning policies, planning guidance and regulations that apply in reference to basement development in Merton. It draws upon relevant national, regional and local authority requirements and expectations for sustainable development and good practice and sets out the requirements for detailed site assessments.

[45] London Borough of Merton, March 2017, Basement and Subterranean Planning Guidance SPD. https://www.merton.gov.uk/Documents/yes_basement_andsubterranean_planing_guidance_2017.pdf

6.4 Next Steps

Sequential Test

6.4.1 London Boroughs of Wandsworth and Merton should use the strategic flood risk information presented within this Level 1 SFRA to apply the Sequential Test to their potential site allocations and ensure development is steered towards those areas at lowest risk of flooding from all sources.

Level 2 SFRA

6.4.2 Where it is not possible to accommodate all the necessary development outside those areas identified to be at risk of flooding, a Level 2 SFRA will be required to provide information to support the application of the Exception Test for future development sites. The scope of the Level 2 SFRA will be to consider the detailed nature of the flood characteristics within a flood zone including:

- flood probability;
- flood depth;
- flood velocity;
- rate of onset of flooding; and
- duration of flood.

6.4.3 The Level 2 SFRA will be delivered as two separate documents for each of the London Boroughs. The Level 2 SFRA will provide a more detailed assessment of the flood risk for specific development sites which may require the application of the Exception Test.

Future Updates to the SFRA

6.4.4 As noted in Section 1.2, SFRAs are intended to be living documents, that are kept up to date as information on flood risk management changes. The Environment Agency SFRA guidance available online[46] states that in order to remain up to date, it is necessary to update a SFRA to incorporate any changes to:

- the predicted impacts of climate change on flood risk;
- detailed flood modelling - such as from the Environment Agency or lead local flood authority;
- the local plan, spatial development strategy or relevant local development documents;
- local flood management schemes;
- flood risk management plans;
- shoreline management plans;
- local flood risk management strategies;
- national planning policy or guidance.

6.4.5 Areas in which each Borough could look to improve their understanding of flood risk include detailed mapping of their ordinary watercourses and working closely with Thames Water to understand local sewer capacity issues. It is recommended that the Drainage Catchments identified in this SFRA should be used to locate strategic SuDS measures to manage surface water runoff as close to the source as possible.

6.4.6 At the time of writing, the Environment Agency are updating the hydraulic modelling of the Beverley Brook to improve the representation of the watercourse. The new modelling will also take account of the latest climate change allowances.

6.4.7 London Borough of Merton are also undertaking surface water modelling for West Merton which, once complete, will be used to update the Risk of Flooding from Surface Water mapping.

6.4.8 Once these datasets are available it is recommended that they are incorporated into the Level 1 SFRA in due course.

[46] https://www.gov.uk/guidance/local-planning-authorities-strategic-flood-risk-assessment

Appendix A Mapping for Wandsworth

Figure Number	Figure Title and Content
Figure 1	Flood Zones, Watercourses, Areas Benefitting Defences, Flood Defences, Emergency Rest Centres, Records of River Flooding
Figure 2	Modelled Flood Extents for the River Wandle including Climate Change, Watercourses, Flood Defences
Figure 3	Modelled Flood Extents for the Beverley Brook
Figure 4A – 4B	Thames Breach Modelling – Maximum Flood Depth (2100)
Figure 5A – 5B	Thames Breach Modelling – Maximum Flood Hazard (2100)
Figure 6A – 6B	Thames Breach Modelling – Maximum Flood Level (2100)
Figure 7	Flood Warning Areas, Emergency Rest Centres
Figure 8A – 8C	Risk of Flooding from Surface Water mapping, Drainage Catchments (DCs), Critical Drainage Areas (CDAs), Records of Surface Water Flooding.
Figure 9	BGS Susceptibility to Groundwater Flooding, Records of Groundwater Flooding
Figure 10	Sewer Flooding Records
Figure 11	Opportunities for reducing the causes and impacts of flooding

Appendix B Mapping for Merton

Most of the mapping for London Borough of Merton is provided on the **Merton SFRA Online Map.**

Where data licence restrictions apply, PDF maps have been provided, as follows:

Figure 1 BGS Susceptibility to Groundwater Flooding

Figure 2 Sewer Flooding Records

Appendix C Applying the Sequential Test

C.1 Sequential Approach

The sequential approach is a simple decision-making tool designed to ensure that sites at little or no risk of flooding are developed in preference to sites at higher risk. This will help avoid the development of sites that are inappropriate on flood risk grounds. The subsequent application of the Exception Test, where required, will ensure that new developments in areas of particular flood risk will only occur where flood risk is clearly outweighed by other sustainability drivers and will ensure that development can be made safe from flooding and not increase flood risk elsewhere.

The sequential approach can be applied at all levels and scales of the planning process, both for sites between flood zones and where a site has to be located in a higher risk zone, within the extent of that flood zone by locating the more vulnerable elements of the development in the areas of lowest risk. All opportunities to locate new developments in reasonably available areas of little or no flood risk should be explored, prior to any decision to locate them in areas of higher risk.

C.2 Sequential Test – Plan-Making

Each LPA must demonstrate that it has considered a range of possible sites in conjunction with the flood zone and vulnerability information from the Level 1 SFRA and applied the Sequential Test, and where necessary, the Exception Test (Level 2 SFRA), in the site allocation process.

Table C-1 shows the flood risk definitions for all sources of flooding and should be used to inform the Sequential Test. Figure C-1 illustrates the approach for applying the Sequential Test for sites without tidal flood defences, which the London Boroughs of Merton should adopt in the allocation of sites as part of the preparation of the Local Plan. Figure illustrates the approach for applying the Sequential Test for sites with existing tidal flood defences, which the London Borough of Wandsworth should adopt in the allocation of sites as part of the preparation of the Local Plan.

The Sequential Test should be undertaken by each London Borough and accurately documented to ensure decision making processes are consistent and transparent.

Table C-1 Flood Risk Definitions for Sequential Test

Risk	Fluvial / Tidal Flood Zone	Other Sources of Flood Risk			
Low	Flood Zone 1	ROFSW Very Low	"Not considered to be at risk of groundwater flooding" OR "Limited potential for groundwater flooding"	TWUL to assess the sewer network for each site	Use EA Flooding from Reservoirs map
Medium	Flood Zone 2	ROFSW Low to Medium	"Potential for groundwater flooding of property below ground surface" OR "Potential for groundwater flooding at surface"		N/A
High	Flood Zone 3a	ROFSW High	Historic records of groundwater flooding		N/A
Very High	Flood Zone 3b	N/A	N/A		N/A

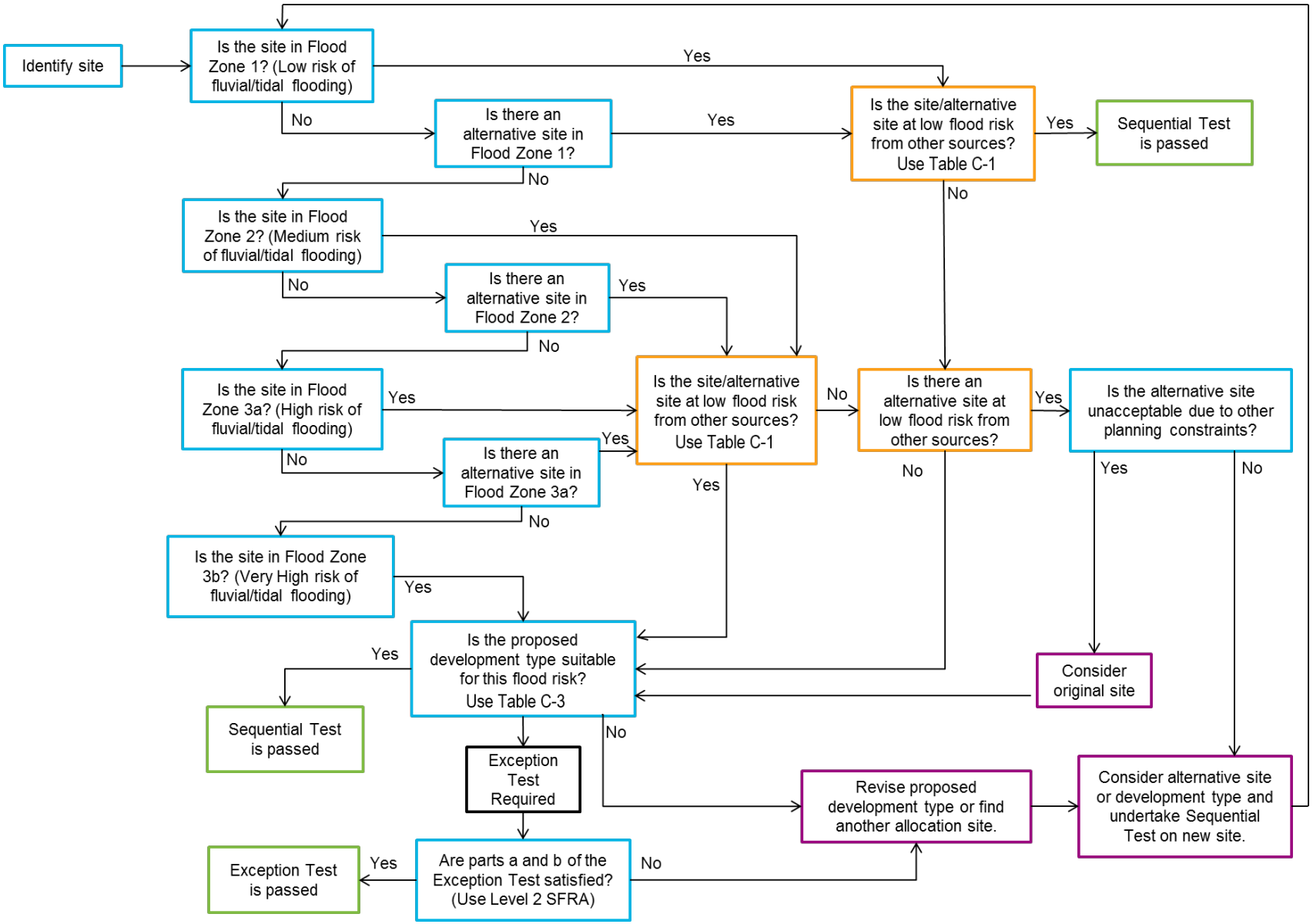


Figure C-1 Application of Sequential Test for Local Plan preparation – Undefended Sites

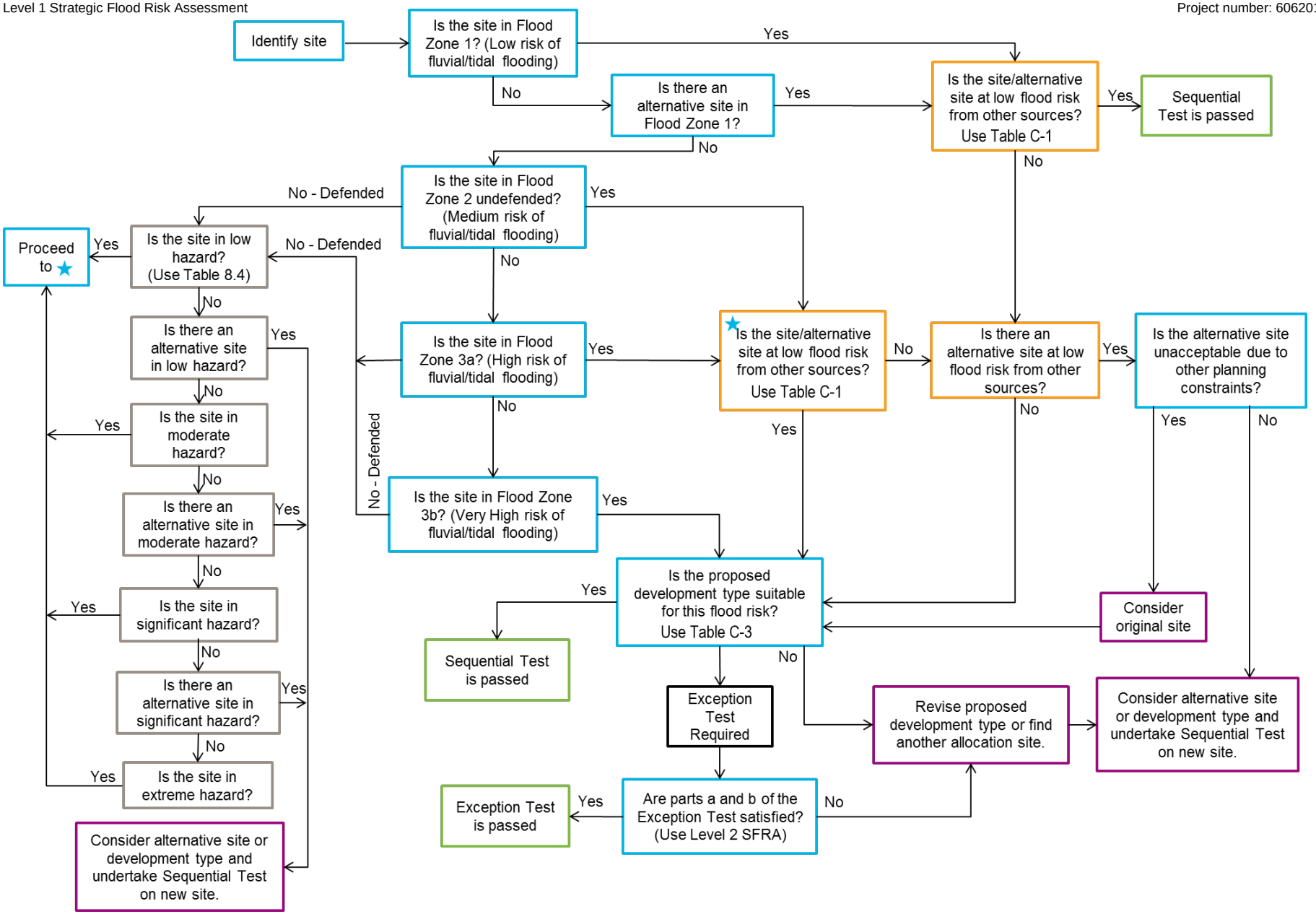


Figure C-2 Application of Sequential Test for Local Plan preparation – Tidal Defended Sites

The Sequential Test requires an understanding of the flood zones in the study area and the vulnerability classification of the proposed developments. Flood zone definitions are provided in Table 4-1 or Table 5-2 and mapped in Appendix A (Wandsworth) and online (Merton) and the Flood Map for Planning (Rivers and Sea). Flood risk vulnerability classifications are defined in PPG Table 2 and are presented in Table C-2.

Table C-2 Flood Risk Vulnerability Classification, PPG Table 2[47]

Classification	Definition
Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly vulnerable	• Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure').
More vulnerable	• Hospitals • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less vulnerable	• Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill* and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.
Water compatible	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel working. • Docks, marinas and wharves. • Navigation facilities. • Ministry of Defence defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

[47] https://www.gov.uk/guidance/flood-risk-and-coastal-change#Table-2-Flood-Risk-Vulnerability-Classification

The recommended steps for LPAs undertaking the Sequential Test to inform Local Plan are detailed below. Where the Sequential Test has been applied, and it has been demonstrated that development has been steered towards areas at lowest risk of flooding, Table C-3 may be needed to determine whether the Exception Test is required.

Table C-3 Flood risk vulnerability and Flood Zone compatibility, PPG Table 3

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	1	✓	✓	✓	✓	✓
	2	✓	✓	Exception Test Required	✓	✓
	3a	Exception Test Required	✓	×	Exception Test Required	✓
	3b	Exception Test Required	✓	×	×	×

✓ - Development is appropriate × - Development should not be permitted

Stages for LPA application of the Sequential Test in Plan-Making

The information required to address many of these steps is provided in the accompanying GIS layers and maps presented in Appendix A or the **Merton SFRA Online Map**.

1. Identify potential development sites and assign a unique ID reference.
2. Assign each potential development with a vulnerability classification (Table C-2). Where development is mixed, the development should be assigned the highest vulnerability class of the development proposed.
3. Determine the Flood Zone classification of each site based on a review of Appendix A Figure 1, **Merton SFRA Online Map** or the Flood Map for Planning (Rivers and Sea). Where a site covers more than one flood zone, all flood zones should be noted.
4. Identify existing flood defences serving the potential development sites. (However, it should be noted that for the purposes of the Sequential Test, flood zones ignoring defences should be used).
5. Identify the design life of the potential development, to determine the time horizon over which the impact of climate change should be considered:

- 100 years – up to 2120 for residential developments; and
- Design life for commercial / industrial developments will be variable, however at least a 60 year design life[48] should be assumed for such development, unless demonstrated otherwise.

6. Highly Vulnerable developments to be accommodated within the LPA area should be located in those sites identified as being at Low Risk (Table C-1). If these cannot be located in areas at Low Risk, because the identified sites are unsuitable or there are insufficient sites in Low Risk areas, sites in Medium Risk (Table C-1) can then be considered. Highly Vulnerable developments in Flood Zone 2 will require application of the Exception Test. If sites at Medium Risk are inadequate, then the LPA may have to identify additional sites at Medium Risk to accommodate development or seek opportunities to locate the development outside their administrative area. Within each area Highly Vulnerable development should be directed, where possible, to the areas at lowest risk from all sources of flooding. It should be noted that Highly Vulnerable development is not appropriate in Flood Zones 3a and 3b.
7. Once all Highly Vulnerable developments have been allocated to a development site, the LPA can consider those development types defined as More Vulnerable. In the first instance More Vulnerable development should be located in any unallocated sites in a Low Risk area (Table C-1). Where these sites are unsuitable or there are insufficient sites remaining, sites at Medium Risk (Table C-1) can be considered. If there are insufficient sites in Low or Medium Risk to accommodate More Vulnerable development, sites in High Risk can be considered. More

[48] Mayor of London, 2014, Sustainable Design and Construction SPG, London Plan 2011 Implementation Framework.

Vulnerable developments in Flood Zone 3a will require application of the Exception Test. As with Highly Vulnerable development, within each area More Vulnerable development should be directed to areas at lowest risk from all sources of flooding. It should be noted that More Vulnerable development is not appropriate in Flood Zone 3b.

8. Once all More Vulnerable developments have been allocated to a development site, the LPA can consider those development types defined as Less Vulnerable. In the first instance Less Vulnerable development should be located in any remaining unallocated sites in Low Risk areas (Table C-1), continuing sequentially with Medium Risk (Table C-1), then High Risk (Table C-1). Less Vulnerable development types are not appropriate in Flood Zone 3b – Functional Floodplain.
9. Essential Infrastructure should be preferentially located in the lowest flood risk zones, however this type of development may be located in Flood Zones 3a and 3b, provided the Exception Test is satisfied.
10. Water Compatible development has the least constraints with respect to flood risk and it is considered appropriate to allocate these sites last. The sequential approach should still be followed in the selection of sites; however, it is appreciated that Water Compatible development by nature often relies on access and proximity to water bodies.
11. Where the development type is Highly Vulnerable, More Vulnerable, Less Vulnerable or Essential Infrastructure and a site is found to be impacted by a recurrent flood source (other than tidal or fluvial), the site and flood sources should be investigated further regardless of any requirement for the Exception Test.

Stages for LPA application of the Sequential Test in Plan-Making – Tidal Defended Sites

For sites that are within the tidal floodplain of the River Thames (Flood Zone 3a), but are protected by the presence of tidal defences, it is recommended that the London Borough of Wandsworth use additional flood risk information to consider the variation in flood risk within the flood zone when applying the Sequential Test. In this case, the flood hazard mapping included in **Appendix A Figure 5A and 5B** should be used to apply the Sequential Test to ensure that development is directed towards areas of Low hazard prior to the consideration of areas at Moderate, Significant and Extreme hazard.

Windfall Sites

Windfall sites are those which have not been specifically identified as available in the Local Plan process. They comprise previously-developed sites that have unexpectedly become available. In cases where development cannot be fully met through the provision of site allocations, LPAs are expected to make a realistic allowance for windfall development, based on past trends and expected future trends. It is recommended that the acceptability of windfall applications in flood risk areas should be considered at the strategic level through a policy setting out broad locations and quantities of windfall development that would be acceptable or not in Sequential Test terms.

C.3 Sequential Test – Individual Applications

Sequential Test Exemptions

It should be noted that the Sequential Test does not need to be applied in the following circumstances:

- Individual developments proposed on sites which have been allocated in development plans through the Sequential Test.
- Minor development, which is defined in the NPPF as:
    - minor non-residential extensions: industrial / commercial / leisure etc. extensions with a footprint <250 m^2;
    - alterations: development that does not increase the size of buildings e.g. alterations to external appearance;
    - householder development: for example; sheds, garages, games rooms etc. within the curtilage of the existing dwelling, in addition to physical extensions to the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling e.g. subdivision of houses into flats;

- Change of Use applications, unless it is for a change of use of land to a caravan, camping or chalet site, or to a mobile home site or park home site;
- Development proposals in Flood Zone 1 (land with a low probability of flooding from rivers or the sea) unless the SFRA, or other more recent information, indicates there may be flooding issues now or in the future (for example, the site was identified as being at risk of surface water or through the impact of climate change);
- Redevelopment of existing properties (e.g. replacement dwellings), provided they do not increase the number of dwellings in an area of flood risk (i.e. replacing a single dwelling with an apartment block).

Applying the Sequential Test to an Individual Application

If development is proposed in Flood Zone 2 or 3, and the Sequential Test has not already been carried out for the site for the same development type at the Local Plan level, then it is necessary to undertake a Sequential Test for the site.

The process can be summarised as follows:

1. Identify the geographical area of search over which the test is to be applied; this could be the Borough area, or a specific catchment if this is appropriate and justification is provided (e.g. school catchment area or the need for affordable housing within a specific area identified for regeneration in Local Plan policies).
2. Identify the source of 'reasonably available' alternative sites; usually drawn from evidence base / background documents produced to inform the Local Plan.
3. State the method used for comparing flood risk between sites; for example, the Flood Map for Planning, the SFRA mapping, site-specific FRAs if appropriate, other mapping of flood sources.
4. Apply the Sequential Test; systematically consider each of the available sites, indicate whether the flood risk is higher or lower than the application site, state whether the alternative option being considered is allocated in the Local Plan, identify the capacity of each alternative site, and detail any constraints to the delivery of the alternative site(s).
5. Conclude whether there are any reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed.
6. Where necessary, as indicated by Table C-3, apply the Exception Test.
7. Apply the Sequential approach to locating development within the site.

It should be noted that it is for LPAs, taking advice from the Environment Agency as appropriate, to consider the extent to which Sequential Test considerations have been satisfied, taking into account the particular circumstances in any given case. The developer should justify with evidence to the LPA what area of search has been used when making the application. Ultimately the LPA needs to be satisfied in all cases that the proposed development would be safe and not lead to increased flood risk elsewhere.

London Borough of Wandsworth Requirements

The emerging Local Plan for London Borough of Wandsworth contains Area Strategies which are the key areas where future housing and development growth will be focused. It is considered by London Borough of Wandsworth in consultation with the Environment Agency that future development within these areas cannot be located in an area of lower risk of flooding elsewhere. Within these areas, development is therefore considered to satisfy the Sequential Test, and a site specific application of the Sequential Test would not be required. In these areas, a sequential approach should be applied *within the site* by steering specific buildings/uses with greater vulnerability towards areas of lowest risk, and, where required, satisfying the requirements of the Exception Test.

The Sequential Test is considered to have been passed if at least one of the following applies:

- The site is located within an Area Strategy area as identified in the Local Plan, including within the 400m buffer around the town centre based strategies. These areas area identified in Figure 12 overleaf and in Appendix A. Those areas identified with a * denote where a 400m buffer applies around town centre locations. There is no 'hard boundary' for the Area Strategies, and therefore application of a 400m buffer ensures adequate coverage.
    - Balham*

  - Clapham Junction and York Road/Winstanley Regeneration area*
  - Vauxhall Nine Elms Battersea Opportunity Area (including Battersea Design and Technology quarter)
  - Putney *
  - Roehampton Regeneration area
  - Tooting*
  - Wandsworth Town including the Wandle Delta Area*
  - The Wandle Valley
  - Wandsworth's Riverside
- The site is a Local Plan Site Allocation and the proposed use is in accordance with the allocation of the Local Plan.
- The site is a minor development, conversion or change of use.

Area of search and alternative sites

For development sites that do not meet one of the criteria set out above, the default area of search will be the Borough administrative area, unless justification is provided for a smaller area as described in Step 1 above (Section C.3).

In order to identify reasonably available alternative sites, applicants should make reference to:

- Authority Monitoring Report
- Site Allocations of the Local Plan
- Brownfield Land Register

London Borough of Merton Requirements

The geographical area of search over which the test is to be applied is generally the Borough area, or a specific catchment if this is appropriate and justification is provided (e.g. school catchment area or the need for affordable housing within a specific area identified for regeneration in Local Plan policies). This will need to be agreed with London Borough of Merton.

In order to identify reasonably available alternative sites, applicants should make reference to:

- Authority Monitoring Report
- Site Allocations in the Local Plan
- Brownfield Land Register

C.4 Exception Test

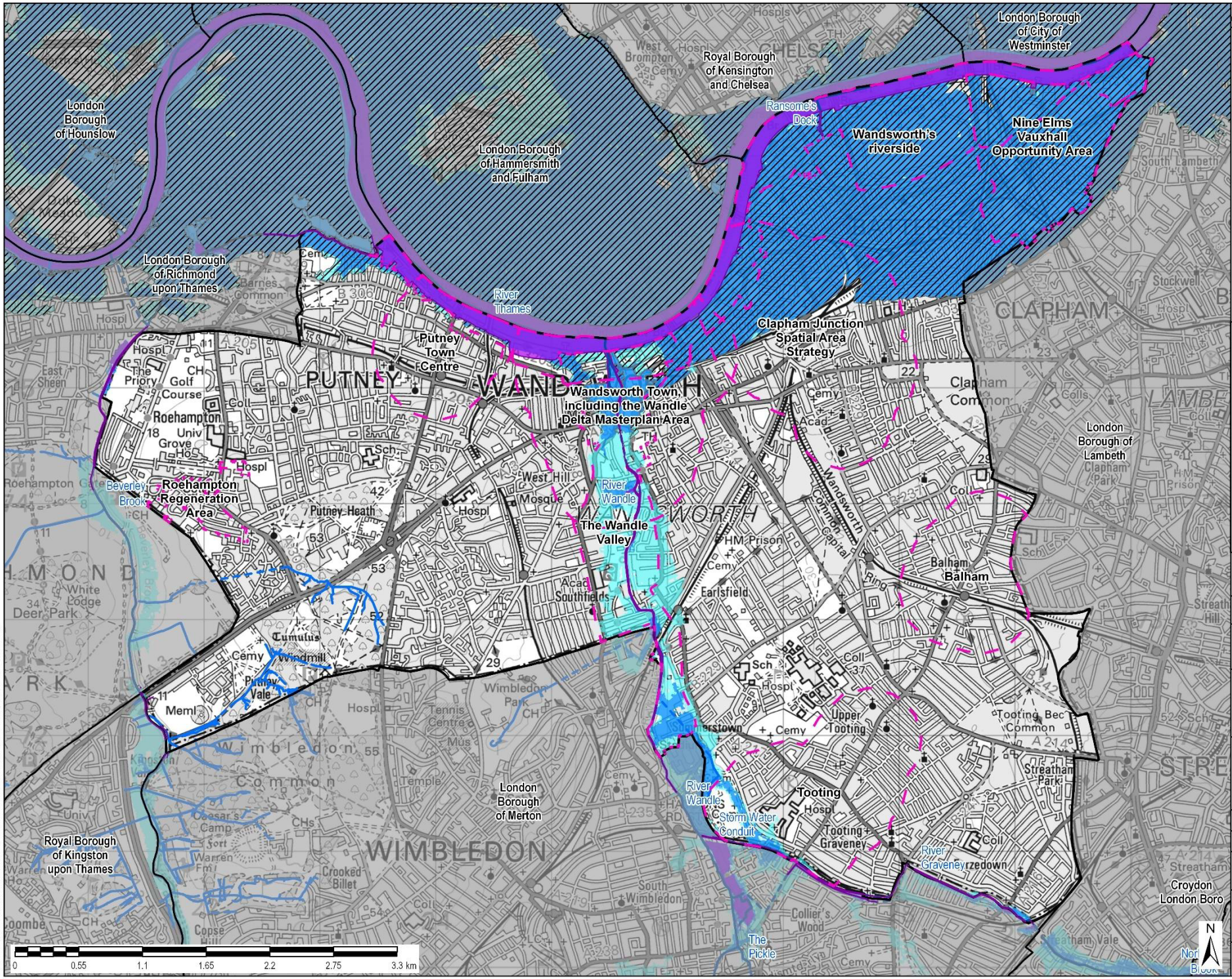
The purpose of the Exception Test is to ensure that where it may be necessary to locate development in areas at risk of flooding, new development is only permitted in Flood Zone 2 and Flood Zone 3 where the flood risk is clearly outweighed by other sustainability factors and where the development will be safe during its lifetime, considering climate change.

The NPPF states that for the Exception Test to be passed:

- Part 1 - "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; and
- Part 2 - A site-specific Flood Risk Assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall."

Both elements of the test will have to be passed for development to be allocated or permitted.

In order to determine Part 1) of the Exception Test, applicants should assess their scheme against the objectives set out in the LPA's Sustainability Appraisal. In order to demonstrate satisfaction of Part 2) of the Exception Test, relevant measures, such as those presented within Appendix D should be applied and demonstrated within a site-specific FRA (as detailed in Appendix E).



THIS DRAWING IS TO BE USED ONLY FOR THE PURPOSE OF ISSUE THAT IT WAS ISSUED FOR AND IS SUBJECT TO AMENDMENT

LEGEND

- Borough Boundary
- Surrounding Boroughs
- Main River (open)
- Main River (culverted)
- Other Watercourse (open)
- Other Watercourse (culverted)

Flood Zones

- Flood Zone 1 Low Probability
- Flood Zone 2 Medium Probability
- Flood Zone 3 High Probability
- Flood Zone 3b Functional Floodplain
- Flood Defences
- Areas Benefitting from Flood Defences
- Sequential Test Area

Notes

Main Rivers are designated by Defra on a 'Main River Map'. The Environment Agency has permissive powers to carry out flood defence works, maintenance and operational activities for Main Rivers only. However overall responsibility for maintenance lies with the riparian owner.

The Environment Agency Flood Map for Planning (Rivers and Sea) is available online (https://flood-map-for-planning.service.gov.uk/) and displays the risk of flooding based on probability.
Flood Zone 1: Land assessed, ignoring the presence of flood defences, as having a less than 0.1% annual probability of fluvial or tidal flooding.
Flood Zone 2: Land assessed, ignoring the presence of flood defences, as having between a 1% and 0.1% annual probability of fluvial flooding or between a 0.5% and 0.1% annual probability of tidal flooding in any year.
Flood Zone 3: Land assessed, ignoring the presence of flood defences, as having a 1% or greater annual probability of fluvial flooding or a 0.5% or greater annual probability of tidal flooding in any year.

This map shows the areas where the Sequential Test is satisfied.

Purpose of Issue: DRAFT

Client: Wandsworth

Project Title: WANDSWORTH LEVEL 1 STRATEGIC FLOOD RISK ASSESSMENT

Drawing Title: AREAS WHERE SEQUENTIAL TEST IS SATISFIED

Drawn	Checked	Approved	Date
LL	SL	EC	Oct 2020

AECOM Internal Project No.	Scale @ A3
60620167	1:30,000

AECOM
Midpoint
Alencon Link, Basingstoke
Hampshire, RG21 7PP
Telephone (01256) 318200
Fax (01256) 318201
www.aecom.com

AECOM

Drawing Number: FIGURE 12

Rev: 01

Appendix D Managing and Mitigating Flood Risk

D.1 Overview

It may not always be possible to avoid locating development in areas at risk of flooding. This Section provides guidance on the types of measures that could be considered in order to manage and mitigate flood risk and that would need to be considered when preparing a site-specific FRA as described in Appendix E. This Section is structured as follows:

- Development layout,
- Safety of occupants,
- Building design,
- Managing the risk of flooding elsewhere.

It is essential that the development management process influencing the design of future development within the study area carefully mitigates the potential impact that climate change may have upon the risk of flooding. As a result, mitigation measures should be designed with an allowance for climate change over the lifetime of a proposed development as follows:

- 100 years (up to 2120) for residential developments; and
- 75 years (up to 2095) for commercial / industrial developments, or other time horizon specific to the non-residential use proposed.

D.2 Development Layout

Sequential Approach

A sequential approach to site planning should be applied within new development sites.

Flood risk should be considered at an early stage in deciding the layout and design of a site to provide an opportunity to reduce flood risk within the development. Most large development proposals include a variety of land uses of varying vulnerability to flooding. The sequential approach should be applied within development sites to locate the most vulnerable elements of a development in the lowest risk areas (considering all sources of flooding) e.g. residential elements should be restricted to areas at lower probability of flooding whereas parking, open space or proposed landscaped areas can be placed on lower ground where there may be a higher probability of flooding.

Riverside Development

Retain an 8 metre wide undeveloped buffer strip alongside Main Rivers and Ordinary Watercourses and explore opportunities for riverside restoration. For London Borough of Wandsworth, retain a 16 metre wide buffer strip alongside the Thames Tidal defence line.

New development within 8 metres of a Main River, 16 metres of the Thames Tidal defence (Wandsworth) or 8 metres of an Ordinary Watercourse will require consent from either the Environment Agency or LPA (as LLFA) respectively.

For sites immediately adjacent to the Thames Tidal Defences, it is the riparian landowner's responsibility to carry out defence raisings in line with the Thames Estuary 2110 Plan. For planning applications that fall within the boundary of a flood defence it is important to consider the lifetime of the development and the status of current flood defence crest levels in the flood risk assessment. Flood risk assessments will be required to demonstrate either how the flood defences will be raised now or a plan of how the flood defence will be raised in the future to meet the demands of climate change. This will form part of the exception test as to whether a development is made safe for its lifetime.

The Environment Agency seeks an 8 metre wide undeveloped buffer strip alongside main fluvial rivers for maintenance purposes, and a 16 metre wide undeveloped buffer strip alongside the Thames Tidal defence line, from the landward toe of the flood defence, measured from the rearmost extent including any ground anchors and tie rods present. The

Environment Agency would also ask developers to explore opportunities for riverside restoration as part of any development.

Under Section 109 of the Water Resources Act 1991 and/or Environment Agency Byelaws, any works within 8 metres of any statutory Main River (both open channels and culverted sections) or 16 metres of a Main Tidal River requires a Flood Risk Activity Permit (FRAP) from the Environment Agency. Whilst FRAPs are dealt with outside of the planning process, since requirements of the permitting process in relation to flood risk, biodiversity and pollution may result in changes to development proposals or construction methods, the Environment Agency aims to advise on such issues as part of its statutory consultee role in the planning process. Should proposed works not require planning permission the Environment Agency can be consulted regarding permission to do work on or near a river, flood or sea defence by contacting enquiries@environment-agency.gov.uk.

Responsibility for the consenting of works by third parties on Ordinary watercourses under Section 23 of the Land Drainage Act 1991 (as amended by the Flood and Water Management Act 2010) lies with the London Boroughs as LLFAs. Each London Borough is responsible for the consenting of works to ordinary watercourses and has powers to enforce un-consented and non-compliant works. This includes any works (including temporary) within 8 metres that affect flow within the channel (such as in channel structures or diversion of watercourses). Enquiries and applications for ordinary watercourse consent should be sent to the following contact information for each London Borough Council:

LONDON BOROUGH OF WANDSWORTH: **Wandsworth Council** **The Town Hall** **Wandsworth High Street, SW18 2PU** **Reception email: enquiries@wandsworth.gov.uk** **Switchboard telephone: 020 8871 6000**	**LONDON BOROUGH OF MERTON:** **Environment and Regeneration Department** **London Borough of Merton** **Civic Centre, London Road, Morden, SM4 5DX** **Telephone: 020 8274 4901** **Email: trafficandhighways@merton.gov.uk**

Consent will be refused if the works would result in an increase in flood risk, a prevention of operational access to the watercourse and/ or an unacceptable risk to nature conservation.

D.3 Safety of occupants

Finished Floor Levels

Areas at risk of fluvial flooding

All More Vulnerable and Highly Vulnerable development within Flood Zones 2 and 3 should set Finished Floor Levels a minimum of 300 mm above the known or modelled 1 in 100 annual probability (1% AEP) flood level including an allowance for climate change over the lifetime of the development.

Where developing in Flood Zone 2 and 3 is unavoidable, the recommended method of mitigating flood risk to people, particularly with More Vulnerable (residential) and Highly Vulnerable land uses, is to ensure internal floor levels are raised a freeboard level above the design flood level.

In certain situations (e.g. for proposed extensions to buildings with a lower floor level or conversion of existing historical structures with limited existing ceiling levels), it could prove impractical to raise the internal ground floor levels to sufficiently meet the general requirements. In these cases, the Environment Agency and/or the LPA should be approached to discuss options for a reduction in the minimum internal ground floor levels provided flood resistance measures are implemented up to an agreed level. There are also circumstances where flood resilience measures should be considered first, these are described further below. For both Less and More Vulnerable developments where internal access to higher floors is required, the associated plans showing the access routes and floor levels should be included within any site-specific FRA. Table D-1 provides an overview of the requirements for finished floor levels in areas of at risk of fluvial flooding.

Table D-1 Finished Floor Levels for fluvial flood risk areas

Development Type	Flood Zone 3	Flood Zone 2

Minor development (i.e. non-residential extensions with a floor space <250 m^2 and householder developments)	Provide evidence to the London Borough Council that EITHER, Floor levels within the proposed development will be set no lower than existing levels AND, flood proofing of the proposed development has been incorporated where appropriate. Details of flood proofing / resilience and resistance techniques to be included in accordance with 'Improving the flood performance of new buildings' CLG (2007). OR, Floor levels within the extension will be set 300 mm above the known or modelled 1% AEP (1 in 100 year) river flood event including climate change allowance. Applicants should provide a plan showing floor levels relative to flood levels. All levels should be stated in relation to Ordnance Datum.	Provide evidence to the London Borough Council that, Floor levels within the proposed development will be set no lower than existing levels AND, flood proofing of the proposed development has been incorporated where appropriate. Details of flood proofing / resilience and resistance techniques to be included in accordance with 'Improving the flood performance of new buildings' CLG (2007).
New residential development (More Vulnerable)	Subject to there being no other planning constraints (e.g. restrictions on building heights), finished floor levels should be set a minimum of 300 mm above the 1% AEP (1 in 100 year) flood level including climate change. The design flood level should be derived for the immediate vicinity of the site (i.e. relative to the extent of a site along a watercourse as flood levels are likely to vary with increasing distance downstream) as part of a site-specific FRA.	
New non-residential development (e.g. Less Vulnerable)	Subject to there being no other planning constraints (e.g. restrictions on building heights), finished floor levels should be set a minimum of 300 mm above the 1% AEP (1 in 100 year) flood level including climate change. The design flood level should be derived for the immediate vicinity of the site (i.e. relative to the extent of a site along a watercourse as flood levels are likely to vary with increasing distance downstream) as part of a site-specific FRA. Where there is robust justification that finished floor levels cannot be raised, it may be possible to consider the use of flood resistance and resilience measures as an alternative. However, it is strongly recommended that internal access is provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. Such refuges will have to be permanent and accessible to all occupants and users of the site and a FWEP should be prepared to document the actions to take in the event of a flood.	
Basements	Basements, basement extensions, conversions of basements to a higher vulnerability classification or self-contained units are not be permitted in Flood Zone 3b. Self-contained residential basements and bedrooms at basement level are not permitted in Flood Zone 3a. Internal access to a higher floor situated 300 mm above the 1% annual probability flood level (1 in 100 year) including climate change must be provided for all other basements, basement extensions and conversions.	All basements, basement extensions and conversions must have internal access to a higher floor situated 300 mm above the 1% annual probability flood level (1 in 100 year) including climate change.

Defended Tidal Floodplain (Wandsworth)

All More Vulnerable and Highly Vulnerable development within defended tidal Flood Zone 3a should set Finished Floor Levels for habitable accommodation above flood levels derived from Thames Tidal breach modelling. The lifetime of the proposed development should be considered when selecting the appropriate modelling scenario to use.

The tidal Flood Zone 3a associated with the River Thames is protected by the presence of the Thames Tidal Defences. Where development in the defended tidal Flood Zone 3a is unavoidable, the London Thames Breach Modelling (described in Section 5.2) should be used to inform the setting of finished floor levels for habitable accommodation. Table D-2 provides an overview of the requirements for finished floor levels.

For both Less and More Vulnerable developments where internal access to higher floors is required, the associated plans showing the access routes and floor levels should be included within any site-specific FRA.

Table D-2 Finished Floor Levels for defended tidal floodplain (Wandsworth)

Development Type	Flood Zone 3
Minor development (i.e. non-residential extensions with a floor space <250 m^2 and	Provide evidence to Wandsworth Council that EITHER, Floor levels within the proposed development will be set no lower than existing levels AND, flood proofing of the proposed development has been incorporated where appropriate. Details of flood proofing / resilience and resistance techniques to be included in accordance with 'Improving the flood performance of new buildings' CLG (2007).

householder developments)	OR, Floor levels within the extension will be set at or above flood levels derived from the breach modelling for the appropriate time horizon. Applicants should provide a plan showing floor levels relative to flood levels. All levels should be stated in relation to Ordnance Datum.
New residential development (More Vulnerable)	The London Thames Breach Modelling can be used to inform finished floor levels for specific development sites. Finished floor levels for more vulnerable development with a sleeping element should be set above the appropriate extreme water level (including an allowance for climate change) as advised by the Environment Agency. With justification, it may be acceptable to install a permanent fixed barrier that prevents floodwater from entering any sleeping accommodation that is located below the appropriate extreme water level (including an allowance for climate change) as advised by the Environment Agency. No freeboard is required as raising finished floor levels of defended properties is considered conservative enough.
New non-residential development (e.g. Less Vulnerable)	Finished floor levels for Less Vulnerable uses do not need to be raised above the extreme flood level. However, safe refuge above the extreme water level (including an allowance for climate change) as advised by the Environment Agency or safe access and egress at Low Hazard rating is required. To provide safe refuge, internal access must be provided to upper floors (first floor or a mezzanine level) above the appropriate extreme water level (including an allowance for climate change) as advised by the Environment Agency. Such refuges will have to be permanent and accessible to all occupants and users of the site and a FWEP should be prepared to document the actions to take in the event of a flood (refer to subsection below).
Basements	Self-contained residential basements and bedrooms at basement level are not permitted in Flood Zone 3a. For all other basements, basement extensions and conversions safe access threshold levels and internal staircases must be provided to access floors above the appropriate extreme water level (including climate change) as advised by the Environment Agency. all sleeping accommodation must be located at or above the modelled tidal breach flood level (MLWL including an allowance for climate change over the lifetime of the development). The only exception to this is where the applicant has demonstrated that a permanent fixed barrier is in place to prevent floodwater from entering the basement including sleeping accommodation.

Safe Access and Egress

Safe access and egress are 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.

A safe access/egress route should allow occupants to safely enter and exit the buildings and be able to reach land outside the flooded area (e.g. within Flood Zone 1) using public rights of way without the intervention of emergency services or others during design flood conditions, including climate change allowances. This is of particular importance when contemplating development on sites within Flood Zone 1, but the surrounding area is within Flood Zone 2 or 3.

Guidance prepared by the Environment Agency[49] uses a calculation of flood hazard to determine safety in relation to flood risk. Flood hazard is a function of the flood depth and flow velocity at a particular point in the floodplain along with a suitable debris factor to account for the hazard posed by any material entrained by the floodwater. The derivation of flood hazard is based on the methodology in Flood Risks to People FD2320, the use of which for the purpose of planning and development control is clarified in the abovementioned publication. Flood hazard mapping is presented within the Level 2 SFRA.

Table D-3 Hazard to People Rating (HR=d x (v +0.5) + DF) (Table 13.1 FD2320/TR2)

Flood Hazard (HR)	Description
Less than 0.75	Very low hazard – Caution
0.75 to 1.25	Dangerous for some – includes children, the elderly and the infirm
1.25 to 2.0	Dangerous for most – includes the general public
More than 2.0	Dangerous for all – includes the emergency services

[49] Environment Agency, HR Wallingford, May 2008, Supplementary note on Flood hazard ratings and thresholds for development planning and control purpose. Clarification of Table 13.1 FD2320/TR2 and Figure 3.2 FD2321/TR1. http://evidence.environment-agency.gov.uk/FCERM/Libraries/FCERM_Project_Documents/FD2321_7400_PR_pdf.sflb.ashx

For developments located in areas at risk of tidal and / or fluvial flooding safe access and egress must be provided for new development 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.
- 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. However, the public should not drive vehicles in floodwater.

For fluvial flooding, a 'dry' access/egress is a route located above the 1% annual probability flood level (1 in 100 year) including an allowance for climate change.

For developments located in areas of defended tidal floodplain (Wandsworth), a 'dry' access/egress is a route located above the appropriate water level (including an allowance for climate change) as advised by the Environment Agency or within an area modelled as low hazard which leads to an area of high ground outside the floodplain.

Safe Refuge

In exceptional circumstances, dry access above the 1% annual probability (1 in 100 year) flood level including climate change associated with fluvial flooding, and above the appropriate extreme water level for tidal flooding, may not be achievable. In these circumstances the Environment Agency and the LPA should be consulted to ensure that the safety of the site occupants can be satisfactorily managed. This will be informed by the type of development, the number of occupants and their vulnerability and the flood hazard along the proposed egress route. For example, this may entail the designation of a safe place of refuge on an upper floor of a building, from which the occupants can be rescued by emergency services. It should be noted that sole reliance on a safe place of refuge is a last resort, and all other possible means to evacuate the site should be considered first. Provision of a safe place of refuge will not guarantee that an application will be granted.

Flood Warning and Evacuation Plans

Evacuation is where flood alerts and warnings provided by the Environment Agency enable timely actions by residents or occupants to allow evacuation to take place unaided, i.e. without the deployment of trained personnel to help people from their homes, businesses and other premises. Rescue by the emergency services is likely to be required where evacuation prior to flooding has not been possible.

For all developments (excluding minor developments and change of use) proposed in Flood Zone 2 or 3, a Flood Warning and Evacuation Plan should be prepared to demonstrate what actions site users will take before, during and after a flood event to ensure their safety, and to demonstrate their development will not impact on the ability of the local authority and the emergency services to safeguard the current population.

For sites in Flood Zone 1 it is important to consider the surrounding area to assess the flood risk of the evacuation route and emergency vehicle access route to the site. If these routes incorporate areas in Flood Zone 2 or 3, it may also be necessary to prepare a Flood Warning and Evacuation Plan to determine potential egress routes away from the site through areas that may be at risk of flooding during the 1% annual probability (1 in 100 year) flood event including an allowance for climate change.

The Environment Agency has a tool on their website to create a Personal Flood Plan[50]. The Plan comprises a checklist of things to do before, during and after a flood and a place to record important contact details. Where proposed development comprises non-residential extension <250 m^2 and householder development (minor development), it is recommended that the use of this tool to create a Personal Flood Plan will be appropriate.

Flood Warning and Evacuation Plans should include:

<u>How flood warning is to be provided, such as:</u>

- availability of existing flood warning systems;

[50] Environment Agency Tool 'Make a Flood Plan'. https://www.gov.uk/government/publications/personal-flood-plan

- where available, rate of onset of flooding and available flood warning time; and
- how flood warning is given.

What will be done to protect the development and contents, such as:

- How easily damaged items (including parked cars) or valuable items (important documents) will be relocated;
- How services can be switched off (gas, electricity, water supplies);
- The use of flood protection products (e.g. flood boards, airbrick covers);
- The availability of staff/occupants/users to respond to a flood warning, including preparing for evacuation, deploying flood barriers across doors etc.; and
- The time taken to respond to a flood warning.

Ensuring safe occupancy and access to and from the development, such as:

- Occupant awareness of the likely frequency and duration of flood events, and the potential need to evacuate;
- Safe access route to and from the development;
- If necessary, the ability to maintain key services during an event;
- Vulnerability of occupants, and whether rescue by emergency services will be necessary and feasible; and
- Expected time taken to re-establish normal use following a flood event (clean-up times, time to re-establish services etc.)

There is no statutory requirement for the Environment Agency or the emergency services to approve evacuation plans. Each London Borough is accountable via planning condition or agreement to ensure that plans are suitable. This should be done in consultation with emergency planning staff.

Flood warning areas and emergency rest centres for each of the London Boroughs are described in Sections 4.2.19 and 5.3.39 and shown in **Appendix A Figure 7** and on the **Merton SFRA Online Map.**

The Environment Agency issues flood warnings to residents and businesses that have registered for the service in these specific areas when flooding is expected. It should be noted that whether each of the emergency rest centres are operational during a flood event is dependent upon the locations and extent of flooding across the Borough at that particular time. The Multi Agency Flood Plan prepared by each of the London Boroughs will provide more detail on the appropriate use of each rest centre.

D.4 Building design

Flood Resistance ‘Water Exclusion Strategy’

There is a range of flood resistance and resilience construction techniques that can be implemented in new developments to mitigate potential flood damage. The Department for Communities and Local Government (CLG) have published a document ‘Improving the Flood Performance of New Buildings, Flood Resilient Construction’[51], the aim of which is to provide guidance to developers and designers on how to improve the resistance and resilience of new properties to flooding through the use of suitable materials and construction details. Figure D-1 provides a summary of the Water Exclusion Strategy (flood resistance measures) and Water Entry Strategy (flood resilience measures) which can be adopted depending on the depth of floodwater that could be experienced.

[51] CLG (2007) Improving the Flood Performance of New Buildings, Flood Resilient Construction

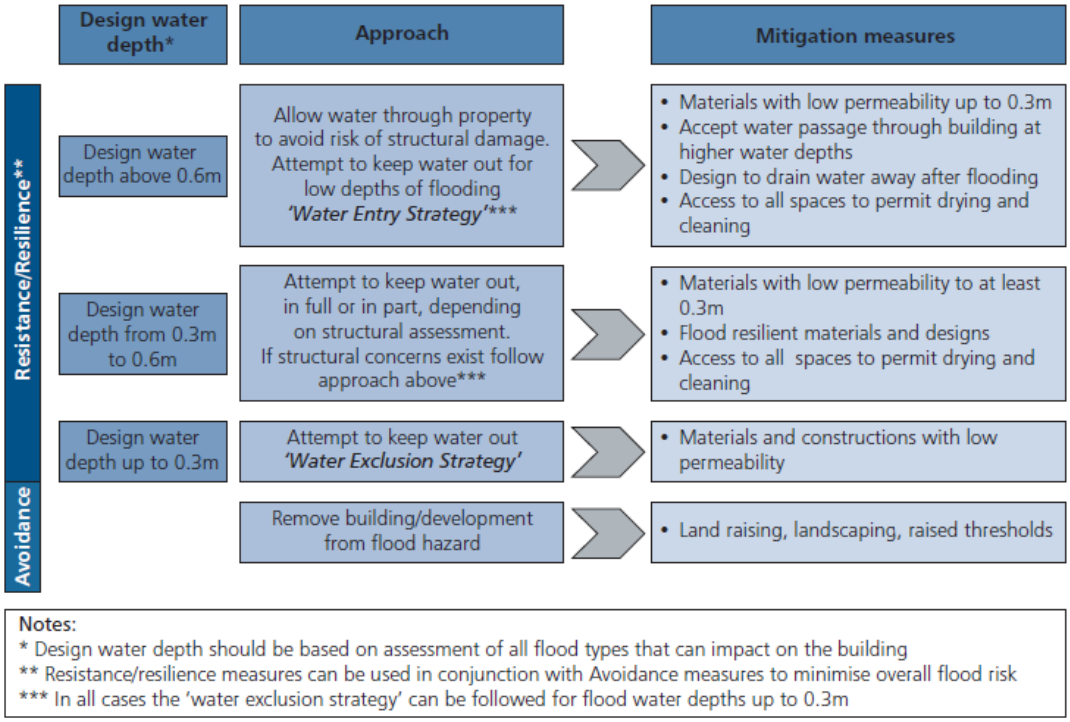


Figure D-1 Flood Resistant / Resilient Design Strategies, Improving Flood Performance, CLG 2007

Resistance measures are aimed at preventing water ingress into a building (Water Exclusion Strategy); they are designed to minimise the impact of floodwaters directly affecting buildings and to give occupants more time to relocate ground floor contents. These measures will probably only be effective for short duration, low depth flooding, i.e. less than 0.3 m, although these measures should be adopted where depths are between 0.3 m and 0.6 m and there are no structural concerns.

In areas at risk of flooding of low depths (<0.3 m), implement flood resistance measures such as:

- Using materials and construction with low permeability.
- Land raising (subject to this not increasing flood risk to neighbouring properties).
- Landscaping e.g. creation of low earth bunds (subject to this not increasing flood risk to neighbouring properties).
- Raising thresholds and finished floor levels e.g. porches with higher thresholds than main entrance.
- Flood gates with waterproof seals.
- Sump and pump for floodwater to remove waste faster than it enters.

There is a range of property flood protection devices available on the market designed specifically to resist the passage of floodwater (Figure D-2 and Figure D-3). These include removable flood barriers and gates designed to fit openings, vent covers and stoppers designed to fit WCs. These measures can be appropriate for preventing water entry associated with fluvial flooding as well as surface water and sewer flooding. The efficacy of such devices relies on their being deployed before a flood event occurs. It should also be borne in mind that devices such as air vent covers, if left in place by occupants as a precautionary measure, may compromise safe ventilation of the building in accordance with Building Regulations.

Figure D-2 Examples of flood barriers, air bricks and non-return valves

Figure D-3 Example of flood gates

Flood Resilience 'Water Entry Strategy'

For flood depths greater than 0.6 m, it is likely that structural damage could occur in traditional masonry construction due to excessive water pressures. In these circumstances, the strategy should be to allow water into the building, but to implement careful design in order to minimise damage and allow rapid re-occupancy. This is referred to as the Water Entry Strategy. These measures are appropriate for uses where temporary disruption is acceptable and suitable flood warning is received.

Materials should be used which allow the passage of water whilst retaining their structural integrity and they should also have good drying and cleaning properties. Alternatively, sacrificial materials can be included for internal and external finishes; for example, the use of gypsum plasterboard which can be removed and replaced following a flood event. Flood resilient fittings should be used to at least 0.1 m above the design flood level. Resilience measures are either an integral part of the building fabric or are features inside a building that will limit the damage caused by floodwaters.

In areas at risk of frequent or prolonged flooding, implement flood resilience measures such as:

- Use materials with either, good drying and cleaning properties, or, sacrificial materials that can easily be replaced post-flood.
- Design for water to drain away after flooding.
- Design access to all spaces to permit drying and cleaning.
- Raise the level of electrical wiring, appliances and utility metres.
- Coat walls with internal cement based renders; apply tanking on the inside of all internal walls.
- Ground supported floors with concrete slabs coated with impermeable membrane.
- Tank basements, cellars or ground floors with water resistant membranes.
- Use plastic water resistant internal doors.

Further specific advice regarding suitable materials and construction techniques for floors, walls, doors and windows and fittings can be found in 'Improving the Flood Performance of New Buildings, Flood Resilient Construction'[52].

Structures

Structures such as (bus, bike) shelters, park benches and refuse bins (and associated storage areas) located in areas with a high flood risk should be flood resilient and be firmly attached to the ground and designed in such a way as to prevent entrainment of debris which in turn could increase flood risk and/or breakaway posing a danger to life during high flows.

D.5 Managing the risk to neighbouring areas

Floodplain Compensation Storage

Any increase in building footprint within the modelled flood extent for the 1% AEP event including an allowance for climate change associated with fluvial watercourses must not result in a net loss of flood storage capacity. Where possible, opportunities should be sought to achieve an increase in the provision of floodplain storage.

Where proposed development results in a change in building footprint, the developer must ensure that it does not impact upon the ability of the floodplain to store water and should seek opportunities to provide betterment with respect to floodplain storage.

Similarly, where ground levels are elevated to raise a development out of the fluvial floodplain, compensatory floodplain storage within areas that currently lie outside the floodplain must be provided to ensure that the total volume of the floodplain storage is not reduced.

As depicted in Figure D-4, floodplain compensation must be provided on a level for level, volume for volume basis on land which does not already flood and is within the site boundary. Where land is not within the site boundary, it must be in the immediate vicinity, in the applicant's ownership and linked to the site[53]. Floodplain compensation must be considered in the context of the 1% annual probability (1 in 100 year) flood level including an appropriate allowance for climate change. As described in the online Environment Agency guidance54 the appropriate allowance to assess off-site impacts and calculate floodplain storage compensation depends on land uses in affected areas, as follows:

- In most cases the higher central allowance should be used to calculate floodplain storage compensation.
- Use the upper end allowance to calculate floodplain storage compensation when the catchment is particularly sensitive to small changes in volume, which could cause significant increases in flood depth or hazard; or when the affected area contains essential infrastructure or vulnerable uses, such as primary schools, caravans, bungalows or basement dwellings.

[52] CLG, 2007, Improving the Flood Performance of New Buildings, Flood Resilient Construction. http://www.planningportal.gov.uk/uploads/br/flood_performance.pdf?bcsi_scan_E956BCBE8ADBC89F=0&bcsi_scan_filename=flood_performance.pdf
[53] In hydrological connectivity.
[54] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#types-of-allowances

- Use the central allowance for floodplain storage compensation if you can demonstrate that the affected area contains only low vulnerability uses, such as water compatible development.

When designing a scheme flood water must be able to flow in and out and must not pond. An FRA must demonstrate that there is no loss of flood storage capacity and include details of an appropriate maintenance regime to ensure mitigation continues to function for the life of the development. Guidance on how to address floodplain compensation is provided in Appendix A3 of the CIRIA Publication C624[55].

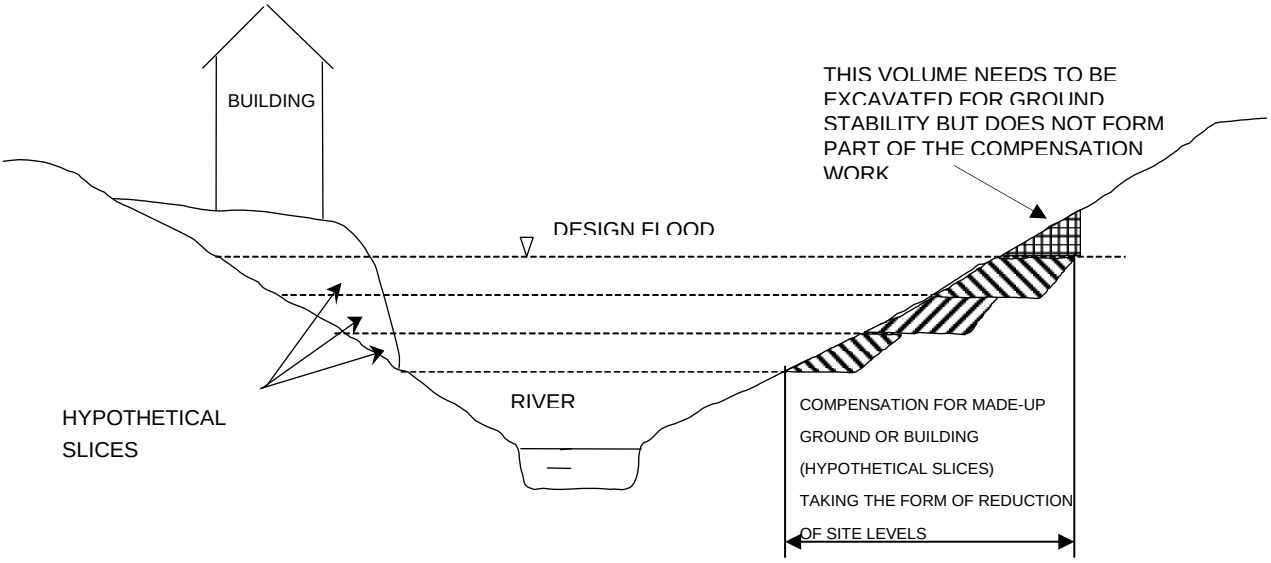


Figure D-4 Example of Floodplain Compensation Storage (Environment Agency 2009)

The requirement for no loss of floodplain storage from the fluvial floodplain means that it is not possible to modify ground levels on sites which lie completely within the floodplain (when viewed in isolation), as there is no land available for lowering to bring it into the floodplain. It is possible to provide off-site compensation within the local area e.g. on a neighbouring or adjacent site, or indirect compensation, by lowering land already within the floodplain, however, this would be subject to detailed investigations and agreement with the Environment Agency to demonstrate (using an appropriate flood model where necessary) that the proposals would improve and not worsen the existing flooding situation or could be used in combination with other measures to limit the impact on floodplain storage.

Areas of Residual Tidal Risk

For areas within London Borough of Wandsworth at residual risk of tidal flooding, there is not usually a requirement from the Environment Agency to provide floodplain compensation storage within the defended floodplain, assuming that the defences will be maintained for the lifetime of the development. However, the impact of residual risk on other properties should be considered, and where the potential increase of flood levels or potential disruption of flow routes as a result of development is significant, compensatory flood storage should be provided.

Flood Voids

In some cases, full floodplain compensation may not always be possible, particularly for minor development schemes and sites wholly in Flood Zone 3. In these cases, **full justification** must be provided, and other measures incorporated to help mitigate the loss of floodplain storage, for example the use of flood voids.

The use of under-floor voids with adequate openings beneath the raised finished floor levels can be considered for development in Flood Zone 3. They are generally considered to provide indirect compensation or mitigation for loss of floodplain storage.

Ideally, void openings should be a minimum of 1 m long and open from existing ground levels to at least the 1% annual probability (1 in 100 year) plus climate change flood level. By setting finished floor levels at a minimum of 300 mm above the design flood level, there is usually enough space provision for voids below. There should be a minimum of 1 m of open void length per 5 m length of wall. Void openings should be provided along all external walls. If security is an issue,

[55] CIRIA January 2004, CIRIA Report 624: Development and Flood Risk - Guidance for the Construction Industry.

10 mm diameter vertical bars set at 100 mm centres can be incorporated into the void openings. The use of under-floor voids will typically require a legal agreement or planning condition and maintenance plan for them to remain open for the lifetime of the development and agreement that the LPA will enforce. Sole reliance on the use of under-floor voids to address the loss of floodplain storage capacity is generally not acceptable on undeveloped sites or for individual properties. The Environment Agency is likely to seek confirmation from the LPA that the voids be maintained in a free and open condition for the lifetime of the development.

Car Parks

Where car parks are specified as areas for the temporary storage of surface water and fluvial floodwaters, flood depths should not exceed 300 mm given that vehicles may be moved by water of greater depths. Where greater depths are expected, car parks should be designed to prevent the vehicles from floating out of the car park. Signs should be in place to notify drivers of the susceptibility of flooding and flood warning should be available to provide sufficient time for car owners to move their vehicles if necessary.

Flood Routing

All new development in Flood Zones 2 and 3 should not adversely affect flood routing and thereby increase flood risk elsewhere. Opportunities should be sought within the site design to make space for water, such as:

- Removing boundary walls or replacing with other boundary treatments such as hedges, fences (with gaps).
- Considering alternatives to solid wooden gates or ensuring that there is a gap beneath the gates to allow the passage of floodwater.
- On uneven or sloping sites, consider lowering ground levels to extend the floodplain without creating ponds. The area of lowered ground must remain connected to the floodplain to allow water to flow back to river when levels recede.
- Create under croft car parks or consider reducing ground floor footprint and creating an open area under the building to allow flood water storage.
- Where proposals entail floodable garages or outbuildings, consider designing a proportion of the external walls to be committed to free flow of floodwater.

In order to demonstrate that 'flood risk is not increased elsewhere', development in the floodplain will need to prove that flood routing is not adversely affected by the development, for example giving rise to backwater effects or diverting floodwaters onto other properties.

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.

Careful consideration should be given to the use of fences and landscaping walls so as to prevent causing obstruction to flow routes and increasing the risk of flooding to the site or neighbouring areas.

Sustainable Drainage Systems

Suitable surface water management measures should be incorporated into new development designs in order to reduce and manage surface water flood risk to and posed by the proposed development. This should be achieved by incorporating Sustainable Drainage Systems (SuDS).

Sustainable Drainage Systems (SuDS) are surface water drainage solutions designed to manage surface water runoff and mitigate the adverse effects of urban storm water runoff by reducing flood risk and controlling pollution[56]. SuDS techniques allow surface water runoff from development to be controlled in ways that imitate natural drainage by controlling the rate of discharge to a receiving watercourse. SuDS may also provide valuable habitat and amenity value when carefully planned for in development.

[56] Defra, Environment Agency (March 2015) Cost Estimation for SuDS – Summary of Evidence

Separate to their capacity as the LPA, each of the London Boroughs are statutory consultees for surface water drainage as part of their role as LLFAs. All major development[57] should include provision for SuDS and a Sustainable Drainage Strategy will need to be completed and signed by a competent drainage engineer to verify that the proposals conform to the Government's 'Sustainable Drainage Systems: Non-Statutory Technical Standards[58].

London Borough of Merton Council and 15 other local authorities across England have worked with Robert Bray Associates and McCloy Consulting to produce a Sustainable Drainage Guide[59]. The Guide provides a new approach to the design and evaluation of SuDS with easy to understand and practical information for all those involved with the development process. Merton Council set out on their website[60], that a Sustainable Drainage Strategy should contain as a minimum:

- A plan of the existing site.
- A topographical level survey of the area to metres Above Ordnance Datum (m AOD).
- Demonstration of a clear understanding of how surface water flows across the site and surrounding area. This could use the topographic survey and the information presented on the 'Flood Map for Surface Water' on the Environment Agency website and with the Council's Surface Water Management Plan (SWMP).
- Plans and drawings of the proposed site layout identifying the footprint of the area being drained (including all buildings, access roads and car parks).
- Calculations of:
    - Changes in permeable and impermeable coverage across the site.
    - The existing and proposed controlled discharge rate for a 1 in 1 year event, 1 in 30 year and a 1 in 100 year event (with an allowance for climate change), which should be based on the estimated greenfield runoff rate.
    - Proposed storage volume (attenuation) including the water storage capacity of the proposed drainage features, with demonstration that they meet the requirements of the Technical Standards.
- Plans, drawings and specification of proposed SuDS measures. This should include detail of hard construction, soft landscaping and planting. A drainage design can incorporate a range of SuDS techniques.
- A design statement describing how the proposed measures manage surface water as close to its source as possible and follow the drainage hierarchy in the London Plan.
- Geological information including borehole logs, depth to water table and/or infiltration test results in accordance with BRE365.
- Details of overland flow routes for exceedance events.
- Details of any offsite works required, together with necessary consents (where relevant).
- A management plan for future maintenance and adoption of drainage system for the lifetime of the development.

Applicants are strongly encouraged to discuss their proposals with the LLFA at the pre-application stage. Requests can be made using the contact details set out below:

LONDON BOROUGH OF WANDSWORTH: http://www.wandsworth.gov.uk/info/485/planning_permission/1321/pre-application_advice Wandsworth Council, The Town Hall, Wandsworth High Street, SW18 2PU Reception email: enquiries@wandsworth.gov.uk Switchboard telephone: 020 8871 6000	LONDON BOROUGH OF MERTON: http://www.merton.gov.uk/environment/planning/planningapplications/dcpreappadvice.htm Environment and Regeneration Department, London Borough of Merton, Civic Centre, London Road, Morden, SM4 5DX Telephone: 020 8274 4901 Email: trafficandhighways@merton.gov.uk

Drainage Catchments

As described in Sections 4.3 and 5.4 Drainage Catchments have been delineated across the study area based on the natural catchment and watersheds. It is recommended that London Boroughs refer to these when developing policies for

[57] Developments of 10 dwellings or more; or equivalent non-residential or mixed development (as set out in Article 2(1) of the Town and Country Planning (Development Management Procedure) (England) Order 2010).
[58] Sustainable drainage systems: non-statutory technical standards - https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards
[59] Sustainable Drainage (SUDS) Design and Evaluation Guide
[60] https://www.merton.gov.uk/streets-parking-transport/streets-and-pavements/surface-water-drainage-and-suds

surface water management requirements to determine whether they wish to set additional standards for specific parts of their administrative area.

The Sustainable Design and Construction SPG states that developers should maximise all opportunities to achieve greenfield runoff rates in their developments or aim for as close to Greenfield runoff rates as reasonably possible from their developments. Greenfield runoff rates are defined as the runoff rates from a site, in its natural state, prior to any development (8 litres per second per hectare). This is particularly important for developments that contribute to a combined sewer system. If Greenfield runoff rates are not possible, developers should achieve 50% attenuation of a site's existing surface water runoff at peak times, as a minimum. As the whole drainage catchment contributes to surface water runoff, it is recommended that this policy is not only applied to areas 'at risk' of flooding, but also incorporates the entire drainage catchment in order to attenuate surface water upstream.

SUDS in London Borough of Merton

Bedrock Geology

The underlying bedrock of Merton is almost entirely London Clay, with a small area of Claygate Member and Bagshot Formation to the northwest.

Superficial Geology

The majority of the superficial deposits are various River Terrace Deposits (gravel, sandy and clayey in part), which differentiate on the basis of altitude but are geologically similar. These can be sub-divided into Taplow Gravel Formation and Hackney Gravel Member which are located in the Mitcham area; Kempton Park Grave in Merton and New Malden and Black Park Gravel is located on the higher ground at Wimbledon. Ribbons of Alluvium (mainly sand, silt and clay) are distributed along the River Wandle and Beverley Brook.

Suitability of Infiltration SuDS based on Geology

- In the northwest the Claygate Member, Bagshot Formation and overlying superficial deposits are thought to be water bearing. The EA groundwater flood incident data suggests that underground structures (e.g. basements) could be vulnerable to groundwater flooding. Therefore, infiltration SuDS in this area are not a viable option.
- In the northwest where the Bagshot Formation overlies the Claygate Member site investigations will be key for any proposed developments, particularly those which contain basements/underground structures (e.g. soakaways). The usage of infiltration SuDS should be considered when these site examinations take place. In the southeast there are several historic landfill sites which must be avoided for infiltration SuDS due to the risk of latent contamination which could lead to groundwater quality issues.
- In the low elevation land where London Clay Formation is overlain by superficial deposits there is increased potential for elevated groundwater. It is implied that where groundwater table exist, they are likely to be close to the surface, therefore basements and structures such as sheet pilling may exacerbate the problem if they intercept the water table. Infiltration SuDS could further exacerbate the problem here therefore should be exempt at this location. Superficial deposits often vary in composition; therefore, site investigations will be key for proposed development sites in order to gain better understanding of the groundwater conditions. Alongside this it is possible to determine if infiltration SuDS will be suitable for this location.
- Where the impermeable London Clay Formation outcrop at the surface at low elevation there are no overlying superficial deposits therefore the potential for elevated groundwater is said to be negligible. However, there are areas where this bedrock has been removed and replaced by artificial material, meaning groundwater could become trapped. These areas could be potential sites for infiltration SuDS.
- Generally speaking, the majority of Merton is potentially unsuitable for infiltration SuDS; mainly where impermeable London Clay Formation is at the surface. Where River Terrace Deposits overlay it is uncertain if infiltration SuDS are appropriate as it is unknown whether the River Terrace Deposits will store and transmit groundwater without causing flooding or draining issues. Merton Council has confirmed that past ground investigations have shown a shallow perched groundwater layer is common across the majority of the borough, which can result in groundwater ingress to basements if tanking is not appropriate or up to standard. Further ground investigation is required in areas where perched groundwater may occur.
- There are several historic landfill sites to the east of Merton in the Mitcham area, particularly beneath Mitcham Common. Infiltration SuDS should be avoided here as they could increase the risk of impaired groundwater quality.

SUDS in London Borough of Wandsworth

Bedrock Geology

In Wandsworth the London Clay Formation dominates the surface bedrock geology across the Borough. The only exception to this is a small area that is overlain by Claygate Member near Wimbledon Common (south west) and a patch of Lambeth Group outcrops in the Upper Tooting area (south east). London Clay Formation is an aquiclude with low to very low permeability, thus prohibits groundwater flow.

Superficial Geology

The majority of Wandsworth is overlain with superficial deposits, consisting of River Terrace Deposits, Head, Langley Silt Member and Alluvium. The River Terrace Deposits consist of various different units based on altitude but are largely geographically similar (gravel, sandy and clayey in part). Strands of Alluvium correspond with the River Wandle, Beverley Brook and River Thames and are mainly sand, silt and clay in nature.

Suitability of Infiltration SuDS based on Geology

- Due to the extensive London Clay Formation in Wandsworth, no areas are deemed suitable for infiltration SuDS.
- However, areas overlain by superficial deposits are likely to be variable in composition and depth across Wandsworth, therefore individual site investigations should be encouraged to understand the local groundwater conditions, thus suitability of infiltration SuDS.
- London Clay Formation is an aquiclude, meaning it does not permit groundwater flow. In areas where this bedrock outcrops at the surface elevated groundwater is negligible. However, in some locations this bedrock has been removed and replaced with artificial ground material. This may increase the potential for elevated groundwater as it may become trapped in these deposits. Infiltration SuDS should be avoided here.
- There are two historic landfill sites to the north and north east of Wandsworth. Infiltration SuDS must not be installed here as this could introduce groundwater quality issues.

Appendix E Site-specific Flood Risk Assessments

E.1 What is a Flood Risk Assessment?

A site-specific FRA is a report suitable for submission with a planning application which provides an assessment of flood risk to and from a proposed development, and demonstrates how the proposed development will be made safe, will not increase flood risk elsewhere and where possible will reduce flood risk overall in accordance with paragraph 100 of the NPPF and PPG. An FRA must be prepared by a suitably qualified and experienced person and must contain all the information needed to allow the LPAs (London Boroughs of Merton and Wandsworth) to be satisfied that the requirements have been met.

E.2 When is a Flood Risk Assessment required?

The NPPF states that a site-specific FRA is required in the following circumstances:

- Proposals for new development (including minor development[61] and change of use) in Flood Zones 2 and 3.
- Proposals for new development (including minor development and change of use) in an area within Flood Zone 1 which has critical drainage problems (as notified to the LPA by the Environment Agency)[62].
- Proposals of 1 hectare or greater in Flood Zone 1.
- Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

E.3 How detailed should an FRA be?

The PPG states that site-specific FRAs should be proportionate to the degree of flood risk, the scale and nature of the development, its vulnerability classification (Table C-2) and the status of the site in relation to the Sequential and Exception Tests. Site-specific FRAs should also make optimum use of readily available information, for example the mapping presented within this SFRA and available on the Environment Agency website, although in some cases additional modelling or detailed calculations will need to be undertaken. For example, where the development is an extension to an existing house (for which planning permission is required) which would not significantly increase the number of people present in an area at risk of flooding, the LPA would generally need a less detailed assessment to be able to reach an informed decision on the planning application. For a new development comprising a greater number of houses in a similar location, or one where the flood risk is greater the LPA may require a more detailed assessment, for example, the preparation of site-specific hydraulic modelling to determine the flood risk to and from the site pre and post-development, and the effectiveness of any management and mitigation measures incorporated within the design.

As a result, the scope of each site-specific FRA will vary considerably. Table E-1 presents the different levels of site-specific FRA as defined in the CIRIA publication C624[63] and identifies typical sources of information that can be used. Sufficient information must be included to enable the Council and where appropriate, consultees, to determine that the proposal will be safe for its lifetime, not increase flood risk elsewhere and where possible, reduce flood risk overall. Failure to provide sufficient information will result in applications being refused.

[61] According to the PPG, minor development means:
minor non-residential extensions: industrial / commercial / leisure etc. extensions with a footprint <250m2.
alterations: development that does not increase the size of buildings e.g. alterations to external appearance.
householder development: for example; sheds, garages, games rooms etc. within the curtilage of the existing dwelling, in addition to physical extensions to the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling e.g. subdivision of houses into flats.

[62] Consultation has confirmed that there are no areas with critical drainage problems identified by the Environment Agency.

[63] CIRIA, 2004, Development and flood risk – guidance for the construction industry C624.

Table E-1 Levels of Site-Specific Flood Risk Assessment

Level of Site-Specific Flood Risk Assessment	Description
Level 1 Screening study	Identify whether there are any flooding or surface water management issues related to a development site that may warrant further consideration. This should be based on readily available existing information. The screening study will ascertain whether a FRA Level 2 or 3 is required. Typical sources of information include: • Strategic Flood Risk Assessment (SFRA) • Flood Map for Planning (Rivers and Sea) • Surface Water Management Plan (SWMP) • Environment Agency Standing Advice • PPG Tables 1, 2 and 3
Level 2 Scoping study	To be undertaken if the Level 1 FRA indicates that the site may lie within an area that is at risk of flooding, or the site may increase flood risk due to increased run-off. This study should confirm the sources of flooding which may affect the site. The study should include: • An appraisal of the availability and adequacy of existing information; • A qualitative appraisal of the flood risk posed to the site, and potential impact of the development on flood risk elsewhere; and • An appraisal of the scope of possible measures to reduce flood risk to acceptable levels. • The scoping study may identify that sufficient quantitative information is already available to complete a FRA appropriate to the scale and nature of the development. Typical sources of information include those listed above, plus: • Local policy statements or guidance. • Thames Catchment Flood Management Plan (CFMP) • Thames Estuary 2100 Plan. • London Borough Merton and Wandsworth Councils' PFRA and LFRMS. • Data request from the EA to obtain result of existing hydraulic modelling studies relevant to the site and outputs such as maximum flood level, depth and velocity. • Consultation with LLFA, Environment Agency, Thames Water and other flood risk consultees to gain information and to identify in broad terms, what issues related to flood risk need to be considered including other sources of flooding. • Historic maps. • Interviews with local people and community groups. • Walkover survey to assess potential sources of flooding, likely routes for floodwaters, the key features on the site including flood defences, their condition. • Site survey to determine general ground levels across the site, levels of any formal or informal flood defences.
Level 3 Detailed study	To be undertaken if a Level 2 FRA concludes that further quantitative analysis is required to assess flood risk issues related to the development site. The study should include: • Quantitative appraisal of the potential flood risk to the development; • Quantitative appraisal of the potential impact of the development site on flood risk elsewhere; and • Quantitative demonstration of the effectiveness of any proposed mitigations measures. Typical sources of information include those listed above, plus: • Detailed topographical survey. • Detailed hydrographic survey. • Site-specific hydrological and hydraulic modelling studies which should include the effects of the proposed development. • Monitoring to assist with model calibration/verification. Continued consultation with the LPA, Environment Agency and other flood risk consultees.

Environment Agency Data Requests

The Environment Agency offers a series of 'products' for obtaining flood risk information suitable for informing the preparation of site-specific FRAs as described on their website https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications

- Products 1 – 4 relate to mapped deliverables including flood level and flood depth information and the presence of flood defences local to the proposed development site;
- Product 5 contains the reports for hydraulic modelling of the Main Rivers, or Breach Modelling;

- Product 6 contains the model output data so the applicant can interrogate the data to inform the FRA.
- Product 7 comprises the hydraulic model itself.
- Product 8 contains flood defence breach hazard mapping.

Products 1 – 6 and 8 can be used to inform a Level 2 FRA. In some cases, it may be appropriate to obtain Product 7 and to use as the basis for developing a site-specific model for a proposed development as part of a Level 3 FRA. This can be requested via either their National Customer Contact Centre via enquiries@environment-agency.gov.uk or the Customer and Engagement Team via KSLEnquiries@environment-agency.gov.uk.

Modelling of Ordinary Watercourses

It should be noted that the scope of modelling studies undertaken by the Environment Agency typically cover flooding associated with Main Rivers, and therefore Ordinary Watercourses that form tributaries to the Main Rivers may not always be included in the model. Where a proposed development site is in close proximity to an Ordinary Watercourse and either no modelling exists, or the available modelling is considered to provide very conservative estimates of flood extents (due to the use of national generalised JFLOW modelling), applicants may need to prepare a simple hydraulic model to enable more accurate assessment of the probability of flooding associated with the watercourse and to inform the site-specific FRA. This should be carried out in line with industry standards and in agreement with the Environment Agency and the LLFAs.

E.4 What needs to be addressed in a FRA?

The PPG states that the objectives of a site-specific flood risk assessment are to establish:

- whether a proposed development is likely to be affected by current or future flooding from any source;
- whether it will increase flood risk elsewhere;
- whether the measures proposed to deal with these effects and risks are appropriate;
- the evidence for the local planning authority to apply (if necessary) the Sequential Test, and;
- whether the development will be safe and pass the Exception Test, if applicable.

E.5 Flood Risk Assessment Checklist

Table E-2 provides a checklist for site-specific FRAs including the likely information that will need to be provided along with references to sources of relevant information. As described in Section E.3, the exact level of detail required under each heading will vary according to the scale of development and the nature of the flood risk. It is expected that this Checklist is completed for all planning applications.

Table E-2 Site-Specific Flood Risk Assessment Checklist (building on guidance in PPG)

What to Include in the FRA		Source(s) of Information
1. Site Description		
Site address	-	-
Site description	-	-
Location plan	Including geographical features, street names, catchment areas, watercourses and other bodies of water	SFRA Appendix A or Merton SFRA Online Map.
Site plan	Plan of site showing development proposals and any structures which may influence local hydraulics e.g. bridges, pipes/ducts crossing watercourses, culverts, screens, embankments, walls, outfalls and condition of channel	OS Mapping Site Survey
Topography	Include general description of the topography local to the site. Where necessary, site survey may be required to confirm site levels (in relation to Ordnance datum). Plans showing existing and proposed levels.	Site Survey Ground Investigation Report London Borough of Merton SWMP: http://www.merton.gov.uk/environment/flooding/flooding-how.htm London Borough of Wandsworth SWMP: http://www.wandsworth.gov.uk/downloads/download/1149/surface_water_management_plan
Geology	General description of geology local to the site.	
Watercourses	Identify Main Rivers and Ordinary Watercourses local to the site.	
Status	Is the development in accordance with the LPA's Local Plan?	Seek advice from the relevant LPA if necessary: London Borough of Merton: http://www.merton.gov.uk/environment/planning/planningpolicy/localplan.htm London Borough of Wandsworth: http://www.wandsworth.gov.uk/info/1004/planning_policy/1366/local_plan
2. Assessing Flood Risk		
The level of assessment will depend on the degree of flood risk and the scale, nature and location of the proposed development. Refer to Table E-1 regarding the levels of assessment. Not all of the prompts listed below will be relevant for every application.		
Tidal Flooding (Wandsworth)	Provide a plan of the site and Flood Zones. Identify any historic flooding that has affected the site, including dates and depths where possible. How is the site likely to be affected by climate change? Determine hazard risk and flood levels on the site from the updated Environment Agency Thames breach modelling. If necessary, undertake new hydraulic breach modelling to determine the flood level, depth, velocity, hazard, rate of onset of flooding on the site.	SFRA Appendix A or Merton SFRA Online Map. Environment Agency London Thames Breach Modelling outputs (Environment Agency Product 8). New hydraulic model.
Flooding from Rivers	Provide a plan of the site and Flood Zones. Identify any historic flooding that has affected the site, including dates and depths where possible. How is the site likely to be affected by climate change? Determine flood levels on the site for the 1% annual probability (1 in 100 chance each year) flood event including an allowance for climate change. Determine flood hazard on the site (in terms of flood depth and velocity). Undertake new hydraulic modelling to determine the flood level, depth, velocity, hazard, rate of onset of flooding on the site.	SFRA Appendix A or Merton SFRA Online Map. Flood Map for Planning (Rivers and Sea). Environment Agency Products 1-7. New hydraulic model.
Flooding from Surface water	Identify any historic flooding that has affected the site. Review the local topography and conduce a site walkover to determine low points at risk of surface water flooding. Review the Risk of Flooding from Surface Water mapping. Where necessary, undertake modelling to assess surface water flood risk.	SFRA Appendix A Figures 2.2, 3.2, 4.2 and 5.2. Site survey and walkover. Risk of Flooding from Surface Water mapping. New modelling study.
Flooding from Groundwater	Desk based assessment based on high level BGS mapping in the SFRA.	SFRA Appendix A or Merton SFRA Online Map. Ground Investigation Report.

	Ground survey investigations. Identify any historic flooding that has affected the site.	SFRA Section 4.4 and 5.5.
Flooding from Sewers	Identify any historic flooding that has affected the site.	SFRA Appendix A or Merton SFRA Online Map. Refer to SFRA Section 4.5 and 5.6
Reservoirs, canals and other artificial sources	Identify any historic flooding that has affected the site. Review the Risk of Flooding from Reservoirs mapping.	Risk of Flooding from Reservoirs mapping. Refer to SFRA Section 4.6 and 5.7
3. Proposed Development		
Current use	Identify the current use of the site.	-
Proposed use	Will the proposals increase the number of occupants / site users on the site such that it may affect the degree of flood risk to these people?	-
Vulnerability Classification	Determine the vulnerability classification of the development. Is the vulnerability classification appropriate within the Flood Zone?	SFRA Table C-2. SFRA Table C-3.
4. Avoiding Flood Risk		
Sequential Test	Determine whether the Sequential Test is required. Consult the LPA (Merton or Wandsworth Council) to determine if the site has been included in the Sequential Test. If required, present the relevant information to the LPA to enable their determination of the Sequential Test for the site on an individual basis.	SFRA Section C.3.
Exception Test	Determine whether the Exception Test is necessary. Where the Exception Test is necessary, present details of: Part 1) how the proposed development contributes to the achievement of wider sustainability objectives as set out in each of the London Borough's Sustainability Appraisal Reports. (Details of how part 2) can be satisfied are addressed in the SFRA Appendix D 'Managing and Mitigating Flood Risk'.)	SFRA Table C-3. SFRA Appendix D.

5. Managing and Mitigating Flood Risk

Section 9 of the SFRA presents measures to manage and mitigate flood risk and when they should be implemented. Where appropriate, the following should be demonstrated within the FRA to address the following questions:

How will the site/building be protected from flooding, including the potential impacts of climate change, over the development's lifetime?

How will you ensure that the proposed development and the measures to protect your site from flooding will not increase flood risk elsewhere?

Are there any opportunities offered by the development to reduce flood risk elsewhere?

What flood-related risks will remain after you have implemented the measures to protect the site from flooding (i.e. residual risk) and how and by whom will these be managed over the lifetime of the development (e.g. flood warning and evacuation procedures)?

Development Layout and Sequential Approach	Plan showing how sensitive land uses have been placed in areas within the site that are at least risk of flooding.	SFRA Appendix D.2.
Riverside Development Buffer Zone	Provide plans showing how a buffer zone of relevant width will be retained adjacent to any Main River or Ordinary Watercourse in accordance with requirements of the Environment Agency or the London Borough Councils.	SFRA Appendix D.2.
Finished Floor Levels	Plans showing finished floor levels in the proposed development in relation to Ordnance Datum taking account of indicated flood depths.	SFRA Appendix D.3.
Safe Access / Egress	Provide a figure showing proposed safe route of escape away from the site and/or details of safe refuge. Include details of signage that will be included on site. Where necessary this will involve mapping of flood hazard associated with river flooding. This may be available from Environment Agency modelling or may need to be prepared as part of hydraulic modelling specific for the proposed development site.	SFRA Appendix D.3.
Flood Warning and Evacuation Plan	Where appropriate reference the Flood Warning and Evacuation Plan or Personal Flood Plan that has been prepared for the proposed development (or will be prepared by site owners).	SFRA Appendix D.3.
Flood Resistance	Details of flood resistance measures that have been incorporated into the design. Include design drawings where appropriate.	SFRA Appendix D.4.

Flood Resilience	Details of flood resilience measures that have been incorporated into the design. Include design drawings where appropriate.	SFRA Appendix D.4.
Floodplain Compensation Storage	Provide calculations or results of a hydraulic modelling study to demonstrate that the proposed development provides compensatory flood storage, and either will not increase flood risk to neighbouring areas or will result in an overall improvement. This should be located and designed to achieve level for level and volume for volume compensation, should be provided on land that is in hydrological continuity with the site within the applicant's ownership and subject to appropriate maintenance regimes for its lifetime. Include cross sectional drawings clearly showing existing and proposed site levels.	SFRA Appendix D.5.
Flow Routing	Provide evidence that proposed development will not impact flood flows to the extent that the risk to surrounding areas is increased. Where necessary this may require modelling.	SFRA Appendix D.5.
Surface Water Management	Details of the following within FRA for all major development proposals in Flood Zones 1, 2 or 3: – Calculations (and plans) showing areas of the site that are permeable and impermeable pre and post-development. – Calculations of pre and post-development runoff rates and volumes including consideration of climate change over the lifetime of the development. – Details of the methods that will be used to manage surface water (e.g. permeable paving, swales, wetlands, rainwater harvesting). – Reference the supporting Sustainable Drainage Strategy for the site. – Information on proposed management arrangements.	SFRA Appendix D.5. Refer to Merton Council website for details on what should be included in a Sustainable Drainage Strategy: https://www.merton.gov.uk/streets-parking-transport/streets-and-pavements/surface-water-drainage-and-suds

E.6 Pre-application Advice

At all stages, the LPA (Merton or Wandsworth Council) and where necessary the Environment Agency and/or the Statutory Water Undertaker may need to be consulted to ensure the FRA provides the necessary information to fulfil the requirements for planning applications.

The Environment Agency and London Borough Councils offer pre-application advice services which should be used to discuss particular requirements for specific applications.

- London Borough of Merton http://www.merton.gov.uk/environment/planning/planningapplications/dcpreappadvice.htm
- London Borough of Wandsworth http://www.wandsworth.gov.uk/info/485/planning_permission/1321/pre-application_advice
- Environment Agency Please email enquiries@environment-agency.gov.uk if you require any pre-application advice. Please see: https://www.gov.uk/guidance/environment-agency-fees-and-charges#planning-application-advice

aecom.com