London Borough of Newham Level 1 Strategic Flood Risk Assessment

Final Report

A1 C03

December 2023

Prepared for:

London Borough of Newham Council

www.jbaconsulting.com

Document Status

Issue date	December 2023
Issued to	London Borough of Newham Council
BIM reference	JQS-JBAU-XX-XX-RP-Z-0001-A1-C02
Revision	A1 C02
Prepared by	Freya Nation BSc Technical Assistant
	Libby Raines BSc Technical Assistant
	Georgie Troy Trainee Technician
Reviewed by	Louise Goode BSc MRes PhD Flood Risk Analyst
	Anna Beasley BSc MSc CEnv MCIWEM C.WEM Technical Director
Authorised by	David Kearney BSc MSc MCIWEM C.WEM Project Director

Carbon Footprint

JBA is committed to championing sustainability and has made The Ten Principles of the UN Global Compact part of its culture and operations. We have a Group-wide objective to be a Net Zero carbon emissions business.

The format of this report is optimised for reading digitally in pdf format; duplex printing in B&W on 100% post-consumer recycled A4 will result in a carbon footprint of 586g

CO_2e. This will increase to 745g CO_2e if primary-source paper is used. Please consider the environment before printing.

Contract

JBA Project Manager	Louise Goode BSc MRes PhD
Address	JBA Coleshill, The Library, St Philip's Courtyard, Church Hill, Coleshill, Birmingham, B46 3AD
JBA Project Code	2022s1632

This report describes work commissioned by London Borough of Newham Council by an email dated 8th December 2022. The Client's representative for the contract was Ellie Kuper Thomas of London Borough of Newham Council. Louise Goode, Freya Nation, Libby Raines and Georgie Troy of JBA Consulting carried out this work.

Purpose and Disclaimer

Jeremy Benn Associates Limited ("JBA") has prepared this Report for the sole use of London Borough of Newham and its appointed agents in accordance with the Agreement under which our services were performed.

JBA has no liability for any use that is made of this Report except to London Borough of Newham for the purposes for which it was originally commissioned and prepared.

No other warranty, expressed or implied, is made as to the professional advice included in this Report or any other services provided by JBA. This Report cannot be relied upon by any other party without the prior and express written agreement of JBA.

The conclusions and recommendations contained in this Report are based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from whom it has been requested and that such information is accurate. Information obtained by JBA has not been independently verified by JBA, unless otherwise stated in the Report.

The methodology adopted and the sources of information used by JBA in providing its services are outlined in this Report. The work described in this Report was undertaken between January 2023 and December 2023, and is based on the conditions encountered and the information available during the said period. The scope of this Report and the services are accordingly factually limited by these circumstances.

JBA disclaims any undertaking or obligation to advise any person of any change in any matter affecting the Report, which may come or be brought to JBA's attention after the date of the Report.

Certain statements made in the Report that are not historical facts may constitute estimates, projections or other forward-looking statements and even though they are based on reasonable assumptions as of the date of the Report, such forward-looking statements by their nature involve risks and uncertainties that could cause actual results to differ materially from the results predicted. JBA specifically does not guarantee or warrant any estimates or projections contained in this Report.

Acknowledgements

We would like to acknowledge the assistance of London Borough of Newham Council, the Environment Agency, Barking and Dagenham Council, Redbridge Council, Waltham Forest Council, Tower Hamlets Council, Hackney Council, Greenwich Council, London Legacy Development Corporation (LLDC) Area, Canal and Rivers Trust and Thames Water.

Contents

List of Figures

List of Tables

Abbreviations

1D	One Dimensional (modelling)
2D	Two Dimensional (modelling)
AEP	Annual Exceedance Probability
AONB	Area of Outstanding Natural Beauty
BGI	Blue Green Infrastructure
BGS	British Geological Survey
CC	Climate Change
CDA	Critical Drainage Areas
CFMP	Catchment Flood Management Plan
CIRIA	Construction Industry Research and Information Association
CSO	Combined Sewer Overflow
DEFRA	Department of the Environment, Food and Rural Affairs (formerly MAFF)
EA	Environment Agency
FCERM	Flood and Coastal Erosion Risk Management (Environment Agency R&D project)
FRA	Flood Risk Assessment
FRM	Flood Risk Management
FWA	Flood Warning Area
FWS	Flood Warning Service
GIS	Geographical Information System
GLA	Greater London Authority
IDB	Internal Drainage Board
ISIS	Hydrology and hydraulic modelling software
IWMS	Integrated Water Management Strategy
LLFA	Lead Local Flood Authority
LFRZ	Local Flood Risk Zones
LPA	Local Planning Authority
LBN	London Borough of Newham
LiDAR	Light Detection And Ranging
LCY	London City Airport
LLDC	London Legacy Development Corporation
MCA	Multi Criteria Analysis

NFM ..... Natural Flood Management
NPPF..... National Planning Policy Framework
OA..... Opportunity Area
PFRA..... Preliminary Flood Risk Assessment
PPG..... Planning Policy Guidance
RBD..... River Basin District
RBMP..... River Basin Management Plan
RoFfSW..... Risk of Flooding from Surface Water
RMA ..... Risk Management Authority
RwH ..... Rain Water Harvesting
SFRA..... Strategic Flood Risk Assessment
SI..... Site Investigation
SuDS..... Sustainable Urban Drainage Systems
WFD ..... Water Framework Directive
TE2100.....Thames Estuary 2100
TUFLOW.....Two-dimensional Unsteady FLOW (a hydraulic model)
UKCP18 .....United Kingdom Climate Projections 2018

Definitions

1D model: One-dimensional hydraulic model.

2D model: Two-dimensional hydraulic model.

Annual Exceedance Probability (AEP): The probability that a given rainfall total accumulated over a given duration will be exceeded in any one year.

Brownfield: Previously developed parcel of land.

Critical drainage areas: A discrete geographic area where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, Main River and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting houses, businesses and/or local infrastructure.

Design flood: This is a flood event of a given annual flood probability, which is generally taken as:

- river flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year); or
- tidal flooding with a 0.5% annual probability (1 in 200 chance each year); or
- surface water flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year),

plus, an appropriate allowance for climate change.

Exception Test: Set out in the NPPF, the Exception Test is a method used to demonstrate that flood risk to people and property will be managed appropriately, where alternative sites at a lower flood risk are not available. The Exception Test is applied following the Sequential Test.

Flood defence: Infrastructure used to protect an area against floods as floodwalls and embankments; they are designed to a specific standard of protection (design standard).

Flood Map for Planning: The Environment Agency Flood Map for Planning (Rivers and Sea) is an online mapping portal which shows the Flood Zones in England. The Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences and do not account for the possible impacts of climate change.

Flood Risk Area: An area determined as having a significant risk of flooding in accordance with guidance published by Defra and WAG (Welsh Assembly Government).

Flood Risk Regulations: Transposition of the EU Floods Directive into UK law. The EU Floods Directive is a piece of European Community (EC) legislation to specifically address flood risk by prescribing a common framework for its measurement and management.

Floods and Water Management Act (2010): Part of the UK Government's response to Sir Michael Pitt's Report on the Summer 2007 floods, the aim of which is to clarify the legislative framework for managing surface water flood risk in England.

Fluvial Flooding: Flooding resulting from water levels exceeding the bank level of a river.

Functional Floodplain: The land where water has to flow or be stored in times of flood.

Greenfield: Undeveloped parcel of land.

Indicative Flood Risk Area: Nationally identified flood risk areas based on the definition of ‘significant’ flood risk described by Defra and WAG.

Lead Local Flood Authority (LLFA): County councils and unitary authorities which lead in managing local flood risks (risks of flooding from surface water, groundwater and ordinary (smaller) watercourses). The London Borough of Newham is a lead local flood authority.

Local Planning Authority (LPA): The local government body which is responsible by law to exercise planning functions for a particular area. The London Borough of Newham and the London Legacy Development Corporation are local planning authorities.

Main River: A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers.

Natural Flood Management (NFM): A wide range of techniques can be used that aim to reduce flooding by working with natural features and processes to store or slow down flood waters before they can damage flood risk receptors (e.g., people, property, infrastructure, etc.).

Net zero: The balance between the amount of greenhouse gas produced and the amount removed from the atmosphere.

Ordinary Watercourse: All watercourses that are not designated Main River. Local Authorities or, where they exist, IDBs have similar permissive powers as the Environment Agency in relation to flood defence work. However, the riparian owner has the responsibility of maintenance.

Pitt Review: Comprehensive independent review of the 2007 summer floods by Sir Michael Pitt, which provided recommendations to improve flood risk management in England.

Resilience Measures: Measures designed to reduce the impact of water that enters property and businesses; could include measures such as raising electrical appliances.

Resistance Measures: Measures designed to keep flood water out of properties and businesses; could include flood guards for example.

Return Period: Is an estimate of the interval of time between events of a certain intensity or size, in this instance it refers to flood events. It is a statistical measurement denoting the average recurrence interval over an extended period of time.

Riparian owner: A riparian landowner, in a water context, owns land or property, next to a river, stream or ditch.

Risk: In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring, and the consequence of the flood.

Risk Management Authority (RMA): Operating authorities who's remit and responsibilities concern flood and/or coastal risk management.

Sequential Test: Set out in the NPPF, the Sequential Test is a method used to steer new development to areas with the lowest probability of flooding.

Sewer flooding: Flooding caused by a blockage or overflowing in a sewer or urban drainage system.

Standard of Protection (SoP): Defences are provided to reduce the risk of flooding from a river and within the flood and defence field standards are usually described in terms of a flood event return period. For example, a flood embankment could be described as providing a 1% AEP standard of protection.

Stakeholder: A person or organisation affected by the problem or solution or interested in the problem or solution. They can be individuals or organisations, includes the public and communities.

Sustainable Drainage Systems (SuDS): Methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques.

Surface water (pluvial) flooding: Flooding as a result of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or watercourse or cannot enter it because the network is full to capacity.

Executive Summary

This report provides a comprehensive and robust evidence base on flood risk issues to support the review and update of the London Borough of Newham (LBN) Local Plan and associated Planning Policy documents, using the best available information. This is a Level 1 Strategic Flood Risk Assessment (SFRA), and it will be used to inform decisions on the location of future development and the preparation of sustainable policies for the long-term management of flood risk.

Introduction

To support the preparation of a new Local Plan for the LBN Council, the key objectives of the assessment are:

- To provide an up-to-date Strategic Flood Risk Assessment, taking into account the most recent policy and legislation in the National Planning Policy Framework (2022).
- To collate and analyse the latest available information and data for current and future (i.e. climate change) flood risk from all sources, and how these may be mitigated.
- To inform decisions in the emerging Local Plans, including the selection of development sites and planning policies.
- To provide evidence to support the application of the Sequential Test for the allocation of new development sites, to support the LBN Council's preparation of the Local Plan.
- To provide a comprehensive set of maps presenting flood risk from all sources that can be used as evidence base for use in the emerging Local Plan.
- To provide advice for applicants carrying out site-specific Flood Risk Assessments and outline specific measures or objectives that are required to manage flood risk.

Summary of flood risk in the London Borough of Newham

Fluvial and tidal flooding: some areas of the LBN are at greater risk than others. The main watercourses associated with fluvial and or tidal risk are:

- River Lee - the River Lee flows along the western boundary of the LBN before converging with the River Thames in the south-western corner of the Borough. Modelled flood extents suggest that properties in Temple Mills, Stratford and Three Mills are at flood risk from the River Lee, particularly in the areas where there are historic recorded flood outlines.

- River Roding – the River Roding flows along the eastern boundary of the LBN before converging with the River Thames in the south-eastern corner of the Borough. Areas at risk include Little Ilford, East Ham and Beckton.
- River Thames – the tidally influenced River Thames flows along the LBN's southern boundary. Due to the flood defences along the River Thames being designed to protect to a 0.1% AEP flood event, the surrounding areas are not at risk of flooding from the Thames. However, breach modelling suggests that if these defences were to fail, the south and west parts, as well as the eastern boundary, of the LBN will be impacted. Areas within these flood extents include Stratford, West Ham, Canning Town, North Woolwich, Cyprus, Beckton and East Ham.
- Ordinary watercourses - there are a number of small ordinary watercourses within the Borough which are not currently modelled but have the potential to cause fluvial flood risk. For this assessment, the surface water mapping has been used to provide an indication of risk; however, modelling of these watercourses will be essential in a Flood Risk Assessment to inform the risk to any development proposals within the vicinity of unmodelled watercourses.

Surface Water: The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping shows that the risk of surface water flooding is widespread across LBN. Three ICM models have been provided to use within this assessment. These models cover areas known to be at surface water flood risk. Water predominantly flows along topographically low-lying areas, including some roads, and channelled into watercourses such as the Rivers Lee and Roding.

Historic data: Data provided by LBN Council showed 255 incidences of recorded flooding within the study area since 2012. The incidents detailed were due to surface water, groundwater and sewer flooding. Details of whether the flooding was internal to properties or affected only highways and curtilage was available for these records. It is likely that the number of recorded flood incidents is smaller than the actual number of incidents that have occurred in LBN due to underreporting.

Effects of climate change: Areas at risk of flooding today are likely to become at increased risk in the future and the frequency of flooding will also increase in such areas as a result of climate change. Flood extents will increase; in some locations, this may not be by very much, but flood depth, velocity and hazard may have more of an impact due to climate change. In particular, fluvial extents increase in Beckton, East Ham, Little Ilford, Stratford and Canning Town. Tidal breach extents increase in the South of the Borough and in the lower reaches of the River Roding and River Lee.

Surface water flooding increases in Canning Town, East Ham, West Ham and Little Ilford in particular. It is recommended that LBN Council work with other Risk Management Authorities (RMAs) to review how existing and new development in these areas are to be protected from flood risk when developing climate change plans and strategies for the borough, particularly in line with the TE2100 plan. For example, SuDS and blue-green infrastructure can help manage and even improve surface water flood risk.

Groundwater: Groundwater emergence mapping indicates that the majority of the Borough is at negligible risk from groundwater emergence. There are some localised areas where groundwater levels are low-moderate. These areas include North Woolwich, Stratford and West Ham. In these areas any groundwater flooding incidence has a greater than 1% annual probability of occurrence. This means there will be a significant possibility that incidence of groundwater flooding could lead to damage to property at, or near, this location. Further consideration of the local level of risk and mitigation is recommended for sites in these areas.

Canals: There are no purpose-built canals within the LBN. However, the tributaries of the River Lee at Stratford are heavily canalised at Bow Back Creek (including the Pudding Mill, Three Mills Wall and Waterworks River) and are managed by the Canal and River Trust. These watercourses are controlled by a series of locks. There have been two recorded flooding incidents at Three Mills on the Bow Back Creek (Section 5.1.).

Reservoirs: There are no records of flooding from reservoirs in the study area and the level and standard of inspection and maintenance required under the Reservoirs Act 1975 means that the risk of flooding from reservoirs is relatively low. Defra's Risk of Flooding from reservoirs mapping (Appendix A) shows the areas within LBN which are at risk from reservoir flooding.

Cumulative Impact Assessment: High level recommendations have been made for sites proposed within in each of the high risk catchments (see Appendix F), and the recommendations should be considered by developers as part of a site specific assessment. These areas include Canning Town, East Ham, Plaistow, West Ham and part of Little Ilford. FRAs should consider the potential cumulative effects of all proposed developments and how this affects sensitive receptors (i.e., surface water flooding).

How to use this report

This report is the Level 1 Strategic Flood Risk Assessment (SFRA) for the London Borough of Newham. It details all sources of flood risk in the borough, the current flood management and defences, the expected effects of climate change, opportunities to reduce the causes and impacts of flooding, the cumulative impacts of development and land-use change and recommendations on how to address flood risk in development.

The Level 2 SFRA contains further detail on the flood risk in the London Borough of Newham at a site level. It contains the information needed to apply the Exception Test, if required.

Planners

The SFRA provides recommendations regarding all sources of flood risk in LBN, which can be used to inform policy on flood risk within Local Plans. This includes how the cumulative impact of development should be considered.

It provides the latest flood risk data and guidance to inform the Sequential Test and provides guidance on how to apply the Exception Test. LBN Council can use the information in this Level 1 SFRA to apply the Sequential Test to strategic allocations and identify where the Exception Test will also be needed.

The SFRA provides guidance for developers, which can be used by development management staff to assess whether site-specific Flood Risk Assessments meet the required quality standard.

Developers

This SFRA provides guidance for the application of the Sequential and Exception Tests at a site level and for detailed site-specific Flood Risk Assessments. For sites that are not strategic allocations, developers will need to apply the Sequential Test (including consideration of reasonably available alternatives).

For the following sites, whether strategic allocations or windfall sites, developers will need to apply the Exception Test and use information in a site-specific Flood Risk Assessment to inform this test at planning application stage:

- Highly vulnerable and in Flood Zone 2
- Essential infrastructure in Flood Zone 3a or 3b
- More vulnerable in Flood Zone 3a
- Any development with significant* risk in the surface water 100-year event plus 40% climate change allowance flood extent
- Any development with significant* risk in the Risk of Flooding from Reservoirs mapping ‘Wet Day’ flood extent.

**Flood risk issues are not always black and white - the significance of issues requires professional judgement, based on the location, topography and nature (including depth, velocity and hazard) of flooding, rather than simply whether part of a site is within a given flood extent. This would be determined as part of a Level 2 assessment.*

Developers can determine the Flood Zone and surface water flood extent which their site lies within by using the Appendix A mapping contained in this report.

This is a strategic assessment and does not replace the need for site-specific Flood Risk Assessments where a development is either within Flood Zones 2 or 3, and either greater than a hectare or on land identified in an SFRA as being at increased risk in the future, in Flood Zone 1. In addition, a Surface Water Drainage Strategy will be needed for all major developments in any Flood Zone to satisfy LBN Council, the Lead Local Flood Authority (LLFA).

Developers can use the information in this SFRA, alongside site-specific research to help scope out what additional work will be needed in a detailed Flood Risk Assessment. To do this, they should refer to Section 5, Appendix A (Flood risk mapping) and Appendix B (Data sources used in the SFRA).

At the planning application stage, developers may need to undertake more detailed hydrological and hydraulic assessments of the watercourses to verify flood extent (including latest climate change allowances, last updated in May 2022), inform Master planning and demonstrate, if required, that the Exception Test is satisfied. As part of the Environment Agency's updated guidance on climate change, which must be considered for all new developments and planning applications, developers will need to undertake a detailed assessment of climate change as part of the planning application process when preparing FRAs.

Developers need to ensure that new development does not increase surface water runoff from a site and should appropriately address the implications of proposals on surface water flow routes and surface storage. Section 8 provides information on the surface water drainage requirements of LBN Council as LLFA. Sustainable Drainage Systems (SuDS) should be considered at the earliest stages that a site is developed which will help to minimise costs and overcome any site-specific constraints.

Site-specific Flood Risk Assessments will need to identify how flood risk will be mitigated so the development is safe from flooding. In high-risk areas, the Flood Risk Assessment will also need to consider emergency arrangements, including how there will be safe access and egress from the site.

Any developments located within an area protected by flood defences and where the standard of protection is not of the required standard (either now or in the future) should be identified and the use of developer contributions considered to fund improvements.

Neighbourhood plans

The SFRA provides:

- Information on the sources of flooding and the variation in the risk across LBN.
- Identifies the organisations that are involved in flood risk management and their latest strategic plans, current plans for major flood defences.
- The requirements for detailed Flood Risk Assessments and to inform the site selection process.

Neighbourhood planning groups can use this information to assess the risk of flooding to sites within their community, using Section 5, the sources of flooding in LBN and the flood mapping in the appendices. The SFRA will also be helpful for developing community level flood risk policies in high flood risk areas.

Mapping

The SFRA mapping highlights on a broad scale where flood risk from fluvial, coastal, surface water, groundwater and the effects of climate change are most likely. The maps are useful to provide a community level view of flood risk but do not identify if an individual property is at risk of flooding or model small scale changes in flood risk.

Local knowledge of flood mechanisms will need to be included to complement this broadscale mapping. Similarly, all known available recorded historical flood events for the Borough are listed in Section 5.1 and this can be used to supplement local knowledge regarding areas worst hit by flooding. There are no known ongoing and proposed flood alleviation schemes planned as outlined in Section 6.6 and Section 7.4 discusses mitigations, resistance and resilience measures which can be applied to alleviate flood risk to an area.

Cumulative Impact Assessment

A cumulative impact assessment has been carried out and has identified catchments in LBN which are more sensitive to the cumulative impact of development and where more stringent policy regarding flood risk is recommended. Any development in these areas should seek to contribute to work that reduces wider flood risk in those catchments. The cumulative impact assessment and associated mapping can be found in Appendix F.

1 Introduction

1.1 Purpose of the Strategic Flood Risk Assessment

> ***"Strategic policies should be informed by a strategic flood risk assessment, and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards."***
> (National Planning Policy Framework (2021), paragraph 160)

The London Borough of Newham (LBN) Council commissioned JBA Consulting to prepare a Level 1 and Level 2 Strategic Flood Risk Assessment (SFRA) for the LBN Council in December 2022. This study provides a comprehensive and robust evidence base to support the production of a new local plan. This SFRA is the Level 1 report and replaces the previous **Level 1 report**, which was last updated in 2017.

This 2023 SFRA will be used to inform decisions on the location of future development and the preparation of sustainable policies for the long-term management of flood risk, provided the implications of the August 2022 changes to the Planning Practice Guidance (PPG) are understood by those developing the Local Plan. Annex 1 - Updates to the Planning Practice Guidance (25 August 2022) provides more information on the August 2022 changes to the PPG.

1.2 Local Plan

The new LBN Council Local Plan is updating the local planning policy framework currently set by the **Newham Local Plan 2018-2033**.The aim of the Local Plan is to establish a planning framework for future development, identifying how much land is available and where such land should be provided for new homes and employment, alongside associated infrastructure.

1.3 Levels of SFRA

The **Planning Practice Guidance (PPG)** identifies the following two levels of SFRA:

- Level 1 (L1): where flooding is not a major issue in relation to potential site allocations and where development pressures are low. The assessment should be of sufficient detail to enable application of the Sequential Test. The L1 should be used to attempt to allocate sites in areas of lowest overall flood risk (including other sources of risk).
- Level 2 (L2): where allocations are proposed in flood risk areas (i.e., from any source now and in the future), or where future windfall pressures in flood risk

areas are expected. The L2 SFRA should be detailed enough to identify which development sites have the least risk of flooding and the application of the Exception Test, if relevant. The L2 SFRA will only be used to assess whether the Exception Test can be passed, and not the Sequential Test.

This L1 SFRA is intended to provide a robust assessment of the Borough's strategic flood risk and to assess the flood risk of identified development sites in order to ensure that sites allocated for development in the revised Local Plan pass the Sequential and Exceptions Tests, to minimise flood risk.

1.4 Level 1 SFRA outputs

The outputs of this SFRA include:

- Identification of policy and technical updates.
- Identification of any strategic flooding issues which may have cross boundary implications.
- Appraisal of all potential sources of flooding, including main river, ordinary watercourse, surface water, sewers, groundwater, reservoirs and canals.
- Review of historic flooding incidents.
- Reporting on the standard of protection provided by existing flood risk management infrastructure.
- Mapping showing distribution of flood risk across all Flood Zones from all sources of flooding including climate change allowances.
- Assessment of the potential increase in flood risk due to climate change.
- Flood Risk Assessment guidance for developers.
- Assessment of surface water management issues, how these can be addressed through development management policies and the application of Sustainable Drainage Systems.
- Recommendations of the criteria that should be used to assess future development proposals and the development of a Sequential Test and sequential approach to flood risk.
- Assessment of strategic flood risk solutions that can be implemented to reduce risks.

1.5 SFRA study area

The study area encompasses the entirety of LBN. This covers an area of approximately 3,600 ha and has a population of approximately 351,100 **(Census, 2021)**.

LBN and the surrounding boroughs of London are densely populated, with neighbouring borough Tower Hamlets having the largest population increase in London of 22.1% between 2011 and 2021. As of 2021, the LBN is the eighth most densely populated of London's 33 local authority areas. LBN has the fourth fastest growing population in London, increasing by 14% between 2011 and 2021 **(Census, 2021).**

Figure 1-1 shows the study area and the neighbouring London boroughs. There are six London boroughs that border LBN. These are the London Boroughs of:

- Tower Hamlets
- Waltham Forest
- Hackney
- Redbridge
- Greenwich; and
- Barking and Dagenham.

The LBN is covered by Thames Water Utilities Ltd as the main water and sewerage provider.

The LBN is covered by the London Borough of Newham Council as the Lead Local Flood Authority (LLFA).

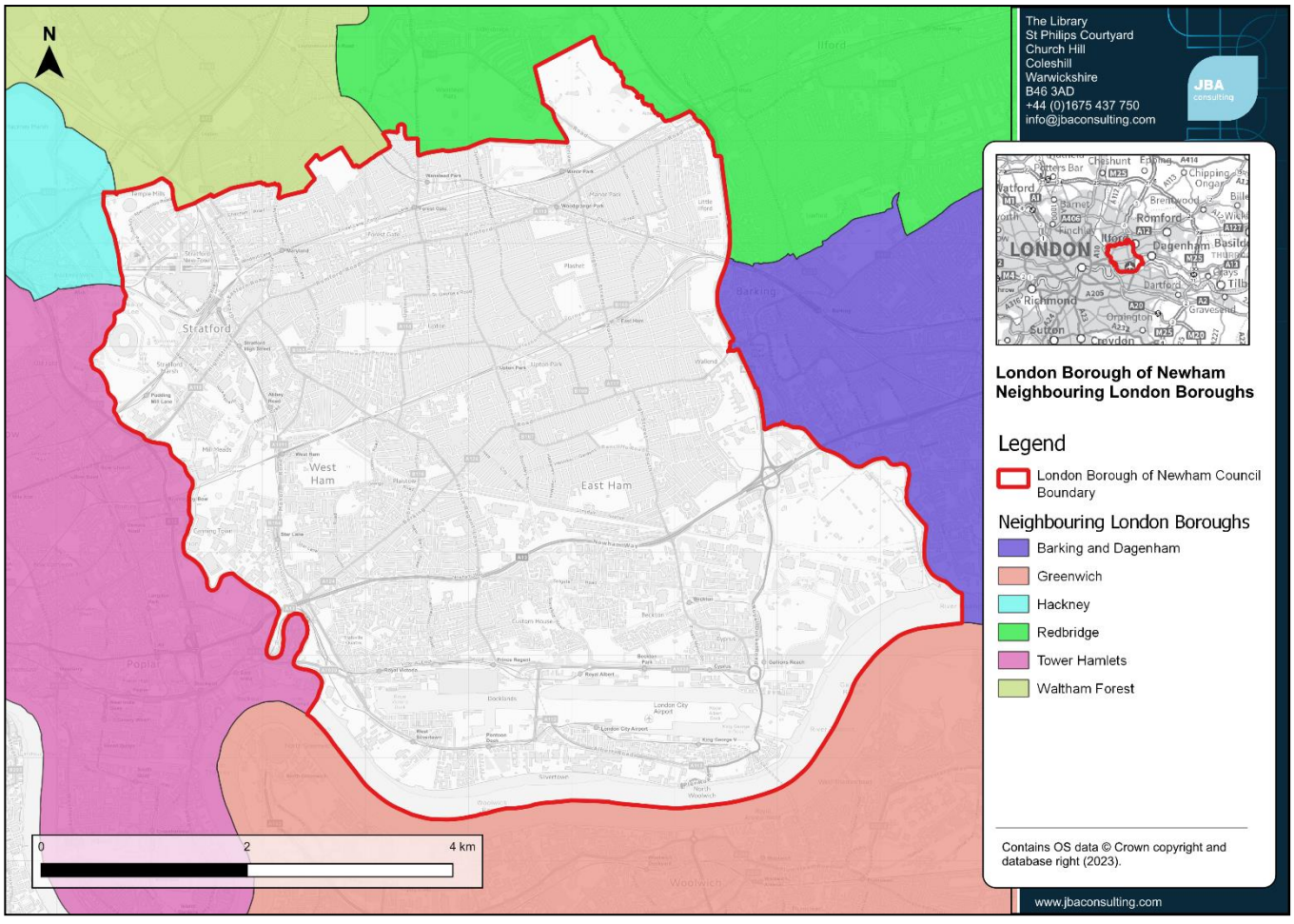

Figure 1-1: LBN Study Area and Neighbouring London Boroughs

The principal watercourses flowing through LBN are displayed in Figure 1-2, and include:

- River Thames
- River Roding and its tributary (Alders Brook).
- River Lea or Lee (hereafter named the River Lee) and tributaries (Bow Creek, Channelsea River, City Mill River, Pudding Mill River, Three Mills Wall River and Water Works River).

The River Thames is tidally influenced and flows along the entire width of the southern boundary of the LBN in an easterly direction. It then continues to flow through the southern boundaries of Barking and Dagenham as well as Havering before eventually discharging into the North Sea. The Thames Barrier is located within the LBN, and stretches between Silvertown (LBN) and New Charlton (Royal Borough of Greenwich).

The River Lee flows from north to south along the western boundary of LBN, discharging into the Thames in the south-western corner of Newham. The final 3.5km of the River Lee is known as Bow Creek.

The River Roding flows from north to south along the eastern boundary of LBN. Part of the River Roding is within the London Borough of Barking and Dagenham. The last 1.5km of the River Roding are known as the Barking Creek (also known as Warpools Reach), which discharges into the River Thames in the south-eastern corner of the LBN.

The Royal Docks are also located in the south of the borough on historical River Thames riverside marshes and collectively enclosed docks.

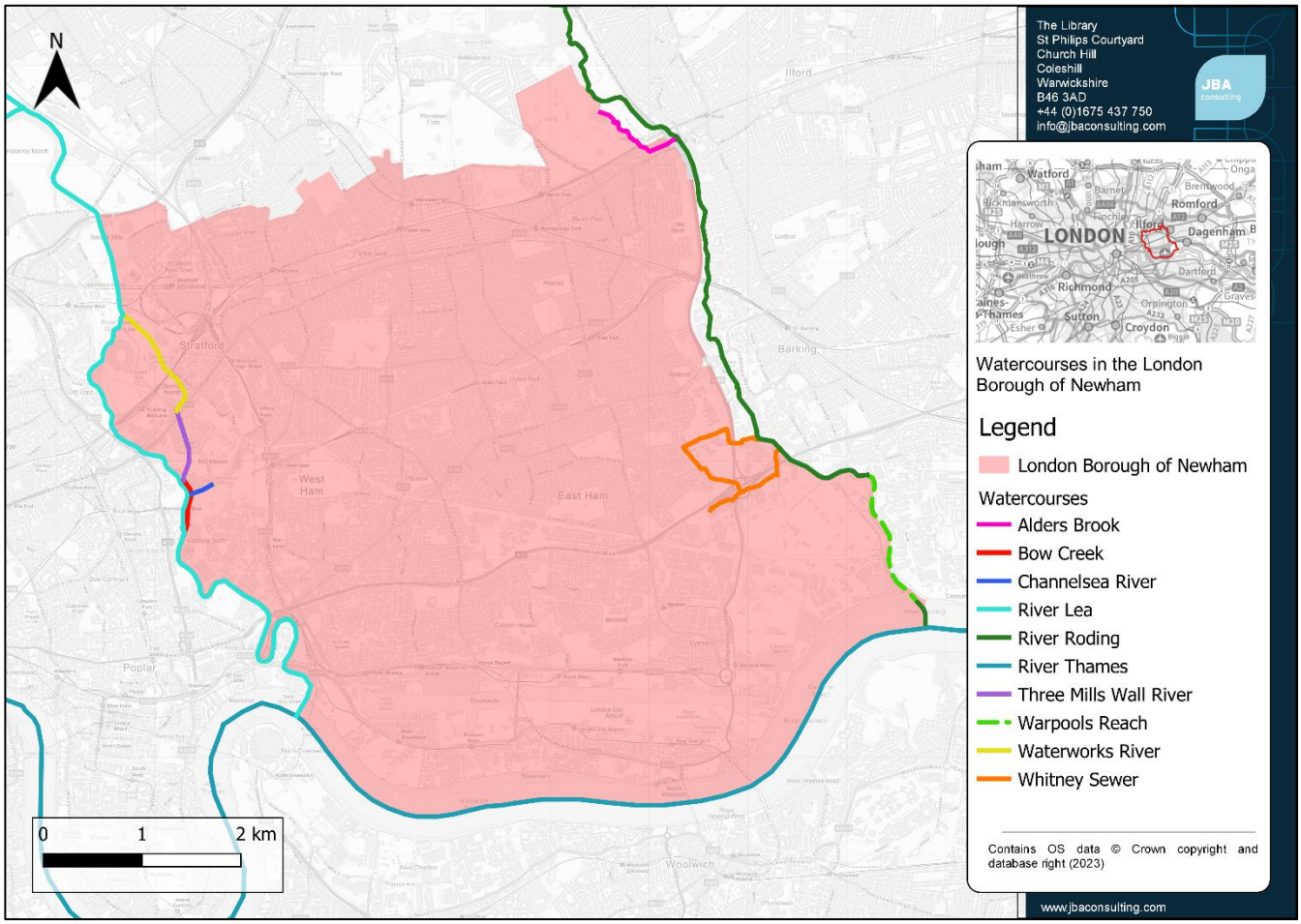

Figure 1-2: Main rivers and watercourses within LBN

1.6 Consultation

The following parties (external to LBN Council) were consulted to inform the SFRA:

- Environment Agency
- LBN Council (LLFA)
- Thames Water
- Canal and River Trust
- London Fire Brigade
- Highways England
- Highways Authority
- Neighbouring authorities:
    i. London Borough of Barking and Dagenham Council
    ii. London Borough of Hackney Council
    iii. London Borough of Redbridge Council
    iv. London Borough of Tower Hamlets Council
    v. London Borough of Waltham Forest Council

vi. London Legacy Development Corporation (LLDC) Area (Local Planning Authority until December 2024 – for more information please visit their **website**).
vii. Royal Borough of Greenwich Council

1.7 Use of SFRA data

L1 SFRAs are high-level strategic documents and do not go into detail on an individual site-specific basis. The primary purpose is to provide an evidence base to inform the preparation of Local Plans and any future flood risk policies.

Developers will still be required to undertake site-specific Flood Risk Assessments to support Planning Applications. Developers will be able to use the information in the SFRA to scope out the sources of flood risk that will need to be explored in more detail at site level.

Appendix C presents a SFRA User Guide, further explaining how SFRA data should be used, including reference to relevant sections of the SFRA, how to consider different sources of flood risk and recommendations and advice for Sequential and Exception Tests.

Advice to users has been highlighted in amber boxes throughout the SFRA.

Key reference material such as external guidance documents/ websites are provided in blue throughout the SFRA.

On the date of publication, the SFRA contains the latest available flood risk information. Over time, new information will become available to inform planning decisions, such as updated hydraulic models (which then update the Flood Map for Planning), updated information on other sources of flood risk or evidence showing future flood risks, new flood event information, new defence schemes and updates to policy, legislation and guidance. Developers should check the online Flood Map for Planning in the first instance to identify any major changes to the EA's Flood Zones and the long term flood risk mapping portal for any changes to flood risk from surface water or inundation from reservoirs.

1.8 Structure of this report

The contents of the report are set out according to the following structure:

Section	Contents	How to use
Executive Summary	Focuses on how the SFRA can be used by planners, developers and neighbourhood planners	Summarises the Level 1 findings and recommendations.
1. Introduction	Provides a background to the study, the Local Plan stage the	For general information and context.

Section	Contents	How to use
	SFRA informs, the study area, the roles and responsibilities for the organisations involved in flood management and how they were involved in the SFRA Provides a short introduction to how flood risk is assessed and the importance of considering all sources Includes this table of the contents of the SFRA	
2. Flood risk policy and strategy	Sets out the relevant legislation, policy and strategy for flood risk management at a national, regional and local level.	Users should refer to this section for any relevant policy which may underpin strategic or site-specific assessments.
3. Planning policy for flood risk management	Provides an overview of both national and existing Local Plan policy on flood risk management This includes the EA's Flood Zones, application of the Sequential Approach and Sequential/Exception Test process. Provides guidance for the Local Planning Authority and Developers on the application of the Sequential and Exception Test for both allocations and windfall sites, at allocation and planning application stages.	Users should use this section to understand and follow the steps required for the Sequential and Exception Tests.
4. Impact of climate change	Outlines the latest climate change guidance published by the Environment Agency and how this was applied to the SFRA. Sets out how developers should apply the guidance to inform site specific Flood Risk Assessments.	This section should be used to understand the climate change allowances for a range of epochs and conditions, linked to the vulnerability of a development.
5. Understanding flood risk in the London Borough of Newham	Provides an overview of the characteristics of flooding affecting the study area and key risks including historical flooding	This section should be used to understand all sources of flood risk in the London Borough of Newham including where has flooded

Section	Contents	How to use
	incidents, flood risk from all sources and flood warning arrangements.	historically. This section may also help identify any data gaps, in conjunction with Appendix B.
6. Flood alleviation schemes and assets	Provides a summary of current flood defences and asset management and future planned schemes. Introduces actual and residual flood risk.	This section should be used to understand if there are any defences or flood schemes in a particular area, for further detailed assessment at site-specific stage.
7. Flood risk management for developers	Guidance for developers on Flood Risk Assessments (FRAs), considering flood risk from all sources.	Developers should use this section to understand requirements for FRAs and what conditions/ guidance documents should be followed, as well as mitigation options.
8. Surface water management and Sustainable Drainage Systems	An overview of Sustainable Drainage Systems, Guidance for developers on Surface Water Drainage Strategies, considering any specific local standards and guidance for Sustainable Drainage Systems (SuDS) from the Lead Local Flood Authority.	Developers should use this section to understand what national, regional and local SuDS standards are applicable. Hyperlinks are provided.
9. Summary and recommendations	Summarises sources of flood risk in the study area and outlines planning policy recommendations.	Developers and planners should use this as a summary of the SFRA. Developers should refer to the Level 1 SFRA recommendations when considering requirements for site-specific assessments.
Appendices	Appendix A: Flood risk maps Appendix B: Data sources used in the SFRA Appendix C: SFRA User Guide Appendix D: Flood Alert and Flood Warning Areas Appendix E: Summary of flood risk across the London Borough of Newham Appendix F: Cumulative Impact Assessment (CIA)	Planners should use these appendices to understand what data has been used in the SFRA, to inform the application of the Sequential and Exception Tests, as relevant, and to use these maps and tabulated summaries of flood risk to understand the nature and location of flood risk.

Section	Contents	How to use
	Appendix G: Modelling Technical Note Annex 1: August 2022 PPG changes.	

1.9 Understanding flood risk

The following content provides useful background information on how flooding arises and how flood risk is determined.

1.9.1 Sources of flooding

Flooding is a natural process and can happen in a wide variety of locations. It constitutes a temporary covering of land not normally covered by water and presents a risk when people and human or environmental assets are present in the area that floods.

Assets at risk from flooding can include housing, transport and public service infrastructure, commercial and industrial enterprises, agricultural land and environmental and cultural heritage. Flooding can occur from many different and combined sources and through many pathways. Major sources of flooding in LBN include:

- Fluvial (rivers) - inundation of floodplains from rivers and watercourses; inundation of areas outside the floodplain due to influence of bridges, embankments and other features that artificially raise water levels; overtopping or breaching of defences; blockages of culverts; blockages of flood channels/corridors.
- Tidal (sea) – The River Thames, as well as the lower reaches of the River Roding and River Lee are tidally influenced. Tidal flooding could occur if the tide overtops or breaches defences.
- Surface water - surface water flooding covers two main pathways including direct run-off from adjacent land (pluvial) and surcharging of piped drainage systems (public sewers, highway drains, etc).
- Groundwater - water table rising after prolonged rainfall to emerge above ground level remote from a watercourse; most likely to occur in low-lying areas underlain by permeable rock (aquifers); groundwater recovery after pumping for mining or industry has ceased.
- Infrastructure failure - reservoirs; canals; industrial processes; burst water mains; blocked sewers or failed pumping stations.

Different types and forms of flooding present a range of different risks and the flood hazards of speed of inundation, depth and duration of flooding can vary greatly. With climate change, the frequency, pattern and severity of flooding are expected to change and become more damaging.

1.10 Likelihood and consequence

Flood risk is a combination of the likelihood of flooding and the potential consequences arising. It is assessed using the source – pathway – receptor model as shown in Figure 1-3. This is a standard environmental risk model common to many hazards and should be the starting point of any assessment of flood risk. However, it should be remembered that flooding could occur from many different sources and pathways, and not simply those shown in the illustration below.

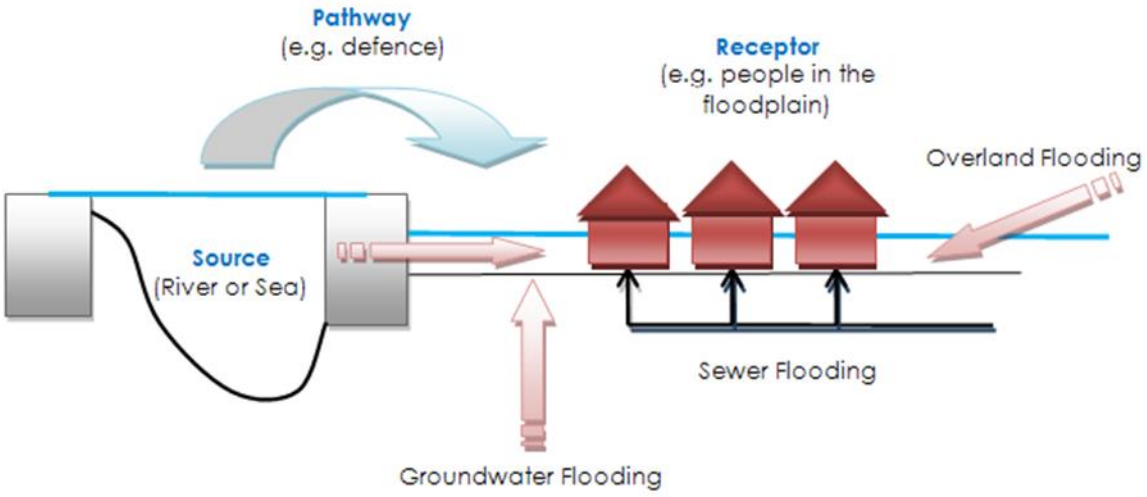

Figure 1-3: Source-Pathway-Receptor Model

The principal sources affecting the study area are rainfall and rivers; the most common pathways are rivers themselves, drains, sewers, overland flows, floodplains and defence assets (for example through overtopping or breach). Receptors can include people, their property and the environment. All these elements must be present for flood risk to arise. Mitigation measures have little or no effect on the magnitude of the sources that cause flooding, but they can block or impede pathways, remove receptors or increase the resilience of receptors.

The planning process is primarily concerned with the appropriate location of receptors, taking appropriate account of potential sources and pathways that might put those receptors at risk. It is therefore important to define the components of flood risk to apply this guidance in a logical and consistent manner.

1.11 Likelihood

Likelihood of flooding is expressed as the percentage probability based on the average frequency measured or extrapolated from records over a large number of years. A 1% probability indicates there is a 1 in 100 chance every year of the predicted flood level being experienced at a particular location i.e., it has a 1% chance of occurring in any one year, not that it will occur once every hundred years.

Considered over the lifetime of development, such an apparently low frequency or rare flood has a significant probability of occurring. For example, a 1% (1 in 100) flood:

- has a 26% (1 in 4) chance of occurring at least once in a 30-year period - the period of a typical residential mortgage; and
- a 49% (1 in 2) chance of occurring in a 70-year period - a typical human lifetime.

1.12 Consequence

The consequences of flooding include fatalities, property damage, disruption to lives and businesses, with severe implications for people (e.g. financial loss, emotional distress, health problems).

Consequences of flooding depend on the hazards caused by flooding (depth of water, speed of flow, rate of onset, duration, wave-action effects, water quality) and the vulnerability of receptors (type of development, nature (e.g. age-structure) of the population, presence and reliability of mitigation measures etc). Flood risk is then expressed in terms of the following relationship:

Flood risk = Probability of flooding x Consequences of flooding

1.13 Risk

Flood risk is not static; it cannot be described simply as a fixed water level that will occur if a river overtops its banks or from a high spring tide that coincides with a storm surge. It is therefore important to consider the continuum of risk carefully. Risk varies depending on the severity of the event, the source of the water, the pathways of flooding (such as the condition of flood defences) and the vulnerability of receptors as mentioned above.

2 Flood Risk Policy and Strategy

This section sets out the flood risk management roles and responsibilities for different organisations and relevant legislation, policy and strategy.

2.1 Roles and responsibilities for Flood Risk Management in the London Borough of Newham

There are different organisations that cover the London Borough of Newham that have responsibilities for flood risk management, known as Risk Management Authorities (RMAs). These are displayed in Table 2-1, with a summary of their responsibilities.

It is important to note that land and property owners are responsible for the maintenance of watercourses either on or next to their properties. Property owners are also responsible for the protection of their properties from flooding as well as other management activities, for example by maintaining riverbeds/ banks, controlling invasive species and allowing the flow of water to pass without obstruction. More information can be found in the Environment Agency publication **'Owning a Watercourse' (2018)**.

When it comes to undertaking works to reduce flood risk, the Environment Agency and the London Borough of Newham as LLFA, have permissive powers and limited resources are prioritised and targeted to where they can have the greatest effect. Permissive powers mean that Risk Management Authorities are permitted to undertake works on watercourses but are not obliged.

Table 2-1: Role and responsibilities for Risk Management Authorities within the LBN.

Risk Management Authority	Strategic Level	Operational Level	Planning role
Environment Agency	Strategic overview for all sources of flooding, national strategy, reporting and general supervision.	Main rivers, reservoirs and tidal flooding.	Statutory consultee for development in Flood Zones 2 and 3 for coastal and fluvial extents.
London Borough of Newham (LLFA)	Preliminary Flood Risk Assessment and Local Flood Risk Management Strategy.	Surface water, groundwater and ordinary watercourses (consenting, enforcement and works).	Statutory consultee for all major developments.
London Borough of Newham Council as Local Planning Authority (LPA).	Local Plans as LPA	Determination of Planning Applications and managing open spaces under Council ownership.	Determination of Planning Applications and managing open spaces under

Risk Management Authority	Strategic Level	Operational Level	Planning role
London Legacy Development Corporation (LLDC) as LPA.*			Council ownership.
Thames Water Utilities Ltd	Asset Management Plans, supported by Periodic Reviews (business cases) Develop Drainage and Wastewater Management Plans	Public sewers	Non-statutory consultee
Highways Authorities: Highways England (for motorways and trunk roads) London Borough of Newham as Local Highway Authority (for other adopted roads).	Highway drainage policy and planning.	Highway drainage Local Highway Authority can adopt some highway drainage features.	Internal planning consultee regarding highways and design standards and options.

*At the time of writing this SFRA, the **London Legacy Development Corporation (LLDC)** acts as the Local Planning Authority (LPA) for development within the Queen Elizabeth Olympic Park and its surrounding areas. Please visit the **LLDC's website** to see the location in which this LPA presides. The LLDC's planning powers and functions will be returned back to the four boroughs it was originally composed of (London Boroughs of Newham, Hackney, Tower Hamlets and Waltham Forest) on the 1st December 2024. Planned developments within the LLDC area should follow the guidance outlined in the **LLDC's Local Plan** and **evidence base** until the LPA's planning powers and functions are returned.

2.2 Relevant legislation

The following legislation is relevant to development and flood risk in LBN:

- **Flood Risk Regulations (2009)** - These transpose the European Floods Directive (2000) into law and require the Environment Agency and LLFAs to produce Preliminary Flood Risk Assessments and identify where there are nationally significant Flood Risk Areas. For the Flood Risk Areas, detailed

flood maps and a Flood Risk Management Plan is produced; this is done in a six-year cycle. At the time of writing this SFRA (September 2023) it is understood that the UK Government intends to scrap the Flood Risk Regulations 2009 as part of a review into retained EU legislation. It is proposed to scrap this by 31st December 2023, as the Flood Risk Regulations duplicate existing domestic legislation, namely the Flood and Water Management Act 2010.

- **Town and Country Planning Act (1990), Water Industry Act (1991), Land Drainage Act (1991), Environment Act (1995), Flood and Water Management Act (2010)** – as amended and implemented via secondary legislation. These set out the roles and responsibilities for organisations that have a role in FRM.
- The **Land Drainage Act (1991, as amended)** and **Environmental Permitting Regulations (2018)** also set out where developers will need to apply for additional permission (as well as planning permission) to undertake works to an Ordinary Watercourse, Main River, or within an IDB district. Local Land Drainage Bylaws are also applicable within IDB areas.
- **The Water Environment Regulations (2017)** – these transpose the European Water Framework Directive (2000) into law and require the Environment Agency to produce River Basin Management Plans (RBMPs). These aim to ensure that the water quality of aquatic ecosystems, riparian ecosystems and wetlands reaches 'good' status.
- Other environmental legislation such as the Habitats Directive (1992), Environmental Impact Assessment Directive (2014) and Strategic Environmental Assessment Directive (2001) also apply as appropriate to strategic and site-specific developments to guard against environmental damage.

2.3 Relevant flood risk policy and strategy documents

Table 2-2 (overleaf) summarises relevant national, regional and local flood risk policy and strategy documents and how these apply to development and flood risk. Hyperlinks are provided to external documents. These documents may:

- Provide useful and specific local information to inform Flood Risk Assessments within the local area.
- Set the strategic policy and direction for Flood Risk Management (FRM) and drainage – they may contain policies and action plans that set out what future flood mitigation and climate change adaptation plans may affect a development site. A developer should seek to contribute in all instances to the strategic vision for FRM and drainage in the district.
- Provide guidance and/or standards that informs how a developer should assess flood risk and/or design flood mitigation and SuDS.

Table 2-2: Summary of relevant national, regional and local flood risk policy and strategy documents.

Scale	Document, lead author and date	Information	Policy and measures	Development	Next update due
National	**National Flood and Coastal Erosion Risk Management Strategy (Environment Agency) 2020**	No	Yes	No	Due to be reviewed in 2026
National	**National Planning Policy Framework and Planning Practice Guidance (Gov.uk) 2021**	No	Yes	Yes	-
National	**Building Regulations Part H (MHCLG) 2010**	No	No	Yes	-
National	**Climate Change Guidance for development and flood risk (Environment Agency 2022)**	No	No	Yes	-
Regional	**London Regional Flood Risk Appraisal (2018)**	Yes	No	Yes	
Regional	**Thames Estuary 2100 Action Plan** (last updated 2023)	Yes	Yes	No	
Regional	**Thames River Basin District River Basin Management Plan (Environment Agency) 2022**	Yes	Yes	No	-
Regional	**Thames River Basin District Flood Risk Management Plan 2022 (Environment Agency)**	Yes	Yes	No	2027
Regional	**Thames Catchment Flood Management Plan (Environment Agency) 2009**	Yes	Yes	No	-

Scale	Document, lead author and date	Information	Policy and measures	Development	Next update due
Regional	**Thames Water- Our Drainage and Wastewater Management Plan 2025-2050**	Yes	Yes	Yes	2028
Local	**Local Flood Risk Management Strategy for Newham 2022**	Yes	Yes	No	-
Local	**London Borough of Newham Preliminary Flood Risk Assessment 2011, updated 2017**	Yes	No	No	-
Local	**Newham Local Plan 2018**	Yes	Yes	Yes	-
Local	**Newham Surface Water Management Plan 2011, updated 2019**	Yes	No	Yes	-

2.4 Key legislation for flood and water management

2.4.1 Flood and Water Management Act (2010)

The **Flood and Water Management Act (FWMA)** was passed in April 2010. It aims to improve both flood risk management and the way water resources are managed.

The FWMA has created clearer roles and responsibilities and helped to define a more risk-based approach to dealing with flooding. This included the creation of a lead role for LAs, as LLFAs, designed to manage local flood risk (from surface water, ground water and ordinary watercourses) and to provide a strategic overview role of all flood risk for the EA.

The content and implications of the FWMA provide considerable opportunities for improved and integrated land use planning and flood risk management by LAs and other key partners. The integration and synergy of strategies and plans at national, regional, and local scales, is increasingly important to protect vulnerable communities and deliver sustainable regeneration and growth.

2.4.2 The Water Framework Directive and Water Environment Regulations

The purpose of the Water Framework Directive (WFD), which was transposed into English Law by the Water Environment Regulations (2003), is to deliver improvements across Europe in the management of water quality and water resources through a series of plans called River Basin Management Plans (RBMP), which were last published in October 2022 and last updated in December 2022.

LBN is located within the Thames River Basin District.

2.5 Key national, regional and local policy documents and strategies

2.5.1 The National Flood and Coastal Erosion Risk Management Strategy for England (2020)

The **National Flood and Coastal Erosion Risk Management Strategy (FCERM)** for England provides the overarching framework for future action by all risk management authorities to tackle flooding and coastal erosion in England. The new Strategy has been in preparation since 2018. The Environment Agency brought together a wide range of stakeholders to develop the strategy collaboratively. The Strategy is much more ambitious than the previous one from 2011 and looks ahead to 2100 and the action needed to address the challenge of climate change.

The Strategy has been split to describe three high level ambitions:

- 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.
- 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.
- 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.

The Strategy was laid before Parliament in July 2020 for formal adoption and published alongside a **new National Policy Statement for Flood and Coastal Erosion Risk Management**. The statement sets out five key commitments which will accelerate progress to better protect and better prepare the country for the coming years:

1. upgrading and expanding flood defences and infrastructure across the country,
2. managing the flow of water to both reduce flood risk and manage drought,
3. harnessing the power of nature to not only reduce flood risk, but deliver benefits for the environment, nature, and communities,
4. better preparing communities for when flooding and erosion does occur, and

5. ensuring every area of England has a comprehensive local plan for dealing with flooding and coastal erosion.

The Flood and Coastal Erosion Risk Management Strategy Roadmap to 2026 published in 2022 describes how the strategy, its objectives and measures will be translated into practical action over the next 4 years.

2.5.2 Updated Strategic Flood Risk Assessment guidance

There was an update to the **'How to prepare a Strategic Flood Risk Assessment guidance' in August 2019**, which had some key additions to both Level 1 and Level 2 assessments. There were also minor updates to the guidance in September 2020.

The most recent update was in March 2022 when a new section was added on setting up governance arrangements for preparing SFRAs. The Level 1 assessment is undertaken in accordance with this guidance.

2.5.3 London Regional Flood Risk Appraisal (2018)

The **London Regional Flood Risk Appraisal** was published in 2018 provides an overview of all sources of flooding in London and addresses its probability and consequences. It was prepared by Greater London Authority officers in close cooperation with the Environment Agency, London Resilience, Transport for London and Thames Water. The plan contains a strategic overview of flood risk from all sources of flooding in London and a revised set of monitoring to manage and prepare for flood risk.

2.5.4 Thames River Basin District Flood Risk Management Plan

The Environment **Agency's Thames River Basin District Flood Risk Management Plan** (RBMP) was published in 2022. The plan identifies what flood risk activities are occurring across the river basin district (RBD) and, in locally important areas, referred to as 'Strategic Areas.' In the Thames RBD, Strategic Areas were put forward by the Environment Agency providing these were not already designated FRAs. The Environment Agency and other RMAs, in particular Lead Local Flood Authorities, such as the LBN Council, worked together to develop the first cycle FRMP. This created a plan to manage the risk from all sources of flooding.

2.5.5 Thames River Basin District River Basin Management Plan 2022

The Water Framework Directive (WFD) requires the production of Management Plans for each River Basin District. River Basin Management Plans (RBMPs) aim to ensure that all aquatic ecosystems, riparian ecosystems and wetlands reach 'good status.' To achieve 'good status', a waterbody must be observed to be at a level of ecological and chemical quality.

The London Borough of Newham falls within the Thames River Basin District. **The Thames River Basin District (RBD) River Basin Management Plan** (2022) describes the challenges that threaten the water environment within the wider Thames basin region and how these challenges can be managed.

The most recent changes in December 2022 updated the tense to reflect that the 2022 RBMPs are the current plans approved by the Secretary of State for the Environment, Food and Rural Affairs. Further information can be found in the RBMP and the **Catchment Based Approach (CaBA)** website.

2.5.6 Catchment Flood Management Plans

Catchment Flood Management Plans (CFMPs) are a high-level strategic plan providing an overview of flood risk across each river catchment. The Environment Agency use CFMPs to work with other key decision makers to identify and agree long-term policies for sustainable flood risk management.

LBN is situated within the **Thames Catchment Flood Management Plan** area.

The northern half of LBN is part of the following sub-area:

- Sub-area 9 (London catchments) – this sub-area contains large urban areas. The London catchment sub-area includes Middle Roding which is part of LBN. According to the Thames CFMP, this area is within policy 4 which states the areas are at low, moderate or high flood risk and are already managing flood risk effectively, with the possibility of further actions needed to keep a pace with climate change. The number of properties in the Middle Roding sub-area with a 1% risk of flooding from rivers is currently 4,240 but this is expected to increase to 4,880 by 2100 due to the future impacts of climate change. Proposed management includes maintaining or improving existing or new flood defences so they are more effective against the impacts of climate change as well as recreating river corridors to reduce flood risk. There is also a focus on developing emergency response planning to deal with extreme floods.

The southern part of LBN is part of the following sub-area:

- Sub-area 8 (Heavily populated floodplain) – this sub-area contains some of the most populated places in the Thames region. This sub-area includes the Lower Roding which is part of LBN. According to the Thames CFMP, this area is within policy 5 which states the areas are at moderate to high flood risk and can generally take further action to reduce flood risk. The number of properties in the Lower Roding sub-area with a 1% risk of flooding from rivers is currently 7,650 but this is expected to increase to 8,760 by 2100 due to the future impacts of climate change. The most sustainable way of reducing flood risk in these areas will be through floodplain management. Flood awareness and emergency response will have an important role to play.

2.5.7 The London Plan

The **London Plan** is a Spatial Development Strategy released by the Mayor of London. The current plan was released in 2021 and sets out an integrated economic, environmental, transport and social framework for the development of London over the next 20-25 years. The plan contains a number of objectives set out by the Mayor of London within an overarching objective to promote sustainable development. The London Plan has a number of policies relevant to this SFRA, including:

Policy D10 Basement Development:

Boroughs should establish policies in their Development Plans to address the negative impacts of large-scale basement development beneath existing buildings, where this is identified as an issue locally. Issues associated with large-scale basements include localised flooding and drainage issues. Local authorities are advised to consider local ground conditions, flood risk and drainage impacts amongst other factors such as land and structural stability, protection of biodiversity, heritage assets and pollution.

Policy D11 Safety, security and resilience to emergency:

The Mayor aims to work with relevant partners and stakeholders to ensure and maintain a safe and secure environment in London that is resilient against emergencies including fire, flood, weather, terrorism and related hazards as set out in the London Risk Register.

Development proposals should maximise building resilience and minimise potential physical risks, including those arising from extreme weather and flood hazards.

Policy SI 12 Flood risk management:

The Mayor will work with the Environment Agency, the Lead Local Flood Authorities, developers and infrastructure providers to manage current and expected flood risk from all sources.

Development plans should use the Mayor's Regional Flood Risk Appraisal and their Strategic Flood Risk Assessment as well as Local Flood Risk Management Strategies, where necessary, to 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. This should include, where possible, making space for water and aiming for development to be set back from the banks of watercourses.

Lead Local Flood Authorities (such as the London Borough of Newham) are responsible in particular for local surface water flood risk management and for maintaining a flood risk management asset register. They must produce Local Flood Risk Management Strategies and should cooperate on strategic and cross-boundary issues.

Development Plans and development proposals should contribute to the delivery of the measures set out in Thames Estuary 2100 Plan. Including the production of Riverside Strategies by Local Authorities as laid out by the TE2100 Plan to improve flood risk management in the vicinity of the river.

The Environment Agency's Thames River Basin District Flood Risk Management Plan should inform the Borough's Strategic Flood Risk Assessment.

2.5.8 Thames Estuary 2100 Action Plan

In 2012, the Environment Agency and partners first published the **Thames Estuary 2100 Plan**. The Plan is a long-term adaptive strategy for how flood risk management authorities (e.g., the Environment Agency, local councils and utility companies) can manage the increasing risk of tidal flooding due to climate change. The Plan aims to:

- take an adaptive approach to managing the risk of flooding to people, property and the environment
- protect the social, cultural and commercial value of the tidal Thames, tributaries and floodplain
- ensure sustainable and resilient development in the floodplain; and
- tackle the climate crisis by enhancing and restoring ecosystems and maximising benefits of natural floods.

The EA recently carried out the first full review and update of the Plan since it was published; the 10-Year Review. The major updates to the Plan from 2012 to 2023 include:

- bringing forward the deadline for adapting flood defences upstream (west) of the Thames Barrier by 15 years to 2050
    - the deadline for defence upgrades downstream (east) of the Thames Barrier remains 2040
- confirmed that all options for replacing the Thames Barrier (end-of-century options) should remain open until a decision is made
- brought forward the deadline for deciding on an end-of-century option from 2050 to 2040

The Plan divides the Thames Estuary into 23 areas called 'policy units'. The pages explaining how to manage flood risk in the policy units within the LBN can be found here:

- **Royal Docks Policy Unit**
- **Isle of Dogs and Lea Valley Policy Unit**

2.5.9 London Borough of Newham Preliminary Flood Risk Assessment (PFRA) (2011)

The London Borough of Newham Preliminary Flood Risk Assessment (2011, last updated 2017) identified 'flood risk areas' within the county based on the Environment Agency's updated Flood Map for Surface Water (uFMfSW) (now the Environment Agency **Risk of Flooding from Surface Water dataset**). Of the ten indicative Flood Risk Areas that have been identified nationally, one is the Greater London administrative area.

Key outputs of the 2011 PFRA include:

- The majority of LBN is within a Flood Risk Area, with the main exception being the area of relatively rural land in the north-east of the borough.
- No past flood events with 'significant harmful consequences' were identified, although this is likely due to a lack of robust evidence.
- There is a high future risk of flooding from local sources such as surface water. LBN was identified as a Surface Water Flood Risk Area in the 2017 PFRA update.
- It is estimated that approximately 23,800 properties are potentially at risk from flooding during a rainfall event with a 0.5% AEP annual chance of occurring.
- The number of properties and businesses at risk from a future flood event is estimated to have 'significant harmful consequences' at a local scale.

The **PFRA for England (2018)** provides information on significant past and future flood risk from river and sea flooding across all of England, including LBN. The Thames River Basin District (RBD) has been identified as a district with a particularly high flood risk to human health and the economy due to it containing large urban areas such as London. The Thames RBD also has the second largest number of Flood Risk Areas (25) in England meaning it is at significant risk of river and sea flooding.

2.5.10 London Borough of Newham Local Flood Risk Management Strategy (LFRMS) 2015

The London Borough of Newham Local Flood Risk Management Strategy (LFRMS) sets out how LBN Council will manage flood risk from surface water runoff, groundwater and ordinary watercourses for which they have a responsibility as LLFA. Other duties of LBN Council include specifying the roles of the different authorities that have responsibilities for managing flood risk in LBN and providing an overall assessment of local flood risk.

The Strategy has seven objectives, which are:

- to maintain and enhance understanding of flood risk in LBN.
- to maintain and improve flood risk management assets and infrastructure.
- to ensure new developments minimise the risk of flooding.
- to reduce the likelihood and impact of flooding within LBN
- to raise public awareness of flooding issues and promote community level action.

- to respond effectively in the event of a flooding emergency; and
- to adopt and maintain a partnership approach to flood risk management.

2.5.11 LLFAs, surface water and SuDS

The **National Planning Policy Framework (NPPF) (2021)** states that: 'Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate' (Para 169). When considering planning applications, local planning authorities should consult the relevant LLFA on the management of surface water in order to satisfy that:

- the proposed minimum standards of operation are appropriate
- through the use of planning conditions or planning obligations there are clear arrangements for on-going maintenance over the development's lifetime.

LBN Council's requirements for new developers on SuDS are set out on their website, alongside supporting documents. At the time of writing this SFRA, documents and policies relevant to SuDS and surface water in the LBN are:

- **LBN Local Plan**
- **LBN draft (Regulation 18) Local Plan 2023-2038**
- **LBN's Local Flood Risk Management Strategy**
- **Planning Application Requirements document issued by LBN Local Planning Authority**
- **LBN's Surface Water Management Plan**
- **LBN SFRA 2017**
- **London Plan 2016: Policy 5.13 and its guidance: Sustainable Design and Construction SPG;** and
- **Building Regulations Part H (2010): drainage and water disposal.**

The NPPF states that flood risk should be managed 'using opportunities provided by new development and improvements in green and other infrastructure to reduce the causes and impacts of flooding' (Para 161). As such, although incorporating SuDS is only a requirement for major development, it is best practice for all development. More information is available in Section 7.

2.5.12 Thames Water Drainage and Wastewater Management Plan (DWMP) 2023

Required as per the **2021 Environment Act**, water and sewerage companies such as Thames Water have recently published Drainage and Wastewater Management Plans (DWMPs). These are long term plans that outline how water and sewerage companies plan to approach and manage sewerage and wastewater over the next 25 years. They include details of reported flooding and flood risk by catchment along with investment plans for the catchment. **The Thames Water Drainage and Wastewater Management Plan** was published in May 2023. It contains a regional plan for London. This contains three core targets, agreed on in conjunction with stakeholders, for London:

- Sewer Flooding: 95% of properties are protected from sewer flooding in a 1 in 50-year storm
- Storm overflows: No more than 10 discharges per overflow on average per year by 2045
- Treatment: 100% permit compliance by enhancing resilience at our STWs

2.5.13 Surface Water Management Plans

A Surface Water Management Plan (SWMP) is a study to understand the flood risks that arise from local flooding, which is defined by the Flood and Water Management Act 2010 as flooding from risk of surface runoff, groundwater, and ordinary watercourses. SWMPs are led by a partnership of flood risk management authorities who have responsibilities for aspects of local flooding, including the LLFA, Local Authority, Sewerage Undertaker and other relevant authorities. The purpose of a SWMP is to identify what the local flood risk issues are, what options there may be to prevent them or the damage they cause and who should take these options forward. This is then presented in an Action Plan that the stakeholders and partners agree.

Capita Symonds prepared a **London Borough of Newham Surface Water Management Plan** on behalf of LBN Council in 2011. This was then updated to reflect the LBN Local Plan in 2019. This SWMP was undertaken in four stages:

- Phase 1: Preparation

- Surface water information was collected from key stakeholders.

- Phase 2 – Risk assessment

- Direct rainfall modelling was carried out across the entire borough for five specified return periods. Thirteen Critical Drainage Areas (CDAs) were identified from the results.

- Analysis of properties at risk of surface water flooding for a 1% AEP rainfall event was also undertaken. The results predict that 17,500 residential properties and 3,500 non-residential properties in LBN could be at risk of surface water flooding of a depth greater than 0.03m during a 1% AEP rainfall event.

- Phase 3: Options Assessment

- For each of the CDAs identified, measures to help reduce risk of surface water flooding were proposed. These measures were then shortlisted to give a preferred option for each CDA.

- Pluvial modelling identified that historic and existing watercourse valleys heavily impact surface water flooding and that this flooding has an impact on important infrastructure assets.

- Therefore, in the short to medium-term the London Borough of Newham should:

- raise residents' awareness of surface water flood risk and their responsibilities regarding their property's drainage as well as how they can increase their resilience to flooding
- inform residents on how they can mitigate surface water flooding in and around their property
- communicate and raise awareness of surface water flood risk to different stakeholders (including the public) using a defined communication strategy; and
- improve maintenance regimes, and targeting areas identified to flood regularly or that are known to have blocked gullies / culverts / watercourses.

- Phase 4: Implementation and Review

- A long-term Action Plan established for the London Borough of Newham to implement options identified in Phase 3.

3 Planning Policy and Flood Risk Management

This section summarises national planning policy for development and flood risk.

3.1 National Planning Policy Framework and Guidance

The revised **National Planning Policy Framework (NPPF)** was published in July 2021, replacing the 2019 version. The NPPF sets out Government's planning policies for England. It must be considered in the preparation of local plans and is a material consideration in planning decisions. The NPPF defines Flood Zones, how these should be used to allocate land and flood risk assessment requirements. The NPPF states that:

"Strategic policies should be informed by a strategic flood risk assessment and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards."

Planning Practice Guidance (PPG) on flood risk was first published in March 2014 and sets out how the policy should be implemented. **Diagram 1 of the PPG** sets out how flood risk should be considered in the preparation of Local Plans. It was updated on the 25 August 2022, see Annex 1 - Updates to the Planning Practice Guidance for more information.

3.2 The risk-based approach

The NPPF takes a risk-based approach to development in flood risk areas. Since July 2021 the approach has adjusted the requirement for the Sequential Test (as defined in Para 162 of the NPPF) so that all sources of flood risk are included in the consideration.

At the time of preparation of the 2023 SFRA the updated planning practice guidance (PPG) has been published, describing a revised approach to the Sequential Test. The requirement for the revised Sequential Test has been addressed by adopting the following approach:

- The test will cease to be based on the use of the Flood Zones describing river and sea flood risk, and instead be based on whether development can be located in the lowest risk areas (high-medium-low) of all sources of flood risk both now and in the future.
- Understanding flood risk to sites based on their vulnerability and incompatibility as opposed to whether development is appropriate.

It is important that the potential implications of all sources of flooding are assessed in performing the Sequential Test and so fluvial, tidal, surface water, reservoir, groundwater

and sewer flood risk are addressed during the process of finalising the selection of allocated sites using the best available mapping.

To inform the completion of the Sequential Test, the future Level 2 SFRA uses the best available data to assess fluvial, tidal and surface water flood risk. It also provides an assessment of the implications of reservoir, sewer and groundwater flood risk. This will help the LPA to establish whether sites with a lower risk of flooding are available, and therefore more appropriate for development.

Decisions on the selection of preferred sites for allocation must consider all sources of flooding, and the potential implications of groundwater, reservoir and sewer flooding and where necessary identify sites where consideration should be given to satisfying the requirements of the Exception Test.

3.2.1 Flood Zones from the EA's Flood Map for Planning - rivers and sea flood risk

Flood Zones are discrete areas of land identified to be at risk from flooding from rivers and sea. They represent the undefended scenario. Table 3-1 outlines the definition of Flood Zones as per the PPG.

Table 3-1: Definition of the Flood Zones as per the Planning Practice Guidance

Flood Zone	Definition
Zone 1 – Low probability	Land having a less than 0.1% annual probability of river or sea flooding.
Zone 2 – Medium probability	Land having between a 1% and 0.1% annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of sea flooding.
Zone 3a– High probability	Land having a 1% or greater annual probability of river flooding; or Land having a 0.5% or greater annual probability of sea.

The Environment Agency has produced the **'Flood Map for Planning'** which identifies areas within Flood Zone 2 (0.1% AEP undefended chance of flooding from rivers and sea) and Flood Zone 3 (1% AEP undefended chance of flooding from rivers, or within a 0.5% chance of flooding from the sea) at a national scale. This information is based on broad scale modelling that has been refined with detailed hydraulic models in areas of higher risk. As a result, the information provided by this data is indicative, rather than specific, and is not sufficiently detailed to assess whether an individual property is at risk of flooding. Locations may also be at risk from other sources of flooding, such as high groundwater levels, overland run off from heavy rain, or failure of infrastructure such as sewers and storm drains. The Flood Zones do not take into account defences. This is important for planning long term developments as long-term policy and funding

for maintaining flood defences over the lifetime of a development may change over time.

They also do not take into account surface water, sewer or groundwater flooding or the impacts of canal or reservoir failure or climate change. Hence there could still be a risk of flooding from other sources and the level of flood risk will change over time during the lifetime of a development.

3.2.2 Flooding from rivers – Fluvial modelling

Updated fluvial modelling has been undertaken for the River Lee and River Roding as displayed in Table 3-2. This provides a more accurate representation of actual flood risk within the LBN than the Environment Agency's Flood Map for Planning, as it accounts for the presence of flood defence structures along both rivers. Further information about the models used is available in Appendix G.

Table 3-2: Details regarding the fluvial flood risk modelling used to inform this SFRA.

Model name	Software
River Lee (2014)	ISIS-TUFLOW
Shonks Mill Lower Roding (2018)	ESTRY-TUFLOW

The following Annual Exceedance Probability events for the defended fluvial scenarios have been assessed:

- 3.3% AEP (1 in 30-yr) defended fluvial*
- 1% AEP (1 in 100-yr) defended fluvial
- 0.5% AEP (1 in 200-yr) defended fluvial**
- 0.1% AEP (1 in 1000-yr) defended fluvial

*Areas within the modelled 3.3% AEP defended extent should be considered as Flood Zone 3b. Where modelled results are not available, Flood Zone 3a should be considered as a proxy for Flood Zone 3b. Flood Zone 3b (the functional floodplain) is defined as Land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively, or land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events.

**The 0.5% AEP event was assessed for this SFRA due to the Rivers Lee and Roding being tidally influenced.

3.2.3 Flooding from the sea – Tidal modelling

Flood defence structures along the tidal Thames are designed to protect to a 0.1% AEP flood event, so during the defended scenario there is no out of bank flooding from the Thames (including and up to the 0.1% AEP event). Therefore, modelling of the defended scenario for the River Thames has not been undertaken for this study.

The Environment Agency's **Reduction in Risk of Flooding from Rivers and Sea due to Defences** dataset extent can be used to visualise the area of the LBN located within this extent (see Appendix A)The dataset shows the area where there is a reduction in risk of flooding from rivers and sea due to flood defences, taking into account the condition they are in.

3.2.4 Surface water risk

To address the requirement that flood risk from all sources is included in the Sequential Test, the Environment Agency's Risk of Flooding from Surface Water (RoFSW) mapping as well as the 2015 Little Ilford, Newham Central and Silvertown Drain London surface water modelling has been used to assess surface water flood risk in the LBN. The location of Critical Drainage Areas (CDAs) within the LBN have also been considered.

Modelling outputs show the extent, depth, velocity and hazard of flooding from surface water during the 3.3%, 1% and 0.1% AEP events.

The surface water modelling also shows areas at risk of flooding during the 1% AEP plus 40% climate change allowance event.

The Environment Agency publishes **peak rainfall allowances** for each Management Catchment. These allowances are applied to modelling to assess impacts of climate change on surface water flood risk.

The western side of the LBN lies within the London Management Catchment and the eastern side lies within the Roding, Beam and Ingrebourne Management Catchment. The upper-end peak rainfall allowance for the 1% AEP event during the 2070s epoch for both Management Catchments is 40%.

3.2.5 Groundwater flood risk

GeoSmart mapping (GW5 version 2.1) has been used to assess the risk of Groundwater flooding to the LBN. This mapping provides a preliminary indication of groundwater flood risk on a 5m grid. This mapping shows areas with a >1% AEP of groundwater flooding within the following classes:

- Class 4: Negligible risk - There is a negligible risk of groundwater flooding in this area and any groundwater flooding incidence has a chance of less than 1% annual probability of occurrence.
- Class 3: Low risk - There is a low risk of groundwater flooding in this area with a chance of greater than 1% annual probability of occurrence.
- Class 2: Moderate - There is a moderate risk of groundwater flooding in this area with a chance of greater than 1% annual probability of occurrence.
- Class 1: High - There is a high risk of groundwater flooding in this area with a chance of greater than 1% annual probability of occurrence or more frequent.

Further information on this mapping can be found in Section 5.7.

3.2.6 Sewer flood risk

According to Thames Water the three main causes of sewer flooding are:

- Blockages in sewers and drains
- Heavy or continued rainfall
- Damage and system failure

Heavy rain can overwhelm the sewer system causing water to back up through pipes and drains, flooding properties, roads and streets with foul and surface water. With the increase in intense rainfall events due to climate change, this type of flooding could become more common.

It is the responsibility of Thames Water to maintain and repair the public sewer system in LBN. However, burst pipes, sewer collapse and pumping station failure can all cause flooding to the borough.

Thames Water provided details of 7,138 recorded incidents of sewer flooding which have occurred in the borough. These were provided using four-digit postcode areas for the period between the January 1957 and December 2022. This information allows each four-digit postcode to be ranked by the number of sewer flooding incidents that have occurred within it, giving a preliminary indication of risk of flooding from sewers.

3.2.7 Reservoir flood risk

The latest available Environment Agency reservoir flood mapping now shows “wet day” and “dry day” reservoir inundation extents. The “wet day” being a reservoir breach at the same time as a 0.1% AEP fluvial flood event (as this is a likely time when a reservoir might fail) and the “dry day” shows the failure just from the water retained by the dam. Neither set of mapping describes a risk-based scenario as they do not provide the probability of a dam failure but are intended to describe a “worst credible case”. There are 14 reservoirs which enter the LBN during the “dry day” scenario and 22 which enter during the “wet day” scenario. The failure of a reservoir has the potential to cause catastrophic damage due to the sudden release of large volumes of water. The LBN will need to evaluate the potential damage to buildings or loss of life in the event of dam failure, compared to other risks, when considering development downstream of a reservoir. Local planning authorities are also advised to consult with the owners/operators of raised reservoirs, to establish constraints upon safe development. If sites selected through a comparative process of assessing the risk of flooding from all sources have a residual risk of flooding from reservoirs it is important to consider the consequences of this flooding. There may, therefore, be a need for different flood risk management measures. For example, emergency plans will be needed wherever

emergency flood response is an important component of making a development safe **(PPG paragraph 043)**.

3.2.8 The Sequential Test

Firstly, land at the lowest risk of flooding from all sources should be considered for development. The 'Sequential Test' is applied to do this. Figure 3-1 summarises the Sequential Test. The LPA will apply the Sequential Test to strategic allocations. For all other developments, developers must supply evidence to the LPA, with a Planning Application, that the development has passed the test.

The LPA should work with the Environment Agency to define a suitable area of search for the consideration of alternative sites in the Sequential Test. The Sequential Test can be undertaken as part of a Local Plan Sustainability Appraisal. Alternatively, it can be demonstrated through a free-standing document, or as part of Strategic Housing Land or Employment Land Availability Assessments.

Whether any further work is needed to decide if the land is suitable for development will depend on both the vulnerability of the development and the Flood Zone for which it is proposed. **Table 2 of the PPG** defines the flood risk vulnerability and flood zone 'incompatibility' of different development types to flooding.

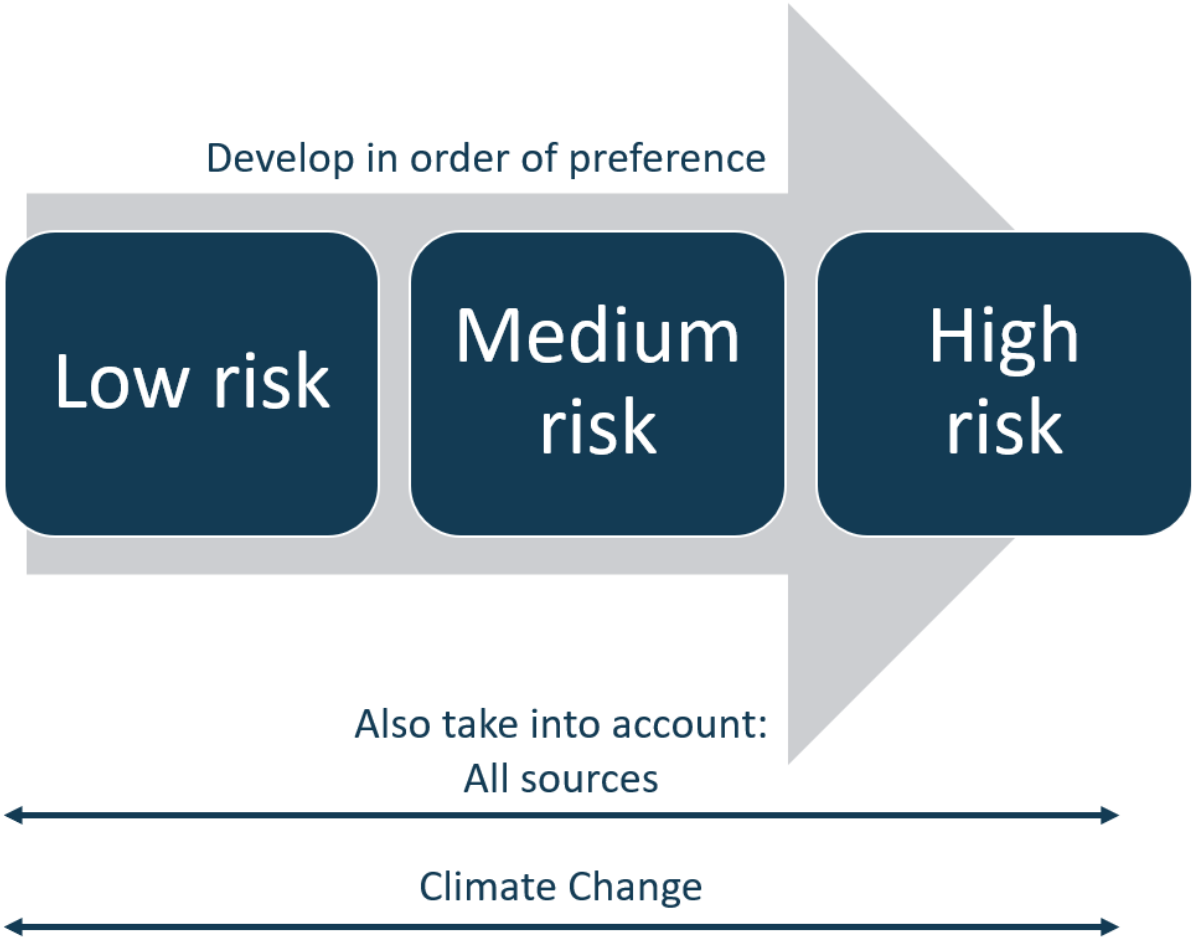

Figure 3-1: Diagram conceptually explaining the Sequential Test

Figure 3-2 illustrates the Sequential and Exception Tests as a process flow diagram (**Diagram 2 of the PPG**) using the information contained in this SFRA to assess potential development sites against flood risk information and development vulnerability compatibilities.

This is a stepwise process, but a challenging one, as a number of the criteria used are qualitative and based on experienced judgement. The process must be documented, and evidence used to support decisions recorded. In addition, the risk of flooding from all sources and the impact of climate change must be considered when considering which sites are suitable to allocate.

The SFRA User Guide in Appendix C shows where the Sequential and Exception Test may be required for the datasets assessed in the SFRA, and how to interpret different levels of concern with the datasets, recommending what proposed development sites should be assessed at Level 2.

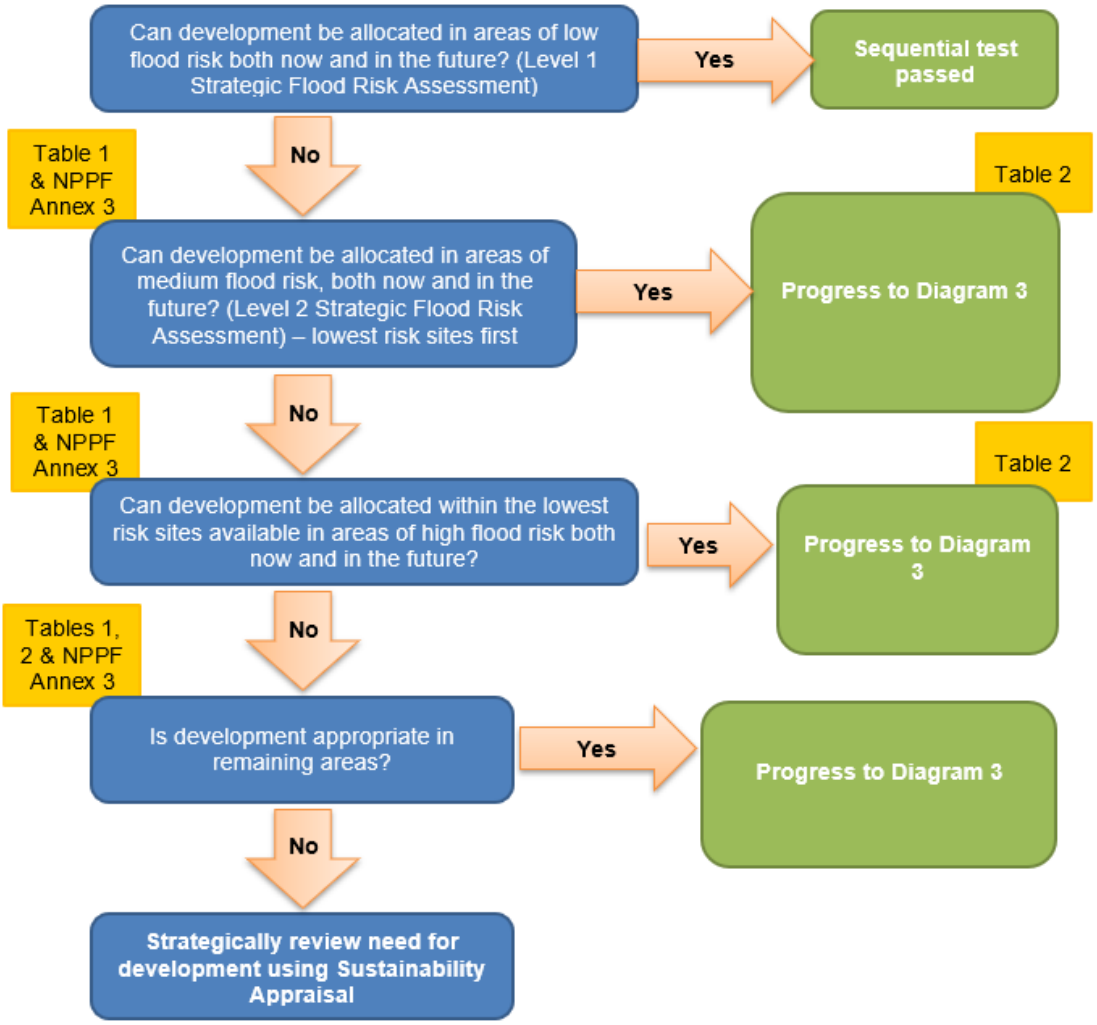

Figure 3-2: Application of the Sequential Test for plan preparation (Source: Planning Practice Guidance, 2022)

3.2.9 The Exception Test

It will not always be possible for all new development to be allocated on land that is at low risk from flooding. To further inform whether land should be allocated, or planning permission granted, a greater understanding of the scale and nature of the flood risks is required. In these instances, the Exception Test will be required.

The Exception Test should only be applied following the application of the Sequential Test. **Table 2 of the PPG** sets out the requirements for the Exception but does not reflect the need to avoid flood risk from sources other than rivers and the sea. There is no guidance on how to consider other sources of flood risk. LBN consider that the Exception Test should be applied in the following circumstances:

- More vulnerable in Flood Zone 3a.
- Essential infrastructure in Flood Zone 3a or 3b.

- Highly vulnerable in Flood Zone 2 (this is NOT permitted in Flood Zone 3a or 3b).
- Any development in the surface water 1% AEP event plus 40% climate change allowance flood extent
- Any development inside of the Risk of Flooding from Reservoirs mapping 'Wet Day' flood extent.

Figure 3-3 summarises the Exception Test. For information relating to the application of the Exception Test to plan preparation, please see **Diagram 3 of the PPG**.

For sites allocated within the Local Plan, the Local Planning Authority (LPA) should use the information in this SFRA to inform the Exception Test. At planning application stage, the Developer must design the site such that it is appropriately flood resistant and resilient in line with the recommendations in National and Local Planning Policy and supporting guidance and those set out in this SFRA. This should demonstrate that the site will still pass the flood risk element of the Exception Test based on the detailed site level analysis.

For developments that have not been allocated in the Local Plan, developers must undertake the Exception Test and present this information to the Local Planning Authority for approval. The Level 1 SFRA can be used to scope the flooding issues that a site-specific FRA should look into in more detail to inform the Exception Test for windfall sites.

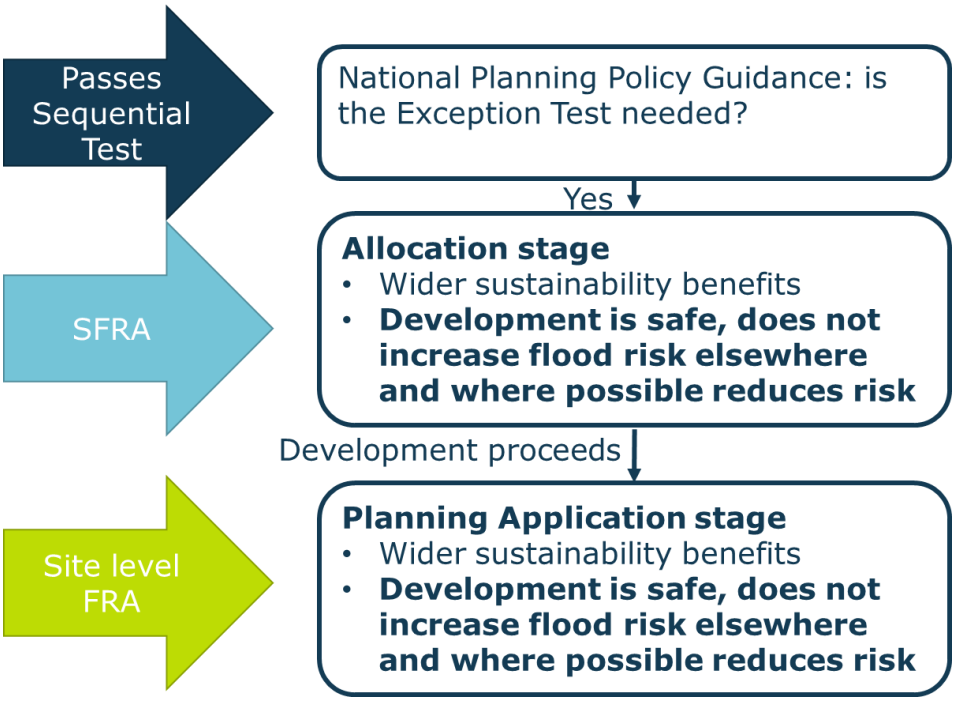

Figure 3-3: Diagram conceptually explaining The Exception Test

There are two parts to demonstrating a development passes the Exception Test:

1. Demonstrating that the development would provide wider sustainability benefits to the community that outweigh the flood risk.

The LBN as Local Planning Authority will need to consider what criteria they will use to assess whether this part of the Exception Test has been satisfied and give advice to enable applicants to provide evidence to demonstrate that it has been passed. If the application fails to prove this, the Local Planning Authority should consider whether the use of planning conditions and / or planning obligations could allow it to pass. If this is not possible, this part of the Exception Test has not been passed and planning permission should be refused.

At the stage of allocating development sites, Local Planning Authorities should consider wider sustainability objectives, such as those set out in Local Plan Sustainability Appraisals. These generally consider matters such as biodiversity, green infrastructure, historic environment, climate change adaptation, flood risk, green energy, pollution, health, transport etc.

The Local Planning Authority should consider the sustainability issues the development will address and how doing so will outweigh the flood risk concerns for the site, e.g. by facilitating wider regeneration of an area, providing community facilities, infrastructure that benefits the wider area etc.

2. Demonstrating 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.

In circumstances where the potential effects of proposed development are material, a Level 2 SFRA is likely to be needed to inform the Exception Test in these circumstances for strategic allocations to provide evidence that the principle of development can be supported. At Planning Application stage, a site-specific Flood Risk Assessment will be needed. Both would need to consider the actual and residual risk and how this will be managed over the lifetime of the development.

3.2.10 Making a site safe from flood risk over its lifetime

Local Planning Authorities will need to consider the actual and residual risk of flooding and how this will be managed over the lifetime of the development:

- The actual risk is the risk to the site considering existing flood mitigation measures. The fluvial 1% annual probability flood event is a key event to consider because the National Planning Policy Guidance refers to this as the ‘design flood’ against which the suitability of a proposed development should be assessed and mitigation measures, if any, are designed.
- Safe access and egress should be available during the design flood event. Firstly, this should seek to avoid areas of a site at flood risk. If that is not possible then access routes should be located above the design flood event

levels. Where that is not possible, access through shallow and slow flowing water that poses a low flood hazard may be acceptable.

- Residual risk is the risk that remains after the effects of flood defences have been taken into account and/ or from a more severe flood event than the design event. The residual risk can be:

- the effects of an extreme 0.1% annual probability flood event. Where there are defences, this could cause them to overtop, which may lead to failure if this causes them to erode, and/ or

- structural failure of any flood defences, such as breaches in embankments or walls.

Flood resistance and resilience measures should be considered to manage any residual flood risk by keeping water out of properties and seeking to reduce the damage it does, should water enter a property. Emergency plans should also account for residual risk, e.g. through the provision of flood warnings and a flood evacuation plan where appropriate.

In line with the NPPF, the impacts of climate change over the lifetime of the development should be taken into account when considering actual and residual flood risk.

3.3 Applying the Sequential Test and Exception Test to individual planning applications

3.3.1 The Sequential Test

LBN Council, with advice from the Environment Agency, are responsible for considering the extent to which Sequential Test considerations have been satisfied.

Developers are required to apply the Sequential Test to all development sites, unless the site is:

- a strategic allocation and the test has already been carried out by the LPA, or
- a change of use (except to a more vulnerable use), or
- a minor development (householder development, small non-residential extensions with a footprint of less than 250m^2), or
- a development in Flood Zone 1 unless there are other flooding issues in the area of the development (i.e. surface water, groundwater, sewer flooding).

The SFRA contains information on all sources of flooding and taking into account the impact of climate change. This should be considered when a developer undertakes the Sequential Test, including the consideration of reasonably available sites at lower flood risk.

Local circumstances must be used to define the area of application of the Sequential Test (within which it is appropriate to identify reasonably available alternatives). The criteria used to determine the appropriate search area relate to the catchment area for

the type of development being proposed. For some sites this may be clear e.g. school catchments, in other cases it may be identified by other Local Plan policies. For some sites e.g. regional distribution sites, it may be suitable to widen the search area beyond LPA administrative boundaries.

The sources of information on reasonably available sites may include:

- site allocations in Local Plans
- site with Planning Permission but not yet built out
- Strategic Housing and Economic Land Availability Assessments (SHELAAs)/ five-year land supply/ annual monitoring reports
- locally listed sites for sale

It may be that a number of smaller sites or part of a larger site at lower flood risk form a suitable alternative to a development site at high flood risk.

Ownership or landowner agreement in itself is not acceptable as a reason not to consider alternatives.

According to the **London Regional Flood Risk Appraisal 2018**, London is heavily built up with a tightly drawn administrative boundary. The delineation of the Green Belt and the other protected open spaces in London mean that the scope for new development on land other than brownfield redevelopment land is extremely limited. Over recent years, the vast majority of new development has taken place on brownfield land. This trend is expected to continue. Many of London's remaining large brownfield areas are either substantially or partially at risk of flooding, including some Opportunity Areas.

3.3.2 The Exception Test

If, following application of the Sequential Test it is not possible for the development to be located in areas with a lower probability of flooding, the Exception Test must then be applied if required (as set out in Table 3 of the PPG). Developers are required to apply the Exception Test to all applicable sites (including strategic allocations).

The applicant will need to provide information that the application can pass both parts of the Exception Test:

- Demonstrating that the development would provide wider sustainability benefits to the community that outweigh the flood risk.
- Applicants should refer to wider sustainability objectives in Local Plan Sustainability Appraisals. These generally consider matters such as biodiversity, green infrastructure, historic environment, climate change adaptation, flood risk, green energy, pollution, health, transport etc.
- Applicants should detail the suitability issues the development will address and how doing it will outweigh the flood risk concerns for the site e.g., by facilitating

wider regeneration of an area, providing community facilities, infrastructure that benefits the wider area etc.

- Demonstrating 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.
- The site-specific Flood Risk Assessment (FRA) should demonstrate that the site will be safe, and the people will not be exposed to hazardous flooding from any source. The FRA should consider actual and residual risk and how this will be managed over the lifetime of the development, including:
  - the design of any flood defence infrastructure
  - access and egress
  - operation and maintenance
  - design of the development to manage and reduce flood risk wherever possible
  - resident awareness
  - flood warning and evacuation procedures, including whether the developer would increase the pressure on emergency services to rescue people during a flood event; and
  - any funding arrangements required for implementing measures.

4 Impact of Climate Change

The NPPF sets out that flood risk should be managed over the lifetime of a development, taking climate change into account. This section sets out how the impact of climate change should be considered.

Climate change projections show an increased chance of warmer, wetter winters and hotter, drier summers with a higher likelihood of more frequent and intense rainfall. This is likely to make severe flooding happen more often.

4.1 Climate emergency

In 2019, LBN Council declared a climate emergency, acknowledging that the world is in a climate crisis and that action to mitigate the climate crisis cannot be delayed.

LBN Council has since published its "**Climate Emergency Action Plan**", establishing the LBN Council's plans for reducing the impacts of climate change. The LBN Council's aspirations relevant to flood risk include:

- Develop within the Flood Risk Management Strategy an approach to sustainable drainage in the borough across public and private sector land and developments.
- Map climate change vulnerability issues and adaptation opportunities within the borough, including flood risk and overheating analysis.

4.2 Revised climate change guidance

The **Climate Change Act 2008** creates a legal requirement for the UK to put in place measures to adapt to climate change and to reduce carbon emissions by at least 80% below 1990 levels by 2050.

In 2018, the Met Office published new **UK Climate Projections** (UKCP18). The Environment Agency has since updated their **guidance on climate change allowances** for river flow (in 2021) and rainfall intensity (in 2022) for new developments. This includes information on how these allowances should be included in both SFRAs and FRAs. The guidance adopts a risk-based approach considering the vulnerability of the development and considers risk allowances on a management catchment level, rather than a river basin level.

Developers should check the government website for the latest guidance before undertaking a detailed Flood Risk Assessment.

4.3 Applying the climate change guidance

To apply the climate change guidance, the following information must be established:

- The vulnerability of the development – as per the **NPPF**.

- The likely lifetime of the development – in general 75 years is used for commercial development and 100 for residential, but this needs to be confirmed in an FRA.
- The Management Catchment that the site is within. The LBN is within two different Management Catchments: the London Management Catchment and the Roding, Beam and Ingrebourne **Catchment.**
- Likely depth, speed and extent of flooding for each allowance of climate change over time considering the allowances for the relevant epoch (2020s, 2050s and 2080s).
- The 'built in' resilience measures used, such as raised floor levels for example.
- The capacity or space in the development to include additional resilience measures in the future, using a 'managed adaptive' approach.

4.4 Relevant allowances for the London Borough of Newham

4.4.1 Fluvial flooding

Tables 4-1 and 4-2 display the updated peak river flow allowances that apply in the LBN for fluvial flood risk for the London Management Catchment (Table 4-1) and Roding, Beam and Ingrebourne Management Catchment (Table 4-2) (both last updated in July 2021). These allowances supersede the previous allowances by River Basin District. In agreement with the Environment Agency, the previous climate allowances can still be used where they lie within +/- 10% of the updated guidance.

Table 4-1: Peak river flow allowances for the London Management Catchment in the London Borough of Newham

Management Catchment	Allowance category	Total potential change anticipated for '2020s' (2015 to 39)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
London Management Catchment	Upper end	26%	30%	54%
	Higher central	14%	14%	27%
	Central	10%	7%	17%

Table 4-2: Peak river flow allowances for the Roding, Beam and Ingrebourne Management Catchment in the London Borough of Newham

Management Catchment	Allowance category	Total potential change anticipated for '2020s' (2015 to 39)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
	Upper end	31%	38%	64%

Management Catchment	Allowance category	Total potential change anticipated for '2020s' (2015 to 39)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
Roding, Beam and Ingrebourne Management Catchment	Higher central	20%	21%	36%
	Central	15%	14%	26%

4.4.2 Surface water flooding

The following tables (Table 4-3 and Table 4-4) display the updated rainfall intensity allowances that apply in the LBN for surface water flood risk for the two different Management Catchments (as of May 2022). These allowances supersede the previous country wide allowances.

Table 4-3: Peak rainfall intensity allowances for small and urban catchments for the London Management Catchment in the London Borough of Newham

Management Catchment	Allowance Category	Total potential change anticipated for the '2050s' (2022 to 2060)		Total potential change anticipated for the '2070s' (2061 to 2125)	
		3.3% AEP event -	1% AEP event	3.3% AEP event	1% AEP event
London Management Catchment	Upper end	35%	40%	35%	40%
	Central	20%	20%	20%	25%

Table 4-4: Peak rainfall intensity allowances for small and urban catchments for the Roding, Beam and Ingrebourne Management Catchment in the London Borough of Newham

Management Catchment	Allowance Category	Total potential change anticipated for the '2050s' (2022 to 2060)		Total potential change anticipated for the '2070s' (2061 to 2125)	
		3.3% AEP event -	1% AEP event	3.3% AEP event	1% AEP event
Roding, Beam and Ingrebourne	Upper end	35%	40%	35%	40%
	Central	20%	20%	20%	25%

4.4.1 Residual Risk - Tidal breach

For tidal flooding, allowances are given in the form of total sea level rise based on a 1981 to 2000 baseline. Table 4-5 shows the relevant sea level allowances for the management catchments considered in this study.

Table 4-5: Sea level allowances in the Thames Area

River Basin district	Cumulative Rise to 2125 (m)
Higher Central	1.2
Upper end	1.6
H++	1.9

Climate change adaptation along the Thames Estuary is outlined in the TE2100 plan, which details how the risk of climate change will be managed.

Therefore, the 'into the future' epoch has been assessed to understand the impact of climate change on tidal breaches within the LBN.

4.5 Representing climate change in the Level 1 SFRA

Representation of climate change within this SFRA was agreed with the EA. The following model outputs were used to represent climate change:

- River Lee model (2014) – 3.3%, 1% and 0.5% AEP events (+17%, +27%, +54%).
    - Conservative proxy donor events have been used for some River Lee climate change events due to model instabilities. This is further discussed in Appendix G.
- Lower Roding (2018 and JBA 2017 extension) model – 3.3%, 1% and 0.5% AEP events (+26%, 36%, 64%).
- Thames Tidal Upriver Breach model (2017) – 2100 epoch 0.5% AEP events.
- Thames Tidal Downriver Breach model (2018) – 2115 epoch 0.5% and 0.1% AEP events.
- RoFSW national mapping - 3.3% and 1% AEP events with the 2070s epoch
- ICM surface water models for Little Ilford, Silvertown and Newham Central - 3.3% and 1% AEP events with the 2070s epoch

Appendices B and G provide further details of the models used in this assessment.

The impacts of climate change within the London Borough of Newham are discussed further in Section 5.10.

5 Understanding Flood Risk in the London Borough of Newham

This section explores the key sources of flooding in the London Borough of Newham Council administrative area and the factors that affect flooding including topography, soils and geology. The main sources of flooding are fluvial, tidal, surface water, sewers and reservoirs.

This is a strategic summary of the risk in the London Borough of Newham Council's administrative area. Developers should use this section to scope out the flood risk issues they need to consider in greater detail in a site-specific Flood Risk Assessment to support a Planning Application.

Appendix B contains a list of the sources of data used in the SFRA and the approach to using hydraulic model data to inform the mapping.

5.1 Historic flooding

5.1.1 Flooding incidents held by the Environment Agency

The Environment Agency's **Historic Flood Map** (HFM) displays areas of land that have been previously subject to fluvial flooding, tidal flooding and flooding from groundwater springs. The Historic Flood Map outlines for the London Borough of Newham area are displayed in Figure 5-1.

The Environment Agency's **Recorded Flood Outlines** dataset contains further details of the flooding incidents displayed in the HFM. Since 1928, there have been seven recorded flood events within the LBN, with further details provided Appendix A. Some of the historic extents refer to older historic flood events, prior to flood defence improvements. It is recommended that Figure 5-2 is viewed alongside the Recorded Flood Outline map in Appendix A.

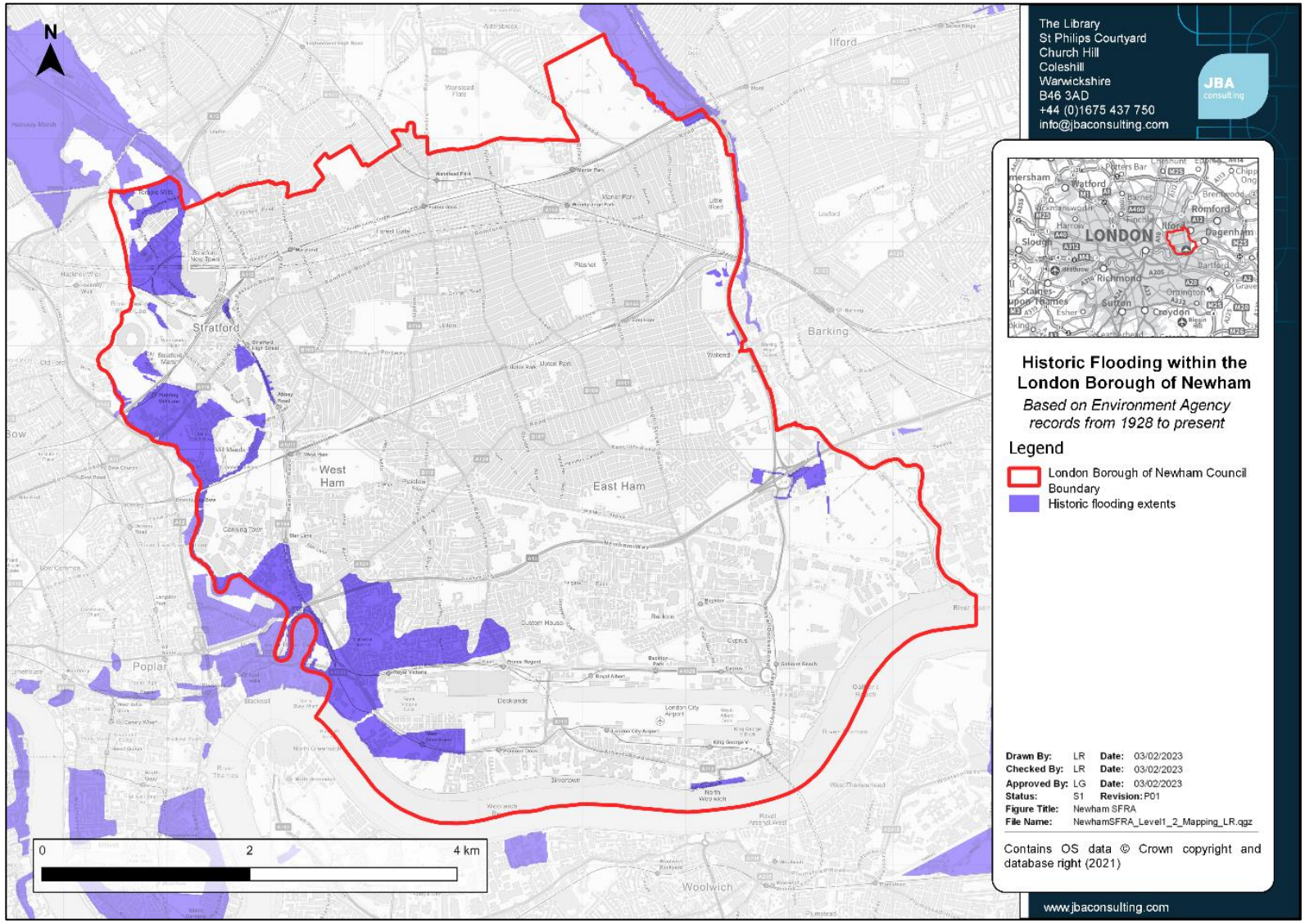

Figure 5-1: Environment Agency historic flood map outlines within the London Borough of Newham

5.1.2 Flooding incident records held by the Lead Local Flood Authority (London Borough of Newham)

The LBN as LLFA are responsible for managing local flood risks, including risk of flooding from surface water, groundwater and ordinary (smaller) watercourses (see Section 2.4.1). They also conduct investigations into any flood in the area that the LLFA deems necessary or appropriate, under **Section 19 of the Flood and Water Management Act (2010)**.

LBN Council (LLFA) conducted a Section 19 investigation of flooding in September 2014. The investigation detailed surface water and sewer flooding incidents in Stratford, Forest Gate, Manor Park, West Ham and East Ham. This flood event affected residential properties (including basements flats), commercial premises and local infrastructure (roads and Manor Park train station). Figure 5-2 shows the number of recorded flood incidents (as held by LBN Council) per postcode.

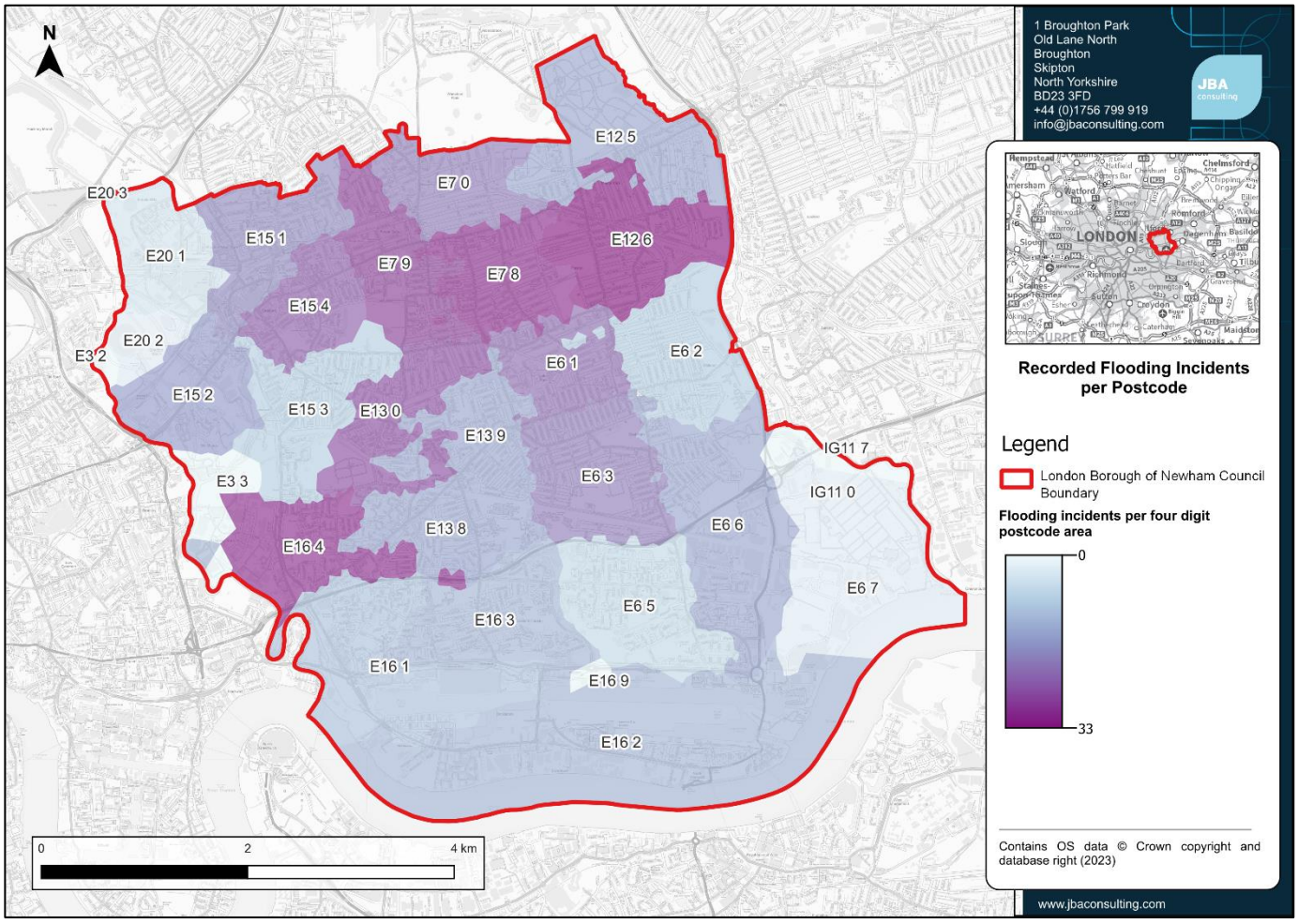

Figure 5-2: Recorded Flood Incidents per Postcode in the London Borough of Newham

5.1.3 Flooding recorded by the Canal and River Trust

As further detailed in Section 5.8., the Canal and Rivers Trust have two recorded flooding incidents within the LBN, which both occurred in November 2013 at Three Mills on the Bow Creek. These were both caused by high spring tides overtopping the river wall at the Three Mills River.

5.2 Topography, geology, soils and hydrology

Topography, geology and soils all influence how a catchment responds to rainfall events:

- Topography affects rainfall run-off rates. In steeper valleys, rainfall generally runs off to the river faster than in a flatter valley.
- Geology and soils influence how water runs off the ground surface. This is mainly due to the permeability of the surface material and bedrock stratigraphy. For example, clay rich (low permeability) soils promote rapid surface runoff, whereas more permeable rocks (e.g., limestone and sandstone) may result in a more subdued response.

5.2.1 Topography

The London Borough of Newham is a low-lying area (Figure 5-3), with the borough's elevation varying from -14.0mAOD, adjacent to the River Thames, to 35mAOD at an area of high ground in the south-east corner of the Borough (Beckton Alps). The LBN's topography slopes to the south towards the River Thames and the elevations of the land parallel to the river are generally under 5mAOD.

There are some areas with higher elevations (greater than 8mAOD) to the north of the LBN adjacent to the Wanstead Flats and covering the suburbs of Forest Gate, Manor Park and Upton.

The Beckton Alps, in the south-eastern corner of the site, has the highest elevation within the LBN. This an area of artificially raised ground corresponding with the location of a former soil heap at the Beckton Gas Works.

5.2.2 Geology

British Geological Survey (BGS) 50K mapping was used to assess LBN geology.

The LBN's bedrock (Figure 5-4) is primarily London Clay Formation (clay, silt and sand) in the centre of the borough. However, portions of the north (Manor Park and Forest Gate) north-west (Stratford) and south-east (Royal Albert Dock) of the LBN have Lambeth Group (clay, silt and sand) bedrock. Additionally, small portions of the south-eastern corner of the site (North Woolwich) are Chalk (Lewes Nodular, Seaford and Newhaven Chalk Formations) and Sand (Thanet Formation).

This bedrock is overlain by different superficial deposits (Figure 5-5). Whilst the majority of the borough is covered by Alluvium (clay, silt, sand and peat), the north and centre of the borough, between East Ham, Plaistow, Forest Gate and Manor Park, are all Taplow Gravel (sand and gravel). Additionally, a small portion in the north-west of the LBN is Kempton Park Gravel (sand and gravel) and the north-eastern corner of the London Borough of Newham parallel to the Wanstead Flats is Hackney Gravel (sand and gravel).

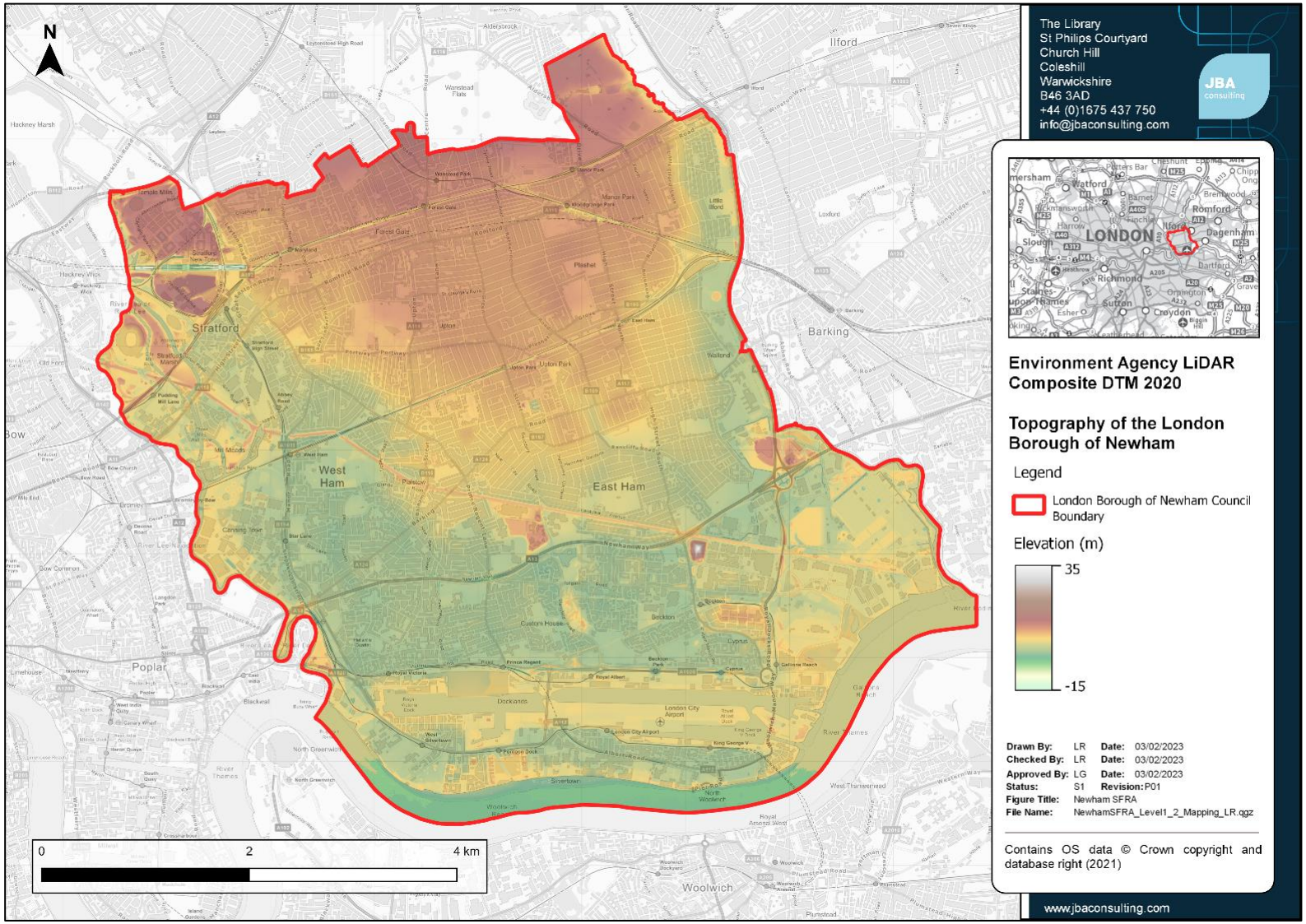

Figure 5-3: The topography of the London Borough of Newham

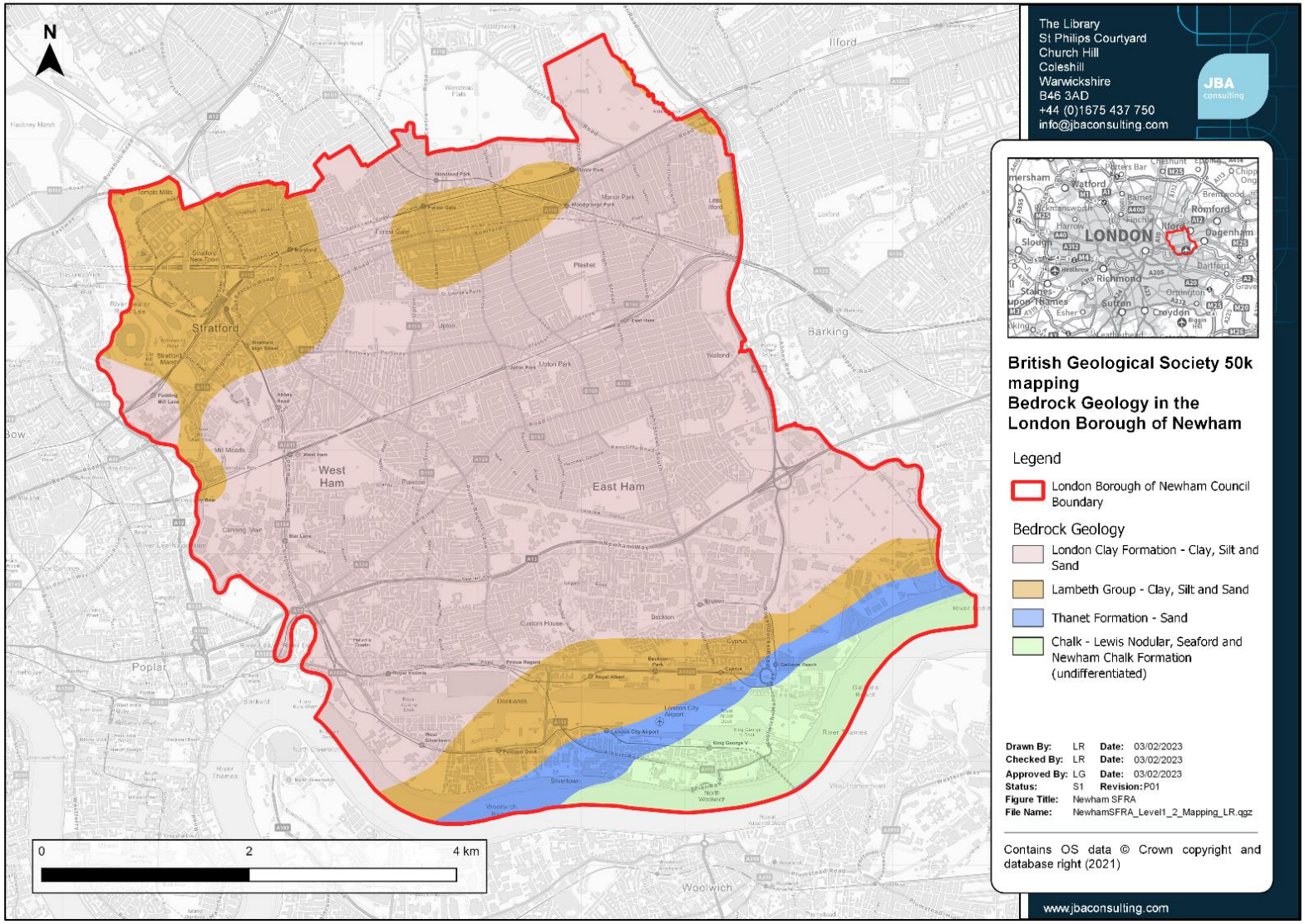

Figure 5-4: The bedrock geology of the London Borough of Newham

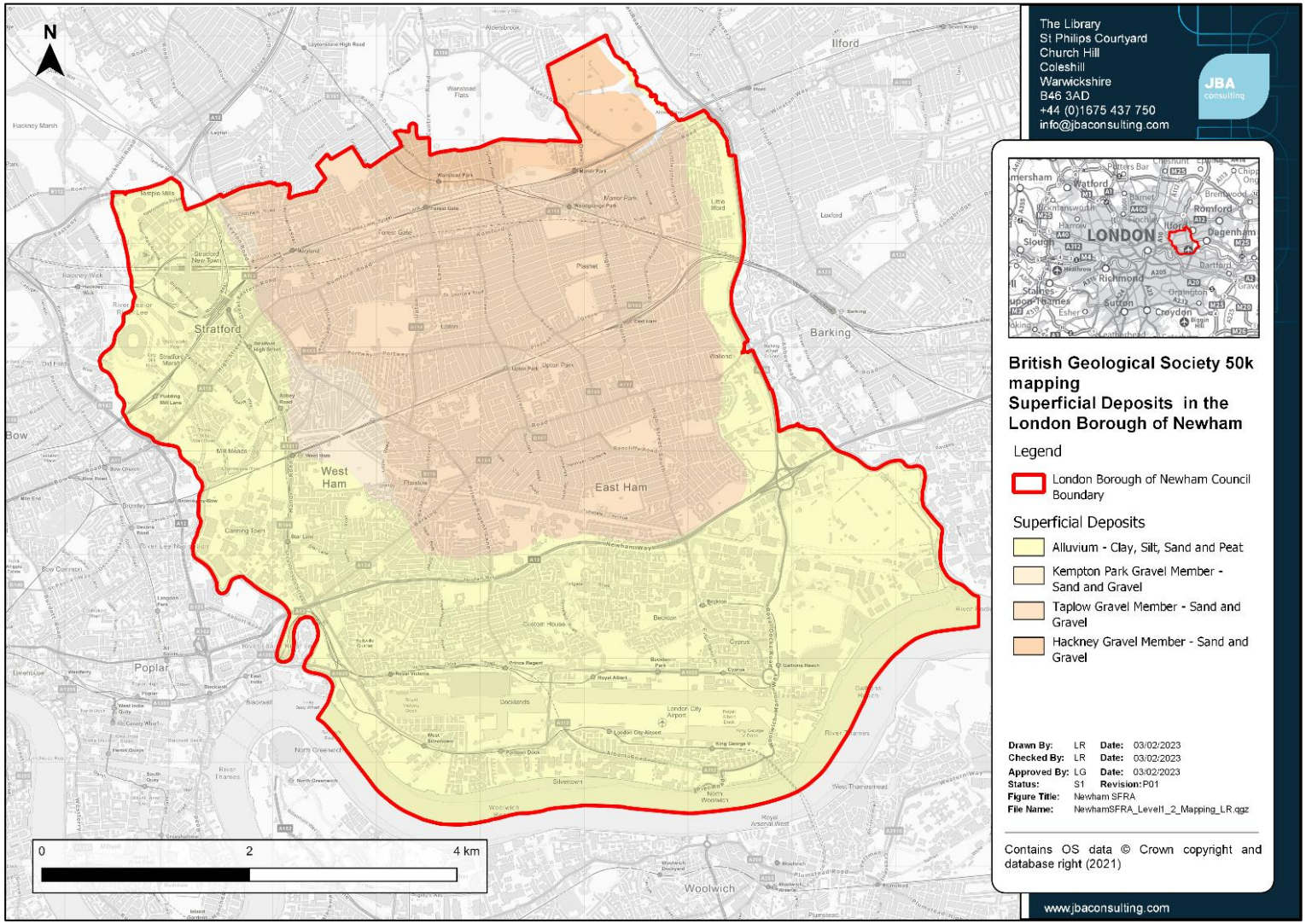

Figure 5-5: Map displaying the superficial deposits overlaying bedrock in the London Borough of Newham

5.2.3 Soils

Cranfield University Soilscapes mapping has been used to assess the LBN's soil types. It should be noted Soilscapes must only be used at strategic level and is not intended as a means for supporting detailed assessments, such as land planning applications or site investigations. For the detailed assessment of soils at a specific site, a ground investigation needs to be conducted. In the south (Beckton, Canning Town and Royal Docks) and west of the LBN (parallel to the River Lee), there are loamy and clayey soils of coastal flats with naturally high groundwater. In the north and centre of the LBN, soils are loamy and have naturally high groundwater. Finally, part of the LBN parallel to the River Roding has loamy and clayey floodplain soils which also have naturally high groundwater.

5.3 Hydrology

The principal watercourses flowing through the London Borough of Newham are the:

- River Lee and tributaries (Bow Back River, Channelsea River, City Mill Lock, Prescott Channel, Three Mills Wall River and Waterworks River);
- River Roding, Warpools Reach and tributaries (Alders Brook);
- River Thames.

Tributaries of these watercourses include smaller main rivers and ordinary watercourses. There is also the Royal Group of Docks (Royal Albert, Royal Victoria and King George V) in the south of the LBN. There are also a number of ponds and lakes within the study area. A map of the primary watercourses is included in Figure 1-2 and static mapping in Appendix A.

5.4 Fluvial and tidal flood risk

Fluvial and tidal flood risk in the Borough is from the River Thames, River Lee and River Roding. The River Lee and River Roding are tributaries of the River Thames, flowing into the Thames at Bow Creek and Barking Creek, respectively.

Tidal flood risk from the River Thames is greatest in the south of the Borough in the Royal Docks, Beckton and Canning Town. These areas are largely located in Flood Zone 3 of the Environment Agency's Flood Map for Planning (FMfP). Within LBN, the areas which lie outside of Flood Zone 2 of the FMfP are Stratford New Town, Maryland, Forest Gate, Manor Park, Upton, Upton Park, Plashet, Plaistow and East Ham.

In reality, the areas of the Borough within Flood Zones 2 and 3 are protected by flood defences with a 0.1% AEP (1 in 1000-year) standard of protection along the Thames, Lee and Roding, excluding parts of the Roding with discontinuous embankment which has a standard of protection of between 0.1% and 5% (see Section 6.4).

The River Lee and River Roding modelling shows that, due to defences, the only areas in LBN in Flood Zone 3b/the modelled 3.3% AEP event are Cuckold Haven Nature

Reserve and Bridle Path Allotments (on the banks of the River Lee), Channelsea Island (an island in the Channelsea River) and Island House (an island in the Three Mills River). The River Lee and River Roding hydraulic modelling used the defended 3.3% AEP fluvial event to define Flood Zone 3b.

Table 5-1 shows the TE2100 Extreme Water Levels (m AOD) during a 0.5% AEP event for nodes upstream and downstream of the London Borough of Newham, provided by the Environment Agency. Extreme Water Level nodes show the point locations of modelled data projections for extreme water levels (heights) that could occur in the estuary in the future. Extreme water levels take into account climate change and predicted sea level rise. It is used in the design of our flood defences to achieve the required standard of defence (crest levels and heights).

Table 5-1 TE2100 Extreme Water Levels (m AOD) for the Tidal Thames

Scenario	0.5% Annual Exceedance Probability of upriver node Maximum Likely Water Level (MLWL)	0.5% Annual Exceedance Probability of downriver node Maximum Likely Water Level (MLWL)
Present Day	4.66	5.85
Future (up to 2065 including climate change)	5.33	6.22
Future (up to 2100 including climate change)	5.64	6.44

5.4.1 The London Thames Breach Assessment

A breach of a defence occurs when there is a failure in the structure or and a subsequent ingress of flood water.

In 2018, the Environment Agency concluded its latest breach flood modelling for the River Thames between Teddington and the Thames Barrier. This modelling highlights the residual risk of a breach in the Thames tidal flood defences, which while a relatively low probability, could have a devastating impact due to the depth and velocity of flood water, increasing risk to life.

The breach modelling outputs display maximum flood extent, depth, level and hazard for both the present day (2005), as well as the 2100 epoch (accounting for the impacts of climate change). The Thames Tidal defence line was split into 20m lengths for hard defences such as concrete walls and 50m lengths for soft defences such as earth embankments, creating 5,679 lengths to undertake individual breach modelling.

The relevant 2005 Maximum Likely Water Level (MLWL) hydrograph was applied to each individual breach length and all outputs were combined to obtain the maximum extent, depth, level and hazard value for a breach at any point along the Thames Tidal Defences. This was then repeated for the 2100 epoch.

The breach assessment modelling shows that the south and west of LBN is at risk of flooding from breaching of existing flood defences in the 2005 MLWL scenario. In the 2100 scenario, the maximum extent of flooding extends further into LBN. The most significant difference between the 2005 and 2100 epoch can be seen in the west of the LBN where the maximum flood extent extends approximately 500m further than seen in the 2005 epoch.

It is worth noting that there are some instances where a site is within the tidal breach flood extent for the year 2100, but not within the current EA's FMfP Flood Zone 3. This is because flood zone mapping is based on present day flood risk, but the breach modelling represents how flood risk can be expected to increase in the future as a result of climate change.

This modelling should be used to assess residual risk. Hence, the model outputs have been used in the Level 2 SFRA to determine residual tidal flood risk to development.

5.4.2 The Thames Estuary Breach Assessment

The Thames Estuary Breach Assessment involved modelling breaches of the Thames defence line to cover the entire extent between the Thames Barrier and Gravesend and Linford. The purpose of this study was to identify the maximum likely water level that would be achieved along the Thames tidal defence line if an individual breach were to occur at any point. The outputs produced as part of this study assist the EA in future planning decisions for London.

Breach scenarios have been modelled for current and future conditions of the Thames, namely the 2005 epoch 0.5% and 0.1% AEP events, and 2115 epoch 0.5% and 0.1% AEP events. A total of 3,149 breach locations were identified for this study by splitting hard defences to 20m wide individual breaches and soft defences to 50m wide individual breaches.

The most significant difference between the 2005 and 2100 epoch is situated in the west of the LBN where the maximum flood extent extends approximately 500m further than observed in the 2005 epoch.

This modelling should be used to assess residual risk. Hence, the model outputs have been used in the Level 2 SFRA to determine residual tidal flood risk to development.

5.5 Surface water flooding

Surface water runoff (or 'pluvial' flooding) is normally caused by intense rainfall e.g. thunderstorms. At times the amount of water falling can completely overwhelm the

drainage network, which is not designed to cope with extreme storms. Flooding can also be exacerbated by blockages to drainage networks, sewers being at capacity and/ or high-water levels in watercourses that cause local drainage networks to back up.

According to LBN Council's SuDS design evaluation guide (2020), Newham has been assessed as having the lowest sewer capacity of all 33 London boroughs (Thames Water's assessment 2018). Newham's sewer infrastructure is nearing capacity and projected to be over capacity within the next 20-30 years. More than half of Newham's sewer infrastructure consists of a historical combined sewer system providing very low capacity which make the borough particularly prone to surface water flooding during rainstorms.

5.5.1 Critical Drainage Areas

As part of the **LBN's Surface Water Management Plan (SWMP)**, 13 Critical Drainage Areas (CDAs) in the LBN were identified. These CDAs were based on the most significant Local Flood Risk Zones (LFRZs) – areas identified using direct rainfall modelling where flooding affects houses, businesses and/or infrastructure. The CDAs are located (as displayed in Figure 5-6):

- at the Royal Docks
- in East Ham
- in Stratford
- in Little Ilford
- around major railway lines – the Great Eastern Main Line/ Elizabeth Line, Gospel Oak to Barking Line, Essex Thameside Line and the Docklands Light Railway.

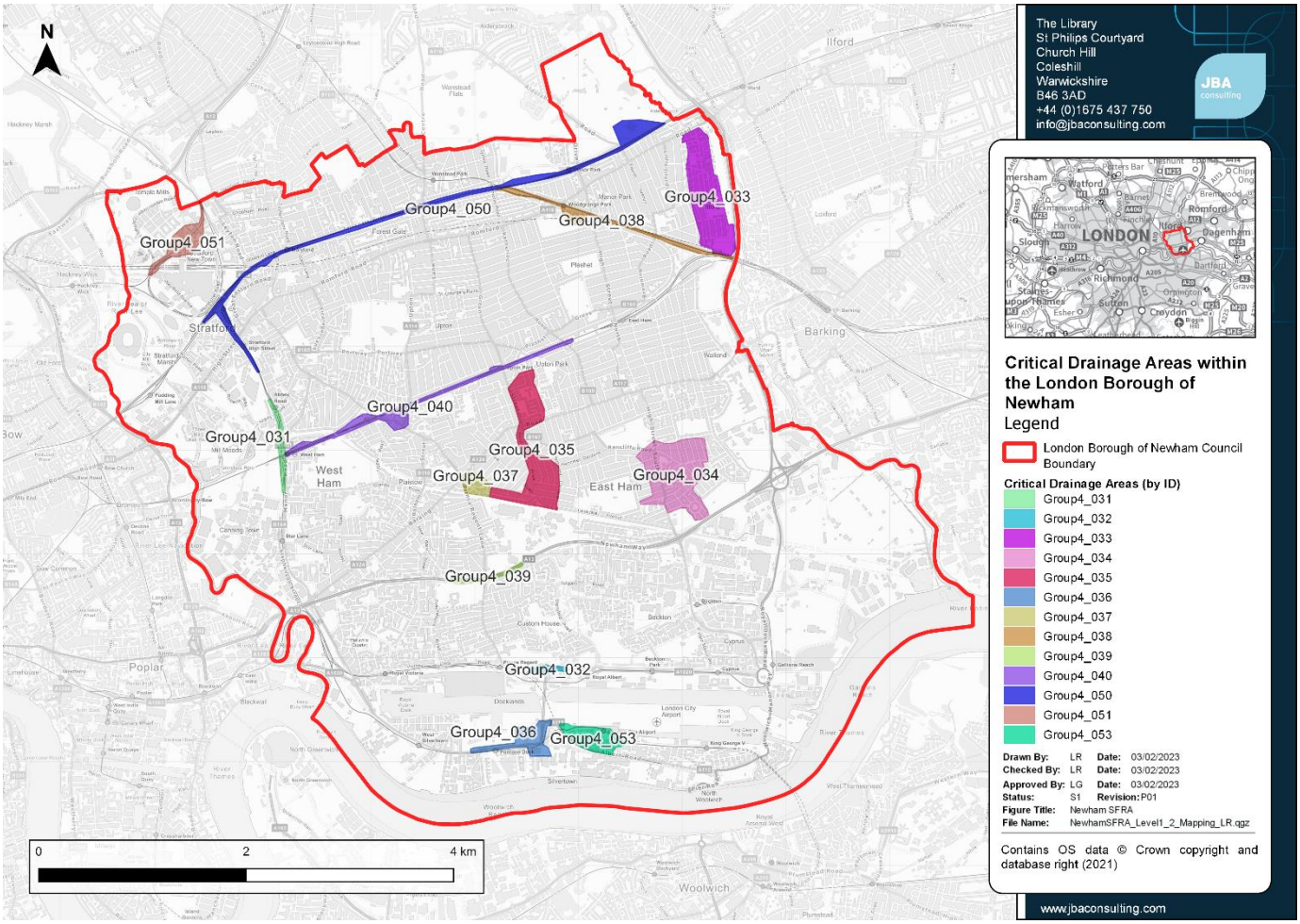

Figure 5-6: Map displaying the designated ‘Critical Drainage Areas’ within the London Borough of Newham.

5.6 Sewer flooding

Sewers in the west and south of the LBN Council area are predominantly combined sewers, which convey both foul sewage and surface water runoff. Sewers in the east of the LBN and in isolated patches in the west, south-west and south-east have separate foul and stormwater sewers.

Sewer flooding occurs when intense rainfall/river flooding overloads sewer capacity (surface water, foul or combined), and/or when sewers cannot discharge to watercourses due to high water levels.

Sewer flooding can also be caused by blockages, collapses, equipment failure or groundwater leaking into sewer pipes. Since 1980, the Sewers for Adoption guidelines have stated that new surface water sewers should be designed to have capacity for a rainfall event with a 1 in 30 chance of occurring in any given year, although until recently this did not apply to smaller private systems. This means that sewers will be overwhelmed in larger rainfall and flood events.

Existing sewers can also become overloaded as new development adds to the surface water discharge to their catchment, or due to incremental increases in roofed and paved surfaces at the individual property scale (urban creep). Sewer flooding is therefore a problem that could occur in many locations across the study area.

Thames Water is the water company responsible for the management of the drainage networks across the LBN. Thames Water provided details of 7,138 recorded incidents of sewer flooding which have occurred in the borough. These were provided using four-digit postcode areas for the period between January 1957 and December 2022.

According to a 2018 Thames Water assessment, Newham has the lowest sewer capacity of all 33 London Boroughs. **The Newham SuDS Design and Evaluation Guide** explains that Newham's sewer system is nearing capacity making the borough prone to surface water flooding during storm events.

The LBN experiences systemic surface water and sewer flooding issues. These are strongly associated with a lack of capacity in the local sewer system and also because the LBN is the 'end pipe' of the larger London combined sewer system, whose load is all conveyed to the Beckton Sewage Treatment Work to the south-east of the LBN.

Records show sewer flooding is widespread across the borough, with recorded incidents on 3,057 separate dates and 25 different postcodes. The most incidents occurred on 12th September 1989, with 441 separate incidents reported. There are spatial clusters of sewer flooding in East Ham, Manor Park and Forest Gate. Some of these spatial clusters (e.g., East Ham) correspond with the CDAs (Section 5.5.1) although there are notable exceptions (e.g., the Royal Docks).

Figure 5-7 displays sewer flooding incidents recorded by Thames Water between January 1957 and December 2022. This data was provided by Thames Water by four digit postcode area. As using a raw sewer count could be misleading – as theoretically

a larger postcode area would have more sewer flooding incidents – this data has been standardised by the area (in hectares) of each postcode district. As a result, sewer flooding incidents can be compared between postcode districts, providing a more meaningful representation of sewer flooding within the LBN.

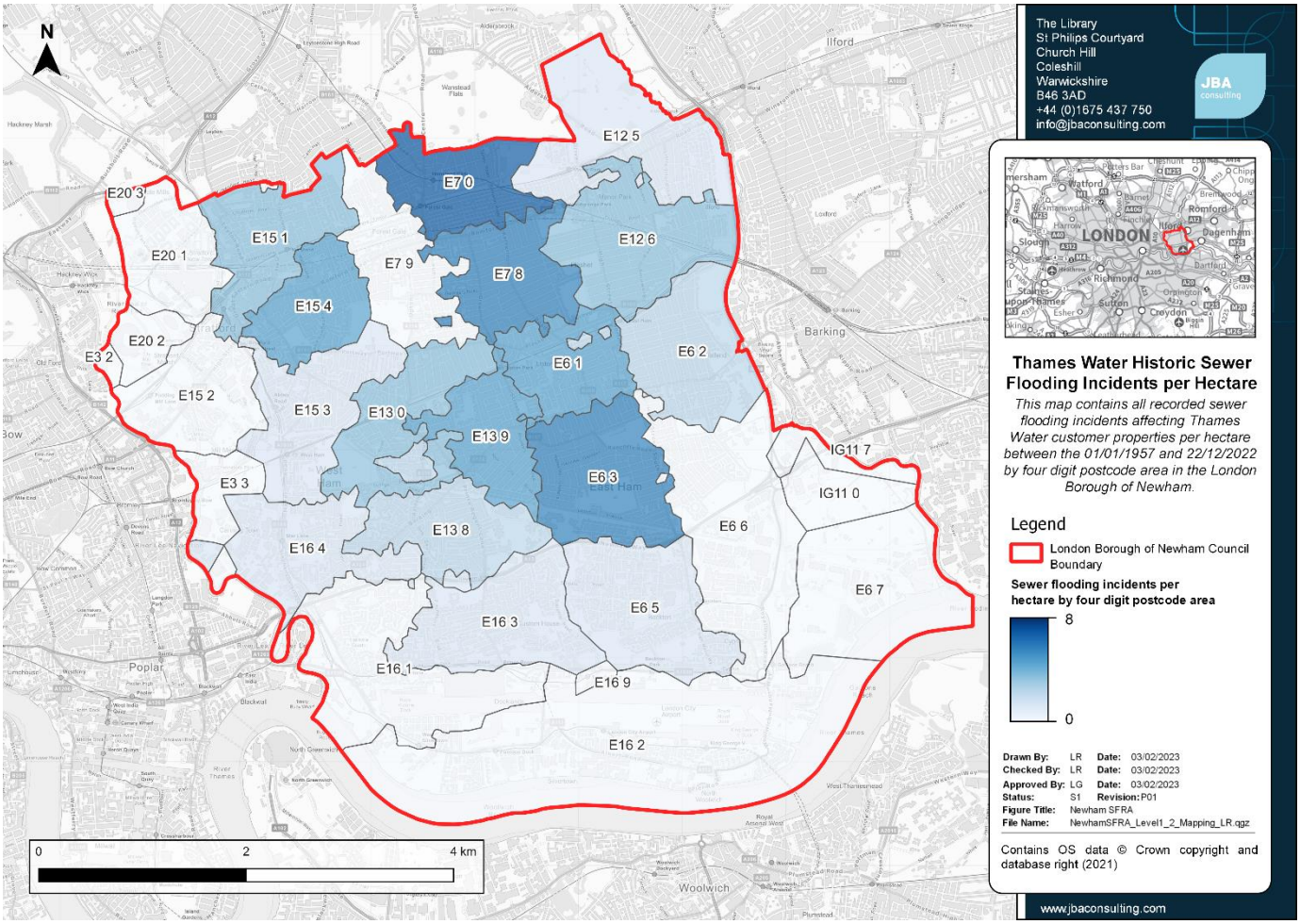

Figure 5-7: Thames Water recorded sewer flooding incidents (1957 – 2022) per hectare in the London Borough of Newham.

5.7 Groundwater flooding

In general, less is known about groundwater flooding than other sources. Groundwater flooding can be caused by:

- High water tables, influenced by the type of bedrock and superficial geology.
- Seasonal flows in dry valleys, which are particularly common in areas of chalk geology.
- Rebounding groundwater levels, where these have been historically lowered for industrial or mining purposes.
- Long culverts that prevent water easily getting into watercourses.

Groundwater flooding is different to other types of flooding in that it can last for days, weeks or even months and is much harder to predict and warn for. Monitoring does occur in certain areas, for example where there are major aquifers or when mining stops.

To assess groundwater flooding within the LBN, the Groundwater Flood Map 5m Resolution GW5 V2.2. (GeoSmart licensed product) has been provided by the LBN council. The GeoSmart Groundwater Flood Risk Map shows areas of potential groundwater emergence and highlights areas where there is sufficient evidence to suggest that flooding should occur. Whilst this data should be used as part of the Sequential Test, it is not directly comparable to other datasets (e.g. Flood Zones) and therefore cannot categorise an area as high, medium or low risk on its own. The map should be interpreted as an initial indicative tool to assess groundwater flood risk at preliminary stages of planning/site allocation.

The V2.2. model categorises four different features classes (1-4), as set out in the GeoSmart Groundwater Flood Risk Map User guide. A detailed description of each individual class is given below in Table 5-2.

Table 5-2: GeoSmart groundwater risk screening categories

Risk Class	Description
Class 1: High	There is a high risk of groundwater flooding in this area with a chance of greater than 1% annual probability of occurrence or more frequent. It is likely that incidence of groundwater flooding will occur, which could lead to damage to property or harm to other sensitive receptors at, or near, this location. Flooding may result in damage to property, road or rail closures and, in exceptional cases, may pose a risk to life. Surface water flooding and failure of drainage systems will be exacerbated when groundwater levels are high. Further consideration of the local level of risk and mitigation, by a suitably qualified professional, is recommended.
Class 2: Moderate	There is a moderate risk of groundwater flooding in this area with a chance of greater than 1% annual probability of occurrence. There will be a significant possibility that incidence of groundwater flooding could lead to damage to property or harm to other sensitive receptors at, or near, this location. Where flooding occurs it is likely to be in the form of shallow pools or streams. There may be basement flooding, but road or rail closures should not be needed and flooding should pose no significant risk to life. Surface water flooding and failure of drainage systems may be exacerbated when groundwater levels are high. Further consideration of the local level of risk and mitigation, by a suitably qualified professional, is recommended.
Class 3: Low	There is a low risk of groundwater flooding in this area with a chance of greater than 1% annual probability of occurrence. There will be a remote possibility that incidence of groundwater flooding could lead to damage to property or harm to other sensitive receptors at, or near, this location. For sensitive land uses further consideration of site topography, drainage, and historical information on flooding in the local area should be

Risk Class	Description
	undertaken by a suitably qualified professional. Should there be any flooding it is likely to be limited to seepages and waterlogged ground, damage to basements and subsurface infrastructure, and should pose no significant risk to life. Surface water flooding, however, may be exacerbated when groundwater levels are high.
Class 4: Negligible	There is a negligible risk of groundwater flooding in this area and any groundwater flooding incidence has a chance of less than 1% annual probability of occurrence. No further investigation of risk is deemed necessary unless proposed site use is unusually sensitive. However, data may be lacking in some areas, so assessment as 'negligible risk' on the basis of the map does not rule out local flooding due to features not currently represented in the national datasets used to generate this version of the map.

According to the GeoSmart Groundwater flood risk map, the only area within LBN classified as high risk is situated in the south-east of the Borough within a sewage treatment works site. There are several areas with the LBN which are at moderate risk of groundwater emergence. This includes along the River Thames on the southern boundary of the Borough from Silvertown to approximately 260m south of Gemini Business Park in the south-east of the Borough. There are also some areas at moderate risk along the River Roding on the LBN's north-eastern boundary between the north-eastern corner of the Borough's boundary and Wallend. Finally, there is a strip of land in the centre of the LBN that is also classified as at moderate risk, which is situated along the east of Stratford, the north and east of West Ham, and through East Ham. For further information on the groundwater flood risk maps, please refer to Appendix A.

The GeoSmart Groundwater flood risk map for the LBN is provided in Appendix A - Flood Risk Mapping. In high-risk areas, a site-specific risk assessment for groundwater flooding may be required to fully inform the likelihood of flooding.

5.7.1 History of groundwater flooding within the LBN

The LBN Surface Water Management Plan (SWMP), which was developed in 2011 and updated to reflect the LBN Local Plan in 2019, states there have been several records of flooding attributed to groundwater in the LBN. These incidents are detailed in Table 5-3.

Table 5-3: Records of groundwater flooding in the LBN

Date	Location	Recorded Impacts
03/01/2003	Central Park Road, East Ham	Wet
06/01/2003	Green Street, Upton Park	Standing Water
07/01/2003	Wanlip Road, Plaistow	Standing Water
23/01/2003	Seventh Avenue, Manor Park	Standing Water
08/08/2003	Gooseley Lane, East Ham	Damp
11/02/2004	Clements Road, Upton Park	Standing Water
17/02/2004	Chaucer Road, West Ham	Standing Water
18/11/2004	Green Street, Upton Park	Standing Water
19/06/2006	Sprowston Mews, Forest Gate	Wet
10/10/2009	Shelley Avenue, Plashet	Standing Water
20/01/2010	Redriffe Road, West Ham	Possible spring

5.8 Flooding from canals

Canals are regulated waterbodies and are unlikely to flood unless there is a sudden failure of an embankment or a sudden ingress of water from a river in areas where they interact closely. Embankment failure can be caused by:

- Culvert collapse
- Overtopping
- Animal burrowing
- Subsidence/ sudden failure e.g., collapse of former mine workings
- Utility or development works close or encroaching onto the footings of a canal embankment.

Flooding from a breach of a canal embankment is largely dictated by canal and ground levels, canal embankment construction, breach characteristics and the volume of water within the canal that can discharge into the lower lying areas behind the embankment. The volume of water released during a breach is dependent on the pound length (i.e., the distance between locks) and how quickly the operating authorities can react to prevent further water loss, for example by the fitting of stop boards to restrict the length of the canal that can empty through the breach, or repair of the breach. The Canal and River Trust monitor embankments at the highest risk of failure.

There are no purpose-built canals within the LBN. However, the tributaries of the River Lee at Stratford are heavily canalised at Bow Back Creek (including the Pudding Mill, Three Mills Wall and Waterworks River) and are managed by the Canal and River Trust. These watercourses are controlled by a series of locks. There have been two recorded flooding incidents at Three Mills on the Bow Back Creek (Section 5.1.).

5.9 Flooding from reservoirs

Reservoirs with an impounded volume greater than 25,000 cubic metres are governed by the **Reservoir Act 1975** and are on a register held by the Environment Agency. The

level and standard of inspection and maintenance required by a Supervising Panel of Engineers under the Act means that the risk of flooding from reservoirs is very low.

Flooding from reservoirs occurs following partial or complete failure of the control structure designed to retain water in the artificial storage area. Reservoir flooding is very different from other forms of flooding; it may happen with little, or no warning and evacuation will need to happen immediately. The likelihood of such flooding is difficult to estimate but is extremely low compared to flooding from other sources. It may not be possible to seek refuge upstairs from floodwater as buildings could be unsafe or unstable due to the force of water from the reservoir breach or failure.

The Environment Agency hold mapping showing what might happen if reservoirs fail. Developers and planners should check the **Long-Term Risk of Flooding website** before using the reservoir data shown in this SFRA to make sure they are using the most up to date mapping. The Environment Agency provide two flooding scenarios for the reservoir flood maps: a “dry day” and a “wet day”. The “dry day” scenario shows the predicted flooding which would occur if the dam or reservoir fails when rivers are at normal levels. The “wet day” scenario shows the predicted worsening of the flooding which would be expected if a river is already experiencing an extreme natural flood.

The current mapping indicates that there are 22 reservoirs with extents that affect the LBN (Table 5-4). Section 7.4.3 provides further considerations for developing in the vicinity of reservoirs. The reservoir flood mapping for both the “dry day” and “wet day” scenarios in the LBN has been provided in Appendix A. The Environment Agency maps represent a credible worst-case scenario. In these circumstances it is the time to inundation, the depth of inundation, the duration of flooding and the velocity of flood flows that will be most influential.

Table 5-4: List of reservoirs which could potentially flood the London Borough of Newham if they were to fail.

Reservoir	Northings and eastings	Reservoir owner	Local Authority Area	Is the reservoir within the study area?	Does the reservoir impact the LBN in the “dry day” scenario?	Does the reservoir impact the LBN in the “wet day” scenario?
Banbury	536200, 191400	Thames Water Limited	Waltham Forest	No	Yes	Yes
Basin Lake, Wanstead	540600, 187600	Wanstead Golf Association Ltd	Redbridge	No	No	Yes
Berners Hall Farm	559000, 209700	Essex Farms	Essex	No	Yes	Yes

Reservoir	Northings and eastings	Reservoir owner	Local Authority Area	Is the reservoir within the study area?	Does the reservoir impact the LBN in the “dry day” scenario?	Does the reservoir impact the LBN in the “wet day” scenario?
Chigwell Raw Water	545700, 193500	Northumbrian Water Ltd	Essex	No	No	Yes
Eagle Pond	540000, 189000	City of London Corporation	Redbridge	No	No	Yes
Heronry Pond, Wanstead Park	541500, 187200	City of London Corporation	Redbridge	No	Yes	Yes
High Maynard	535500, 189600	Thames Water Limited	Waltham Forest	No	Yes	Yes
Highams Park Lake	539291, 192050	City of London Corporation	Waltham Forest	No	No	Yes
King George V	537400, 196500	Thames Water Limited	Enfield	No	Yes	Yes
Lockwood	535300, 190200	Thames Water Limited	Waltham Forest	No	Yes	Yes
Ornamental Water, Wanstead Park	541700, 187700	City of London Corporation	Redbridge	No	Yes	Yes
Perch Pond, Wanstead Park	541700, 187100	City of London Corporation	Redbridge	No	Yes	Yes
Queen Elizabeth II	511800, 167100	Thames Water Limited	Surrey	No	No	Yes
Stoke Newington (East)	532700, 187600	Thames Water Limited	Hackney	No	No	Yes
Stoke Newington (West)	532400, 187300	Hackney Council	Hackney	No	No	Yes

Reservoir	Northings and eastings	Reservoir owner	Local Authority Area	Is the reservoir within the study area?	Does the reservoir impact the LBN in the "dry day" scenario?	Does the reservoir impact the LBN in the "wet day" scenario?
Valentines Park Lake	543500, 187300	London Borough of Redbridge	Redbridge	No	Yes	Yes
Walthamstow No.4	535400, 189100	Thames Water Limited	Waltham Forest	No	Yes	Yes
Walthamstow No.5	535500, 188600	Thames Water Limited	Waltham Forest	No	Yes	Yes
Warwick East Reservoir	534800, 188500	Thames Water Limited	Waltham Forest	No	Yes	Yes
West Warwick	534600, 188300	Thames Water Limited	Waltham Forest	No	Yes	Yes
William Girling	536700, 194100	Thames Water Limited	Enfield	No	Yes	Yes
Wraysbury	502500, 174500	Thames Water Limited	Surrey	No	No	Yes

5.10 Impact of climate change in the London Borough of Newham

This section explores which areas of the LBN are most sensitive to increases in flood risk due to climate change. It should be noted that areas that are already at high risk will also become at increasing risk in future and the frequency of flooding will increase in such areas.

It is recommended that LBN Council work with other Risk Management Authorities (RMAs) to review how existing and new development in these areas are to be protected from flood risk when developing climate change plans and strategies for the borough, particularly in line with the TE2100 plan. For example, SuDS and blue-green infrastructure can help manage and even improve surface water flood risk.

5.10.1 Impact of climate change on fluvial flood risk

Areas within the LBN most sensitive to fluvial impacts of climate change, based on flood extents, include:

- The easternmost areas of Beckton, East Ham and Little Ilford, where flooding from the River Roding increases in extent significantly.
- Areas either side of the DLR line in Stratford, parts of Three Mills and the northern half of Canning Town where flooding from the River Lee increases in extent.

5.10.2 Impact of climate change on surface water flood risk

The latest climate change allowances have been applied to the Environment Agency's Risk of Flooding from Surface Water dataset and the three surface water models within the LBN – Little Ilford (2015), Newham Central (2015) and Silvertown (2015) – to provide an indication of the impact of climate change on surface water risk (as well as for smaller watercourses).

In general, surface water is modelled to follow similar paths and patterns in the future as present day, just with significantly greater extents and associated depths, velocities and hazards.

Areas in the LBN Council's Administrative Area particularly sensitive to climate change impacts on surface water flooding are:

- Canning Town – significantly increased flood extents on roads neighbouring Hermit Road and Star Lane.
- East Ham – significant pooling of water surrounding Barking Road, Central Park Road, Lonsdale Avenue and near Folkstone Road.
- West Ham – significant flow paths along Manor Road and surrounding smaller streets and roads.
- Little Ilford – significant increase in extent around Dore Avenue and perpendicular Avenues off this.

5.10.3 Impact of climate change on residual risk - tidal breach

The 2100 or 2115 epoch for the Thames Tidal Breach Upriver and Downriver models respectively shows areas that are sensitive to climate change increasing the tidal breach extents when compared to the present day (2005) epoch extents;

- The Downriver 2115 epoch breach extent shows increased depths and extents of flooding around Beckton, including South and West Beckton.
- The Upriver 2100 epoch breach extent shows increased depths and extents of flooding around the West of Canning Town, West Ham and Stratford.

5.10.4 Impact of climate change on groundwater flood risk

There is no technical modelling data available to assess climate change impacts on groundwater. It would depend on the flooding mechanism, historic evidence of known

flooding and geological characteristics, for example prolonged rainfall in a chalk catchment. Flood risk could increase when groundwater is already high or emerged, causing additional overland flow paths or areas of still ponding.

A high likelihood of groundwater flooding may mean infiltration SuDS are not appropriate and groundwater monitoring may be recommended.

5.10.5 Impact of climate change on sewer flooding

Surface water and fluvial flooding with climate change have the potential to impact the sewerage system, so careful management of these is needed for development. Due to differing ages of settlements, there will be drainage systems consisting of different types of sewers. Increasing pressures from climate change, urban creep and infill development could impact the performance of the sewerage system.

5.10.6 Adapting to climate change

The **PPG Climate Change guidance** contains information and guidance for how to identify suitable mitigation and adaptation measures in the planning process to address the impacts of climate change. Examples of adapting to climate change include:

- Considering future climate risks when allocating development sites to ensure risks are understood over the development's lifetime;
- Considering the impact of and promoting design responses to flood risk and coastal change for the lifetime of the development;
- Considering availability of water and water infrastructure for the lifetime of the development and design responses to promote water efficiency and protect water quality;
- Promoting adaptation approaches in design policies for developments and the public realm for example by building in flexibility to allow future adaptation if needed, such as setting new development back from watercourses;
- Identifying no or low-cost responses to climate risks that also deliver other benefits, such as green infrastructure that improves adaptation, biodiversity and amenity, for example by leaving areas shown to be at risk of flooding as public open space;
- Considering the standard of protection of defences and sites for future development, in relation to sensitivity to climate change. The London Borough of Newham Council and developers will need to work with RMAs and use the SFRA datasets to understand whether development is affordable or deliverable. Locating development in such areas of risk may not be a sustainable long-term option, such as at the defence locations mentioned in Section 6; and
- It is recommended that the differences in flood extents from climate change are compared by the London Borough of Newham Council when allocating

sites, to understand how much additional risk there could be, where this risk is in the site, whether the increase is marginal or activates new flow paths, whether it affects access/ egress and how much land could still be developable overall. Recommendations for development are made for the levels of risk in the SFRA User Guide in Appendix C.

5.11 Flood Alert and Flood Warnings

The Environment Agency is the lead organisation for providing warnings of river flooding. Flood Warnings are supplied via the Flood Warning System (FWS) service, to homes and business within Flood Zones 2 and 3. There are currently eight Flood Alert Areas (FAA) and 12 Flood Warning Areas (FWAs) covering the LBN.

Flood Alerts are issued when there is water out of bank for the first time anywhere in the catchment, signalling that 'flooding is possible', and therefore Flood Alert Areas usually cover the majority of Main River reaches.

Flood Warnings are issued to designated Flood Warning Areas (i.e. properties within the extreme flood extent which are at risk of flooding), when the river level hits a certain threshold; this is correlated between the FWA and the gauge, with a lead time to warn that 'flooding is expected'.

A list of the Flood Alert and Flood Warning Areas is available in Appendix D. A map of the Flood Alert Areas and Flood Warning Areas is included in the flood risk mapping in Appendix A.

5.12 Summary of flood risk in the London Borough of Newham area

A table summarising all sources of flood risk to key settlements in the London Borough of Newham Council administrative area can be found in Appendix E. Static mapping is provided in Appendix A. These show the outlines from each source of flood risk in separate maps. These separate maps are then further divided into four sections of LBN, each section having its own map.

6 Flood Alleviation Schemes and Assets

This section provides a summary of existing flood alleviation schemes and assets in the London Borough of Newham. Planners should note the areas that are protected by defences, where further work to understand the actual and residual flood risk through a Level 2 SFRA may be beneficial. Developers should consider the benefit they provide over the lifetime of a development in a site-specific Flood Risk Assessment.

6.1 Asset management

Risk Management Authorities (RMAs) hold databases of flood risk management and drainage assets:

- The Environment Agency holds a national database that is updated by local teams.
- The LLFA holds a database of significant local flood risk assets, required under **Section 21 of the Flood and Water Management Act (2010)**.
- Highways Authorities hold databases of highways drainage assets, such as gullies and connecting pipes.
- Water Companies hold records of public surface water, foul and combined sewers, the records may also include information on culverted watercourses.

The databases include assets maintained by RMAs, as well as third-party assets. The drainage network is extensive and will have been modified over time. It is unlikely that any RMA contains full information on the location, condition and ownership of all the assets in their area. They take a prioritised approach to collecting asset information, which will continue to refine the understanding of flood risk over time.

Developers should collect the available asset information and undertake further survey as necessary to present an understanding of current flood risk and the existing drainage network in a site-specific FRA.

6.2 Standards of Protection

Flood defences are designed to give a specific Standard of Protection (SoP), reducing the risk of flooding to people and property in flood prone areas. For example, a flood defence with a 100-year SoP means that the flood risk in the defended area is reduced to at least a 1% chance of flooding in any given year.

Over time the actual SoP provided by the defence may decrease, due to deterioration in condition or increases in flood risk due to climate change. The understanding of SoP may also change over time as RMAs collect more data, undertake more detailed surveys and flood modelling studies, or review SoP after a flood event.

It should be noted that the Environment Agency's on-going hydraulic modelling programme may revise flood risk datasets and, consequently, the standard of protection offered by flood defences in the area may differ from those discussed in this report.

Developers should consider the SoP provided by defences and residual risk as part of a detailed FRA.

6.3 Maintenance

The Environment Agency and local authorities have permissive powers to maintain and improve Main Rivers and Ordinary Watercourses, respectively. There is no legal duty to maintain watercourses, defences or assets and maintenance and improvements are prioritised based on flood risk. The ultimate responsibility for maintaining watercourses rests with the landowner.

Highway's authorities have a duty to maintain public roads, making sure they are safe, passable and the impacts of severe weather have been considered. Water companies have a duty to effectually drain their area.

What this means in practise is that assets are maintained to common standards and improvements are prioritised for the parts of the network that do not meet this standard e.g., where there is frequent highway or sewer flooding. The London Borough of Newham Council as the LLFA have permissive powers and limited resources are prioritised and targeted to where it can have the greatest effect.

There is potential for the risk of flooding to increase in areas where flood alleviation measures are not maintained regularly. Breaches in raised flood defences are most likely to occur where the condition of a flood defences has degraded over time. Drainage networks in urban areas can also frequently become blocked with debris and this can lead to blockages at culverts or bridges.

Developers should not assume that any defence, asset or watercourse is being or will continue to be maintained throughout the lifetime of a development. They should contact the relevant RMA about current and likely future maintenance arrangements and ensure future users of the development are aware of their obligations to maintain watercourses.

Formal structural defences are given a rating based on a grading system for their condition. A summary of the grading system used by the Environment Agency for condition is provided in Table 6-1.

Table 6-1: Grading system used by the Environment Agency to assess asset condition

Grade	Rating	Description
1	Very good	Cosmetic defects that will have no effect on performance
2	Good	Minor defects that will not reduce the overall performance of the asset.
3	Fair	Defects that could reduce the performance of the asset.
4	Poor	Defects that would significantly reduce the performance of the asset. Further investigation required.
5	Very Poor	Severe defects resulting in complete performance failure.

Source: Environment Agency (2006) Condition Assessment Manual

6.4 Major flood risk management assets in the London Borough of Newham

'**Reduction in Risk of Flooding from Rivers and Sea due to Defences**' is a spatial dataset produced by the Environment Agency. It displays areas which have reduced flood risk from rivers and sea due to the presence of flood defences. The underlying model is run taking account of current flood defences to determine how much water would flood the land for a range of events (between 0.1% and 1% AEP events) and in which direction it would travel.

Almost 40% of the LBN has been identified as having a reduced risk of river and sea flooding due to the presence of defences. This area incorporates the south of the LBN parallel to the River Thames (Royal Docks, Beckton and Canning Town), the west of the LBN parallel to the River Lee (Stratford and West Ham) and the east of the LBN parallel to the River Roding (Little Ilford and East Ham). This is an indicative dataset, and is not reliable for identifying individual properties at risk.

In addition, the Environment Agency's **'AIMS spatial flood defences'** dataset gives further information on all flood defence assets within the London Borough of Newham council area. Table 6-2 displays the locations which benefit from flood defences at a lower (or unknown) standard of protection in the LBN.

Table 6-2: Locations displayed in the Environment Agency's 'spatial flood defences including AIMS' dataset.

Watercourse and, if applicable, name of defence	Location	Type	Design SOP	Condition Rating
River Thames – Thames Barrier	Silvertown to New Charlton (Royal Borough of Greenwich)	Retractable flood barrier	0.1%	Good
River Thames	Continuous wall adjacent to the River Thames between the River Lee and River Roding.	Wall	0.1%	Unknown
River Lee and tributaries	Small stretches at Mill Meads and Bow Creek	Embankment	0.1%	Unknown
River Lee and tributaries	Small stretches at West Ham and Canning Town	Engineered high ground	0.1% AEP	Unknown
River Lee and tributaries	Discontinuous wall from Stratford to Bow Creek	Wall	0.1% AEP to no protection given.	Unknown
River Roding	Discontinuous embankment between Manor Park and Warpools Reach	Embankment	0.1% to 5% AEP	Fair to unknown
River Roding – Barking Creek Barrier	Beckton to Creekmouth (London Borough of Barking and Dagenham)	Retractable flood barrier	0.1% AEP	Good
River Roding and tributary (Alders Brook)	Discontinuous wall from Little Ilford to Warpools Reach	Wall	0.1% to 5% AEP	Unknown

6.5 Existing and future flood alleviation schemes

6.5.1 Thames Barrier

The Tidal Thames is defended to a 0.1% AEP standard of protection by a series of walls, embankments, flood gates and barriers. It has also considered climate change to at least 2100.

The Thames Barrier is a retractable flood barrier located within the LBN between Silvertown and New Charlton (Royal Borough of Greenwich). It is operated and maintained by the Environment Agency. The barrier is composed of ten steel gates which are closed under storm surge conditions to protect central London (upstream of the barrier) from flooding from the sea. This provides a 0.1% AEP standard of protection and the **Thames Estuary 2100 Action Plan** (see section 2.5.8) states that major changes in this flood management system will not be needed until 2070 (based on current climate predictions).

The Environment Agency recently carried out the first full review and update of the Plan since it was published; the 10-Year Review. The major updates to the Plan regarding the Thames Barrier include:

- bringing forward the deadline for adapting flood defences upstream (west) of the Thames Barrier by 15 years to 2050. All defences along the Thames are to be raised by up to 0.5m by 2050 and by an additional 0.5m by 2100. Defences on the River Lee must also be raised by up to 1m in total by 2100.
- confirmed that all options for replacing the Thames Barrier (end-of-century options) should remain open until a decision is made
- brought forward the deadline for deciding on an end-of-century option from 2050 to 2040
- If the decision is made to modify/improve the Thames Barrier rather than build a new barrier further downstream, it will be required to raise all defences downstream of the Thames Barrier by up to 1.1m by 2070, and by an additional 0.5m by 2100

As a local planning authority, the LBN Council have a responsibility to maintain and raise any defences they own, as well as ensuring that proposed works to third party defences align with the requirements of the Plan.

6.5.2 Barking Creek Barrier

The Barking Creek Barrier is a retractable tidal flood barrier located at the confluence between the River Roding and River Thames at Beckton in the LBN. It is owned and operated by the Environment Agency. The barrier provides a 0.1% AEP standard of defence and is closed under storm surge conditions to protect north-east London from extreme tidal flooding.

The updated Thames Estuary 2100 Action Plan states that:

- the deadline for defence upgrades downstream (east) of the Thames Barrier remains 2040.

- Defences on the River Roding from Ilford Bridge to the Barking Barrier need to be raised by up to 1m by 2100.

6.5.3 King George V Dock Flood Control Gate

The King George V Flood Control Gate is located at the confluence of the King George V Dock and the River Thames in the LBN. It is owned and operated by the Environment Agency. The gate provides a 0.1% AEP standard of protection.

If the decision is made to modify/improve the Thames Barrier rather than build a new barrier further downstream, it will be required to replace the flood control gate on the King George V Dock.

6.5.4 Pier Road to Bradfield Road flood wall improvements

In 2018, concerns were raised about the condition of a 3.7km flood wall between Pier Road and Bradfield Road after recent flooding at Pier Road (January 2018). Newham Council, as the riparian owner, are responsible for the maintenance of these flood defence assets. A 2018 scoping study assessed sections of this flood wall to have critical defects requiring immediate attention and repair.

High priority works identified include repairing the stairs of the flood wall at Bradfield Road and Victoria Park, as well as sealing river wall flap valves for known surface water outfalls at Pier Road. The project is currently at detailed design phase.

6.6 Natural Flood Management

Natural Flood Management (NFM) is used to protect, restore and re-naturalise the function of catchments and rivers to reduce flood risk. A wide range of techniques can be used that aim to reduce flooding by working with natural features and processes to store or slow down flood waters before they can damage flood risk receptors (e.g., people, property, infrastructure, etc.).

NFM has been identified as an important flood risk reduction tool in the Environment Agency's 2020 **'National Flood and Coastal Erosion Risk Management Strategy for England'** (see Section 2.5.1). NFM techniques which could be applied in the LBN Council area include:

- SuDS including swales, wetlands in urban areas, green roofs, permeable pavements, detention ponds and filter strips.
- Targeted woodland planting.
- Improvements in land and soil management practices.
- Reconnection and restoration of functional floodplains.
- Re-meandering streams (creation of new meandering courses or reconnecting cut-off meanders to slow the flow of the river).

- Restoration of rivers and removal of redundant structures i.e., weirs and sluices no longer used or needed.
- Development of inland storage ponds and wetlands.
- Installation of in-stream structures e.g., woody debris.

In 2017, the Environment Agency published an **online evidence base to support the implementation of NFM** and **datasets displaying locations with the potential for NFM measures.** These maps are intended to be used alongside the evidence directory to help practitioners think about the types of measure that may work in a catchment and the best places in which to locate them.

The main NFM opportunities identified within the LBN are related to woodland planting. This information has been obtained from the **Environment Agency's 'Working with Natural Processes' datasets.** Woodland planting 'slows the flow' of the river, reducing and delaying the flood peak. This includes:

- Riparian and floodplain woodland planting adjacent to the River Roding at Beckton and Little Ilford.
- Wider catchment woodland planting in the greenspaces within Newham. This includes the areas parallel to the River Roding (Beckton, Little Ilford and the City of London Crematorium), West Ham (West Ham Park and East London cemetery) and Beckton (Beckton District Park and King George V Park).

However, as the LBN is an overwhelmingly urban area there are constraints on the potential for some NFM interventions. Nevertheless, there are some ongoing NFM projects in the upstream catchments of the Rivers Lee and Roding, as detailed below.

6.6.1 River Roding – Natural Flood Management measures

The Environment Agency, along with Thames 21, Natural England and Groundwater East, are working together to engage farmers and landowners within the Roding catchment who may be interested in implementing NFM measures on their land. This project is concentrated on the upper and middle reaches of the River Roding in Essex and north-east London suburbs.

NFM measures implemented include leaky barriers and tree planting. Although these measures are not located in the LBN directly, they will have downstream benefits reducing the volume and velocity of water flowing downstream into the LBN.

More information about this project can be found on the **Thames 21 website**.

6.6.2 Greater River Lee catchment – trees for rivers: a new woodland for London

Thames 21, in partnership with Enfield Council, are currently working on the **'trees for rivers' project** in the Salmon's Brook catchment, part of the wider River Lee catchment, approximately 15km north-west of the LBN Council Area. The project involves restoring tree cover in the 60-hectare Enfield Chase and constructing more

than 20 rural SuDS schemes. This is London's largest reforestation project, with over 100,000 trees planted between 2020 and 2022.

Catchment woodland intercepts, slows and stores water. This can help reduce downstream flood peaks, flood flows and flood frequency in the LBN.

More information about this project can be found on the Thames 21 website.

6.7 Other schemes

The **Environment Agency's Asset Management map** provides an updated indication of schemes that are under construction or have a forecast start date. There are no capital schemes within the extent of the LBN.

6.8 Actual and residual flood risk

A Level 2 SFRA (for strategic allocations) or developer site-specific Flood Risk Assessment will need to consider the actual and residual flood risk due to the presence of flood and drainage assets in greater detail.

6.8.1 Actual flood risk

This is the risk to the site considering existing flood mitigation measures and any planned to be provided through new development.

The assessment of the actual risk should consider that:

- The level of protection afforded by existing defences might be less than the appropriate standards and hence may need to be improved if further growth is contemplated.
- The flood risk management policy for the defences will provide information on the level of future commitment to maintain existing standards of protection. If there is a conflict between the proposed level of commitment and the future needs to support growth, then it will be a priority for this to be reviewed.
- The standard of safety must be maintained for the intended lifetime of the development. Over time the effects of climate change will erode the present-day standard of protection afforded by defences and so commitment is needed to invest in the maintenance and upgrade of defences if the present-day levels of protection are to be maintained and where necessary, land secured and safe-guarded that is required for affordable future flood risk management measures.
- By understanding the depth, velocity, speed of onset and rate of rise of floodwater it is possible to assess the level of hazard posed by flood events from the respective sources.

6.8.2 Residual risk

Residual risk is the risk that remains after the impacts of flood risk infrastructure have been considered. It is important that these risks are quantified to confirm that the consequences can be safely managed. The residual risk can be:

- The effects of a larger flood than defences were designed to alleviate (the 'design flood'). This can cause overtopping of flood banks, failure of flood gates to cope with the level of flow or failure of pumping systems to cope with the incoming amount of water.
- Failure of the defences or flood risk management measures, such as breaches in embankments or walls, failure of flood gates to open or close or failure of pumping stations.

It is the responsibility of the developer to fully assess flood risk, propose measures to mitigate it and demonstrate that any residual risks can be safely managed.

As outlined in Sections 5.4.1 and 5.4.2 of this report, the London Thames Breach Assessment modelling and the Thames Estuary Breach Assessment modelling highlights the residual risk of a breach in the Thames tidal flood defences, which while a relatively low probability, could have a devastating impact due to the depth and velocity of flood water. In accordance with NPPF, all sources of flooding need to be considered. If a breach or overtopping event were to occur, then the consequences to people and property could be high. Developers should be aware that any site that is at or below defence level, may be subject to flooding if an event occurs that exceeds the design capacity of the defences, or the defences fail, and this should be considered in a detailed Flood Risk Assessment.

The assessment of residual risk should consider:

- The flood hazard, depth and velocity that would result from overtopping or breach of defences. Flood gate or pumping station failure and/ or culvert blockage (as appropriate). The Environment Agency can provide advice at site-specific development level for advice on breach/ overtopping parameters for flood models.
- The design of the development to take account of the highest risk parts of the site e.g., allowing for flood storage on parts of the site and considering the design of the development to keep people safe e.g., sleeping accommodation above the flood level or raising finished floor levels above the breach flood levels.
- A system of warning and a safe means of access and egress from the site in the event of a flood for users of the site and emergency services.
- Climate change and/ or policy-dependent residual risks (such as those that may be created, if necessary, future defence improvements are required, or those associated with any managed adaptive strategies).

6.8.2.1 Overtopping

The risk from overtopping of defences is based on the relative heights of property or defence, the distance from the defence level and the height of water above the crest

level of the defence. The **Defra Flood Risks to People** guidance document provides standard flood hazard ratings based on the distance from the defence and the level of overtopping.

Any sites located next to defences or perched ponds/ reservoirs, may need overtopping modelling or assessments at the site-specific FRA stage, and climate change needs to be taken in to account.

6.8.2.2 Defence breach

A breach of a defence occurs when there is a failure in the structure and a subsequent ingress of flood water.

Where defences are present, risk of breach events should be considered as part of the site-specific FRA. Flood flows from breach events can be associated with significant depths and flow velocities in the immediate vicinity of the breach location and so FRAs must include assessment of the hazards that might be present so that the safety of people and structural stability of properties and infrastructure can be appropriately taken into account. Whilst the area in the immediate vicinity of a breach can be subject to high flows, the whole flood risk area associated with a breach must also be considered as there may be areas remote from the breach that might, due to topography, involve increased depth hazards.

Considerations include the location of a breach, when it would occur and for how long, the depth of the breach (toe level), the loadings on the defence and the potential for multiple breaches. There are currently no national standards for breach assessments and there are various ways of assessing breaches using hydraulic modelling. However, with regards to Thames tidal breaches, developers are required to use existing EA breach modelling for FRAs.

For the purposes of this SFRA, the EA have provided the Thames Upriver and Downriver Tidal Breach models. The breach scenarios form these models are as follows:

- Thames Tidal Upriver Breach Inundation Modelling 2017:
  - 2005 epoch 0.5% AEP
  - 2100 epoch 0.5% AEP
- Thames Tidal Downriver Breach Inundation Modelling 2018:
  - 2005 epoch 0.5% and 0.1% AEP
  - 2115 epoch 0.5% and 0.1% AEP

7 Flood Risk Management Requirements for Developers

This section provides guidance on site-specific Flood Risk Assessments (FRAs). These are carried out by (or on behalf of) developers to assess flood risk to and from a site. They are submitted with Planning Applications and should demonstrate how flood risk will be managed over the development's lifetime, considering climate change and vulnerability of users.

The report provides a strategic assessment of flood risk within the London Borough of Newham. Prior to the planning stage of any construction or development, site-specific assessments will need to be undertaken so all forms of flood risk and the actual and residual risk and standard of protection and safety at a site are considered in more detail.

Developers should, where required, undertake more detailed hydrological and hydraulic assessments of watercourses to verify flood extents (including latest climate change allowances), to inform the sequential approach within the site and prove, if required, whether the Exception Test can be satisfied.

A detailed FRA may show that a site, windfall[1] or other, is not appropriate for development of a particular vulnerability or even at all. The Sequential and Exception Tests in the NPPF apply to all developments and an FRA should not been seen as an alternative to proving these tests have been met.

As explained in Section 2.1, the **London Legacy Development Corporation (LLDC)** currently acts as the LPA for development within the Queen Elizabeth Olympic Park and its surrounding areas until the 1st December 2024. Development within the LLDC should follow the FRA guidance detailed in the **LLDC's Local Plan** and associated **evidence base** until the LPA's planning powers and functions are returned back the original LPAs it was formed from, including the LBN council.

7.1 Principles for new developments

7.1.1 Apply the Sequential and Exception Tests

Developers should refer to Section 3 for more information on how to consider the Sequential and Exception Tests. For allocated sites, LBN Council should use the information in this SFRA to apply the Sequential Test. For windfall sites a developer must undertake the Sequential Test, which includes considering reasonable alternative sites at lower flood risk. Only if it passes the Sequential Test should the Exception Test then be applied if required. The Sequential and Exception Tests in the NPPF apply to

[1] 'Windfall sites' is used to refer to those sites which become available for development unexpectedly and are therefore not included as allocated land in a planning authority's development plan.

all developments and an FRA should not be seen as an alternative to proving these tests have been met.

Developers should also apply the sequential approach to locating development within the site. The following questions should be considered:

- can risk be avoided through substituting less vulnerable uses or by amending the site layout?
- can it be demonstrated that less vulnerable uses for the site have been considered and reasonably discounted? and
- can the site layout be varied to reduce the number of people, the flood risk vulnerability or the building units located in higher risk parts of the site?

7.1.2 Consult with statutory consultees at an early stage to understand their requirements

Developers should consult with the Environment Agency, the London Borough of Newham Council (including LLFA) and infrastructure providers at an early stage to discuss flood risk including requirements for site-specific FRAs, detailed hydraulic modelling and drainage assessment and design (Newham draft (regulation 18) **Local Plan Policy CE7**).

Additionally, under the concern of risk management (e.g., bird strike). London City Airport (LCY) may object to development proposal deemed potentially to increase bird presence within 13km of the airport (this includes the entire LBN Council area). This may be relevant to a site's flood risk management requirements (e.g., development of SuDS). Whilst this concern should be heeded and early consultation with City Airport is advised, LCY's general concern should never be used to scope out requirement of green infrastructure, such as SuDS, nor LCY's objection accepted without site specific evidences and mitigation requirements to be evaluated by the London Borough of Newham's LPA. Further information can be found on **LCY airport's website**.

7.1.3 Consider the risk from all sources of flooding and that they are using the most up to date flood risk data and guidance.

The SFRA can be used by developers to scope out what further detailed work is likely to be needed to inform a site-specific Flood Risk Assessment. At a site level, developers will need to check before commencing on a more detailed Flood Risk Assessment that they are using the latest available datasets. Developers should apply the most up-to-date **Environment Agency climate change guidance** (last updated in May 2022) and ensure the development has taken into account climate change adaptation measures.

7.1.4 Ensure that the development does not increase flood risk elsewhere

Section 8 sets out the requirements for taking a sustainable approach to surface water management. Developers should also ensure mitigation measures do not increase flood risk elsewhere and that floodplain compensation is provided where necessary.

7.1.5 Ensure the development is safe for future users

Consideration should first be given to minimising risk by planning sequentially across a site. Once risk has been minimised as far as possible, only then should mitigation measures be considered. Developers should consider both the actual and residual risk of flooding to the site, as discussed in Section 3.2.10.

Further flood mitigation measures may be needed for any developments in an area protected by flood defences, where the condition of those defences is 'fair' or 'poor', and where the standard of protection is not of the required standard.

7.1.6 Enhance the natural river corridor and floodplain environment through new development

Developments should demonstrate opportunities to create, enhance and link green assets. This can provide multiple benefits across several disciplines including flood risk and biodiversity/ ecology and may provide opportunities to use the land for an amenity and recreational purposes. Development that may adversely affect green infrastructure assets should not be permitted. Where possible, developers should identify and work with partners to explore all avenues for improving the wider river corridor environment. Developers should open up existing culverts and should not construct new culverts on site except for short lengths to allow essential infrastructure crossings.

7.1.7 Consider and contribute to wider flood mitigation strategy and measures in the area and apply the relevant local planning policy

Wherever possible, developments should seek to help reduce flood risk in the wider area e.g., by contributing to a wider community scheme or strategy for strategic measures, such as defences or NFM or by contributing in kind by mitigating wider flood risk on a development site. More information on the contribution developers are expected to make towards achieving the wider vision for FRM and sustainable drainage in the LBN can be found in Appendix F - Cumulative Impact Assessment (CIA). Developers must demonstrate in an FRA how they are contributing towards this vision.

7.2 Requirements for site specific Flood Risk Assessments

7.2.1 When is an FRA required?

Site-specific FRAs are required in the following circumstances:

- All development in Flood Zones 2 and 3 over 250 sqm.
- Proposals of 1 hectare or greater in Flood Zone 1.

- 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 Drain London Project).
- Where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

A FRA may also be required for some specific situations:

- If the site may be at risk from the breach of a local defence (even if the site is actually in Flood Zone 1)
  - EA guidance states Finished Floor Levels of developments that will be impacted by a Thames tidal defence breach should be raised to 300mm above the 0.5% AEP plus climate change event. In the case of tidal breaches, the climate change allowance here is referring to the 2100 or 2115 epoch.
  - EA guidance also states that any defences within the planning area need to be raised to the 2100 or 2115 epoch breach flood level.
- Where evidence of historical or recent flood events have been passed to the LPA.
- If a basement property falls within a Critical Drainage Area, an FRA is required for surface water and sewer flooding.
- Land identified in an SFRA as being at increased risk in the future.

7.2.2 Objectives of a site-specific FRA

Site-specific FRAs should be proportionate to the degree of flood risk and the scale, nature and location of the development.

Site-specific FRAs should establish:

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

FRAs should follow the approach recommended by the NPPF (and associated guidance) and guidance provided by the Environment Agency and the LBN Council administrative area. Guidance and advice for developers on the preparation of site-specific FRAs include:

- **Standing Advice on Flood Risk** (Environment Agency)

- **Flood Risk Assessment for Planning Applications** (Environment Agency); and
- **Site-specific Flood Risk Assessment: Checklist** (NPPF PPG, Defra)
- The LBNs **'Flood Risk and Sustainable Drainage: requirements and guidance for Planning Application'** (2020) provides guidance on the sustainable drainage policies for Newham as an LLFA. Please note that this document will be reviewed in the near future following the completion of the Newham Local Plan 2024.
- Guidance for local planning authorities for reviewing Flood Risk Assessments submitted as part of planning applications has been published by Defra in 2015 – **Flood Risk Assessment: standing advice for Local Planning Authorities.**

7.2.3 Potential site layout and design solutions to mitigate flood risk

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.

The NPPF states that a sequential, risk-based approach should be applied to try to locate more vulnerable land use away from Flood Zones to higher ground, while more flood-compatible development (e.g., vehicular parking, recreational space) can be located in higher risk areas. Whether parking in floodplains is appropriate will be based on the likely flood depths and hazard, evacuation procedures and availability of flood warning.

Waterside areas, or areas along known flow routes, can act as green infrastructure, being used for recreation, amenity and environmental purposes, allowing the preservation of flow routes and flood storage, and at the same time providing valuable social and environmental benefits contributing to other sustainability objectives. However, this landscaping should not increase the presence of birds in the area (Section 7.1.2). Landscaping should ensure safe access to higher ground from these areas and avoid the creation of isolated islands as water levels rise.

Policy CE7 in the LBN's draft (regulation 18) **Local Plan** provides guidance on site layout and design which should be followed for developments specifically in the EA's FMfP Flood Zones 2 and 3, or where detailed up-to-date modelling displays the development will be at increased risk of flooding due to the impacts of the climate emergency. More vulnerable site uses should be placed above ground level, whilst still delivering active, welcome and functional street level design.

7.2.3.1 Modification of ground levels

Any proposal for the modification of ground levels will need to be assessed as part of a detailed flood risk assessment.

Modifying ground levels to raise the land above the required flood level is an effective way of reducing flood risk to a particular site in circumstances where the land does not act as conveyance for flood waters. However, care must be taken as raising land above the floodplain could reduce conveyance or flood storage in the floodplain and could adversely impact flood risk downstream or on neighbouring land. Raising ground levels can also deflect flood flows, so analyses should be performed to demonstrate that there are no adverse effects on third party land or property.

Compensatory flood storage should be provided, and would normally be on a level for level, volume for volume basis on land that does not currently flood but is adjacent to the floodplain (for it to fill and drain). It should be in the vicinity of the site and within the red line of the planning application boundary (unless the site is strategically allocated). Guidance on how to address floodplain compensation is provided in Appendix A3 of the **CIRIA Publication C624**.

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

Raising levels can also create areas where surface water might pond during significant rainfall events. Any proposals to raise ground levels should be tested to ensure that it would not cause increased ponding or build-up of surface runoff on third party land.

7.2.3.2 Raised floor levels

If raised floor levels are proposed, these should be agreed with LBN Council and the Environment Agency. The minimum Finished Floor Level (FFL) may change dependent upon the vulnerability and flood risk to the development.

The Environment Agency advises that **minimum finished floor levels should be set 300mm above the 100-year plus climate change peak flood level**, where the new climate change allowances have been used (see Section 4 for the climate change allowances). An additional allowance may be required because of risks relating to blockages to the channel, culvert or bridge and should be considered as part of an FRA.

The LBN Local Plan states that as per the **NPPF Annex 3** all development rated as ‘more vulnerable,’ ‘highly vulnerable,’ and ‘essential infrastructure’ uses have finished floor levels of no less than 300mm above the 1% AEP flood level, with an allowance for the impact of the climate emergency.

Allocating the ground floor of a building for less vulnerable, non-residential, use is an effective way of raising living space above flood levels. Single storey buildings such as ground floor flats or bungalows are especially vulnerable to rapid rise of water (such as that experienced during a breach). This risk can be reduced by use of multiple storey construction and raised areas that provide an escape route.

7.2.3.3 Safe access and egress

The Environment Agency's Flood Risk Assessment Standing Advice states that you need to provide details of your emergency escape plans for any part of a building which are below the estimated flood level. Further information about what these plans require is available on the **Environment Agency's website**.

Additionally, draft (regulation 18) policy CE7 of the **LBN's local plan** also provides guidance on safe access and egress requirements within the LBN.

All developments in Flood Zones 2 and 3 or where detailed up-to-date modelling displays the development will be at increased risk of flooding due to the impacts of the climate emergency should:

- Provide safe access/egress, such that occupants can reach Flood Zone 1 via public rights of way.
- Ensure all basement locations provide internal access and egress via floors no less than 300 millimetres above the one per cent annual probability flood level and an allowance for the impact of the climate emergency, or above the 2100 tidal breach flood level where the site is within the Thames tidal breach flood extent.

7.2.3.4 Development and raised defences

Construction of localised raised floodwalls or embankments to protect new development is not a preferred option, as a residual risk of flooding will remain. Compensatory storage must be provided where raised defences remove storage from the floodplain.

Where development is located behind, or in an area where there is a reduction of the risk of flooding from the rivers and sea due to defences, the residual risk of flooding must be considered.

According to the Thames Estuary 2100 Plan, any guidance on improving the condition of flood defences will need to be sought from the EA. The guidance will be updated in the TE2100 Plan (further details can be found **here**). Any future development is dictated by this Plan and will need to be raised above the specified breach level.

7.2.3.5 Developer contributions

In some cases, and following the application of the Sequential Test, it may be appropriate for the developer to contribute to the improvement of flood defence provision that would benefit both proposed new development and the existing local community. Developer contributions can also be made to maintenance and provision of flood risk management assets, flood warning and the reduction of surface water flooding (i.e. SuDS).

7.2.3.6 Buffer strips

The provision of a buffer strip to 'make space for water', allows additional capacity to accommodate climate change and ensure access to the watercourse, structures and defences is maintained for future maintenance purposes. It also enables the avoidance of disturbing riverbanks, adversely impacting ecology and having to construct engineered riverbank protection.

For any development (including redevelopment of existing buildings and sites) a buffer strip of 8m is required from the toe of any Main River and 16m from tidal defence structures, taking into account the requirements set by the **Flood Risk Activities: Environmental Permits guidance** (and any subsequent updates). Where flood defences are present, these distances should be taken from the toe of the defence.

Development adjacent to flood defences must confirm, through liaison with the Environment Agency, that the defence structure are in good condition and will provide protection for the lifetime of the development including taking into consideration the latest Climate Change Allowance modelling and, where applicable, meet the provisions set out in the **Thames Estuary 2100 Action Plan** (and subsequent updates). If improvements are required, these should be made at the earliest possible stage (factoring in impacts on scheme phasing and the end user of schemes) and should consider the need to design for extreme climate change scenarios.

Where no formal flood defences are present, development will be set back eight metres from the top of the riverbank.

Building adjacent to riverbanks can cause problems to the structural integrity of the riverbanks and the building itself, making future maintenance of the river much more difficult. Any development in these areas will likely require a Flood Risk Permit from the Environment Agency alongside any permission. There should be no built development within these distances from main rivers / flood defences (where present).

7.2.3.7 Making space for water

The **PPG** sets out a clear aim in Flood Zone 3 to create space for flooding by restoring functional floodplain. Generally, development should be directed away from these areas.

Developments within Flood Zones 2 and 3 or where detailed up-to-date modelling shows it will be at increased risk of flooding due to climate change should create space for water (draft (regulation 18) **Newham Local Plan Policy CE7**).

All new development close to rivers should consider the opportunity to improve and enhance the river environment. Developments should look at opportunities for river restoration and enhancement as part of the development. Options include backwater creation, de-silting, in-channel habitat enhancement and removal of structures. When designed properly, such measures can have benefits such as reducing the costs of

maintaining hard engineering structures, reducing flood risk, improving water quality and increasing biodiversity. Social benefits are also gained by increasing green space and access to the river.

7.2.4 Requirements for development which includes basements.

7.2.5 Basements

Whilst there is no specific guidance from the LBN Council regarding basements, such regulations are set out within the EA's **Flood Risk Assessment standing advice**. This includes the following:

- Plans must show that any basement rooms have clear internal access (for example a staircase) to an upper floor above the estimated flood level.

As part of this SFRA further suggested guidance regarding basements is as follows:

- Habitable uses of basements within Flood Zone 3 should not be permitted for self-contained basement dwellings, whilst the Exception Test should be passed for other basement development in Flood Zone 3 and self-contained basement dwellings in Flood Zone 2. An FRA is required for surface water and sewer flooding if the basement property falls within a Critical Drainage Area.
- New basements must be restricted to Less Vulnerable/ Water Compatible uses only.
- More vulnerable uses will only be considered if a site-specific FRA can demonstrate the risk to life from breach events can be managed.
- Must have internal access that is above the 2100 tidal flood level, assuming a defence breach.
- Flood resilient designs should be adopted which may include:
    - Solid, impermeable (concrete) walls and floors at basement level, where possible.
    - Installation of a pumped device to the basement level in case of any intrusion (where appropriate).
    - Ensure any basement level windows, and doors are of a flood proof design to ensure flood water cannot enter the properties.

7.3 Resistance and resilience measures

Developments within Flood Zones 2 and 3 or where detailed up-to-date modelling shows it will be at increased risk of flooding due to the climate emergency should be designed and constructed to be flood resilient. Flood resilience measures, such as installing plug sockets at a high level above the floor (above 600mm) and replacing ordinary plaster with 'breathable' lime-based plaster or cement based render, aim to reduce the damage caused by flood water which has entered the property (draft (Regulation 18) **Newham Local Plan Policy CE7**).

Nevertheless, the consideration of resistance and resilience measures should not be used to justify development in inappropriate locations.

Having applied planning policy, there will be instances where developments, such as those that are water compatible and essential infrastructure are permitted in high flood risk areas. The above measures should be considered before resistance and resilience measures are replied on. The effectiveness of these forms of measures are often dependant on the availability of a reliable forecasting and warning system and the use of back up pumping to evacuate water from a property as quickly as possible. The proposals must include details of how the temporary measures will be erected and decommissioned, responsibility for maintenance and the cost of replacement when they deteriorate. Available resistance and resilience measures are shown in Table 7-1.

Table 7-1: Available temporary measures

Measures	Description
Permanent barriers	Permanent barriers can include built up doorsteps, rendered brick walls and toughened glass barriers
Temporary barriers	Temporary barriers consist of moveable flood defences which can be fitted into doorways and/or windows. The permanent fixings required to install these temporary defences should be discrete and keep architectural impact to a minimum. On a smaller scale, temporary snap on covers for airbricks and air vents can also be fitted to prevent the entrance of flood water.
Community resistance measures	These include demountable defences that can be deployed by local communities to reduce the risk of water ingress to a number of properties. The methods require the deployment of inflatable (usually with water) or temporary quick assembly barriers in conjunction with pumps to collect water that seeps through the systems during a flood.
Flood resilience measures	These measures aim to ensure no permanent damage is caused, the structural integrity of the building is not compromised and the clean up after the flood is easier. Interior design measures to reduce damage caused by flooding can include electrical circuitry installed at a higher level and water-resistant materials for floors, walls and fixtures.

7.4 Reducing flood risk from other sources

7.4.1 Groundwater

Groundwater flooding has a very different flood mechanism to any other and so many conventional flood mitigation methods are not suitable. The only way to fully reduce flood risk would be through building design (development form), ensuring floor levels are raised above the water levels caused by a 1 in 100-year plus climate change event. Site design would also need to preserve any flow routes followed by the groundwater overland to ensure flood risk is not increased downstream.

Infiltration SuDS can cause increased groundwater levels and subsequently may increase flood risk on or off a site. Developers should provide evidence and ensure that this will not be a significant risk.

7.4.2 Surface water and sewer flooding

Developers should discuss public sewerage capacity with the water utility company at the earliest possible stage. It is important that a Surface Water Drainage Strategy (often done as part of a Flood Risk Assessment) shows that this will not increase flood risk elsewhere, and that the drainage requirements regarding runoff rates and SuDS for new development are met.

If residual surface water flood risk remains, the likely flow routes and depths across the site should be modelled. The site should be designed so that these flow routes are preserved and building design should provide resilience against this residual risk.

When redeveloping existing buildings, the installation of some permanent or temporary floodproofing and resilience measures could protect against both surface water and sewer flooding. Non-return valves prevent water entering the property from drains and sewers. Non-return valves can be installed within gravity sewers or drains within a property's private sewer upstream of the public sewerage system. These need to be carefully installed and must be regularly maintained.

In some cases, new development within brownfield sites will provide betterment due to strict SuDS measures that will be put in place. The importance of prioritising these sites is reiterated in the **London Plan 2021** which states boroughs should make as much use as possible of suitable brownfield sites to accommodate their housing targets.

Consideration must also be given to attenuation and flow ensuring that flows during the 100-year plus climate change storm event are retained within the site if any flap valves shut. This should be demonstrated with suitable modelling techniques.

7.4.3 Reservoirs

As discussed in Section 5.9, the risk of reservoir flooding is extremely low. However, there remains a residual risk to development from reservoirs which developers should consider during the planning stage:

- Developers should contact the reservoir owner for information on:
    - the Reservoir Risk Designation
    - reservoir characteristics: type, dam height at outlet, area/volume, overflow location
    - operation: discharge rates / maximum discharge
    - discharge during emergency drawdown; and
    - inspection / maintenance regime.

- The EA online Reservoir Flood Maps contain information on the extents, depths and velocities following a reservoir breach (note: only for those reservoirs with an impounded volume greater than 25,000 cubic metres are governed by the Reservoir Act 1975). Consideration should be given to the extent, depths and velocities shown in these online maps.
- The GOV.UK website on **Reservoirs: owner and operator requirements** provides information on how to register reservoirs, appoint a panel engineer, produce a flood plan and report an incident.
- In addition, developers should consult the **'Newham emergency plans and advice'** and **'London Resilience Partnership'** about emergency plans.

Developers should use the above information to:

- Apply the sequential approach to locating development within the site.
- Consider the impact of a breach and overtopping, particularly for sites proposed to be located immediately downstream of a reservoir. This should consider whether there is sufficient time to respond, and whether in fact it is appropriate to place development immediately on the downstream side of a reservoir.
- Assess the potential hydraulic forces imposed by sudden reservoir failure event and check that that the proposed infrastructure fabric could withstand the structural loads.
- Develop site-specific Emergency Plans and/ or Off-site Plans if necessary and ensure the future users of the development are aware of these plans. This may need to consider emergency drawdown and the movement of people beforehand.

Consideration should also be given to the potential implications of proposed development on the risk designation of the reservoir, as it is a requirement that in particular circumstances where there could be a danger to life that a commitment is made to the hydraulic capacity and safety of the reservoir embankment and spillway. The implications of such potential obligations should be identified and understood so that it can be confirmed that these can be met if proposed new development is permitted.

7.5 Emergency planning

Emergency planning covers three phases: before, during and after a flood. Measures involve developing and maintaining arrangements to reduce, control or mitigate the impact and consequences of flooding and to improve the ability of people and property to absorb, respond to and recover from flooding. National Planning Policy takes this into account by seeking to avoid inappropriate development in areas of flood risk and considering the vulnerability of new developments to flooding.

The 2021 **NPPF** requires site level Flood Risk Assessments to demonstrate that:

"d) any residual risk can be safely managed; and

e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan."

Certain sites will need emergency plans:

- Sites with vulnerable users, such as hospitals and care homes
- Camping and caravan sites
- Sites with transient occupants e.g. hostels and hotels
- Developments at a high residual risk of flooding from any source e.g. immediately downstream of a reservoir or behind raised flood defences
- Situations where occupants cannot be evacuated (e.g. prisons) or where it is safer to remain "in-situ" and / or move to a higher floor or safe refuge area (e.g. at risk of a breach).

Emergency Plans will need to consider:

- The characteristics of the flooding e.g., onset, depth, velocity, hazard, flood borne debris
- The vulnerability of site occupants.
- Structural safety
- The impact of the flooding on essential services e.g., electricity, drinking water
- Flood warning systems and how users will be encouraged to sign up for them.
- Safe access and egress for users and emergency services
- How to manage the consequences of events that are un-foreseen or for which no warnings can be provided e.g. managing the residual risk of a breach.
- A safe place of refuge where safe access and egress and advance warning may not be possible, having discussed and agreed this first with emergency planners. Proposed new development that places an additional burden on the existing response capacity of LBN Council will not normally be appropriate.

The **'Newham emergency plans and advice'** and **'London Resilience Partnership'** provide Emergency Planning, resilience based, information that is both general and flood specific. This includes practical advice before, during and after flooding has occurred including, preparation, understanding warnings, actions to limit exposure to risk and recovery.

Further information is available from:

- **The National Planning Policy Guidance**
- **2004 Civil Contingencies Act**
- **DEFRA (2014) National Flood Emergency Framework for England**
- **FloodRe**
- The Environment Agency and DEFRA's **Standing Advice for FRAs**
- The LBN Council's **'flooding advice'** and **'help when there is a flood'** pages.

- Environment Agency's **'How to plan ahead for flooding'**
- Signing up for **Flood Warnings** with the Environment Agency
- The **National Flood Forum**
- The UK Government's **'Personal flood plan'** guidance
- **ADEPT Flood Risk Plans for new development**

8 Surface Water Management and SuDS

8.1 Role of the LLFA and Local Planning Authority in surface water management

As an LLFA, the London Borough of Newham Council is responsible for reducing the risk of flooding from surface water under the **Flood and Water Management Act (2010).** They provide technical advice on surface water drainage strategies and designs put forward for major development proposals, to ensure that onsite drainage systems are designed in accordance with the current legislation and guidance.

However, the UK Government are in the process of implementing Schedule 3 of the Flood and Water Management Act. In January 2023, the UK Government released their report setting out the findings of **a review into the implementation of Schedule 3 to The Flood and Water Management Act 2010** which outlined the possibility of LLFAs becoming SuDS Approving Body (SAB). This would create a new process for the approval and adoption of SuDS, separate to the planning system.

When considering planning applications LBN Council as the LLFA will provide advice to the Planning Department on the management of surface water. As an LPA, LBN Council should satisfy themselves that the development's proposed minimum standards of operation are appropriate and ensure, using planning conditions or planning obligations, that there are clear arrangements for on-going maintenance over the lifetime of the development.

It is essential that developers consider sustainable drainage at an early stage of the development process – ideally at the master-planning stage. To further inform development proposals at the master-planning stage, pre-application submissions are accepted by LBN Council, dependent on the area. This will assist with the delivery of well designed, appropriate and effective SuDS.

As explained in Section 2.1, the London Legacy Development Corporation (LLDC) currently acts as the LPA for development within the Queen Elizabeth Olympic Park and its surrounding areas until the 1st December 2024. Development within the LLDC should follow the surface water management and SuDS guidance detailed in the LLDC's Local Plan and associated evidence base until the LPA's planning powers and functions are returned back the original LPAs it was formed from, including the LBN council.

8.2 Sustainable Drainage Systems (SuDS)

Sustainable Drainage Systems (SuDS) are designed to maximise the opportunities and benefits that can be secured from surface water management practices.

SuDS provide a means of dealing with the quantity and quality of surface water and can also provide amenity and biodiversity benefits. Given the flexible nature of SuDS

they can be used in most situations within new developments as well as being retrofitted into existing developments. SuDS can also be designed to fit into most spaces. For example, permeable paving could be used in parking spaces or rainwater gardens as part of traffic calming measures.

It is a requirement for all new major development proposals to ensure that sustainable drainage systems for management of runoff are put in place, unless there is clear evidence that this would be inappropriate (**NPPF** para.169). Likewise, minor developments should also ensure sustainable systems for runoff management are provided. The developer is responsible for ensuring the design, construction and future/ongoing maintenance of such a scheme is carefully and clearly defined, and a clear and comprehensive understanding of the existing catchment hydrological processes and current drainage arrangements is essential.

8.3 Sources of SuDS guidance and policy

8.3.1 C753 CIRIA SuDS Manual (2015)

The **C753 CIRIA SuDS Manual (2015)** provides guidance on planning, design, construction and maintenance of SuDS. The manual is divided into five sections ranging from a high-level overview of SuDS, progressing to more detailed guidance with progression through the document.

8.3.2 Non-Statutory Technical Guidance, Defra (March 2015)

Non-Statutory Technical guidance provides non-statutory standards on the design and performance of SuDS. It outlines peak flow control, volume control, structural integrity, flood risk management and maintenance and construction considerations.

8.3.3 Non-Statutory Technical Guidance for Sustainable Drainage Practice Guidance, LASOO (2016)

The Local Authority SuDS Officer Organisation produced their **practice guidance** in 2016 to give further detail to the Non-statutory technical guidance.

8.3.4 London Plan 2021

The **London Plan 2021** is an overall strategic plan for London, setting out an integrated economic, environmental, transport and social framework for the development of London over the next 20-25 years.

The London Plan sets out in Policy S1 13 Sustainable drainage, that 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. Drainage should also be designed and implemented in ways that promote multiple benefits including increase

water use efficiency, improved water quality, and enhanced biodiversity, urban greening, amenity and recreation.

There should be a preference for green features 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).
5. Controlled rainwater discharge to a surface water sewer or drain.
6. Controlled rainwater discharge to a combined sewer.

Development proposals for impermeable surfacing should be resisted unless they can be shown to unavoidable, including on small surfaces such as driveways.

8.3.5 London Sustainable Drainage Action Plan

The **London Sustainable Drainage Action Plan (2016)** aims to promote the awareness, and retrofitting, of SuDS across London. The action plan's primary focus is the retrofitting of sustainable drainage of existing buildings, land and infrastructure. SuDS retrofitting will be timed and opportunities identified when and where other planned maintenance, repair or improvement works are scheduled.

The action plan aims to set the direction for London SuDS infrastructure the next 20 years, including 40 specific actions, 'live' progress towards each can be found on the Greater London Authority website.

Sector specific SuDS guidance (for schools, social housing, parks and green spaces, hospitals, commercial and retail) has also been developed as part of the action plan.

8.3.6 London Sustainable Drainage Proforma

The Greater London Authority (GLA) produced a **London-wide SuDS planning proforma** to help London's thirty three Lead Local Flood Authorities (LLFAs) and Local Planning Authorities (LPAs) in assessing planning applications in relation to SuDS and drainage. The main aim of this is to provide consistency across London in the information provided on SuDS for all major developments. It sets a clear standard for the information that should be provided in a Sustainable Drainage strategy for all development in London. The proforma aims to ensure that key information is provided with the initial planning application, reducing the need to request further information throughout the assessment process and prevent delays in approval. As of 1st April 2019, all major applications within London have been required to complete the proforma.

8.3.7 Newham Local Plan 2024

The **draft Newham Local Plan (first draft – regulation 18) (2023)** includes the LBN's policy regarding surface water and SuDS. The Plan is currently in draft revision with aim for it to be adopted in 2024. Relevant guidance includes 'Policy CE7: Managing flood risk' and 'Policy CE8: Sustainable drainage.'

8.3.8 London Borough of Newham Council Sustainable Drainage and Evaluation Guidance

The **London Borough of Newham Council Sustainable Drainage and Evaluation Guidance** (2016) provides information on the design of SuDS within the evaluation requirement of planning in a sequence that mirrors the SuDS design process. This includes providing a background on SuDS and why they are needed, before outlining local SuDS requirements, such as application of greenfield runoff rates, pre-application advice and SuDS adoption guidance. The guidance also covers the three design and evaluation stages required for integrating SuDS into development – Concept, Outline and Detailed design.

The guide promotes the idea of using available landscape spaces as well as the construction profile of building and is intended to facilitate consultation to achieve the best possible SuDS designs.

8.3.9 London Borough of Newham Lead Local Flood Authority Flood Risk and Sustainable Drainage: requirements and guidance for planning application.

The LBNs **'Flood Risk and Sustainable Drainage: requirements and guidance for Planning Application'** (2020) provides guidance on the sustainable drainage policies for Newham as an LLFA. Please note that this document will be reviewed in the near future following the completion of the Newham Local Plan 2024.

The document states that surface water management details must be set out within a Flood Risk Assessment Report for all applications in Flood Zones 2 and 3 over 250sqm, in a Critical Drainage Area (CDA) and any development over 1 hectare. All other major developments that do not require an FRA are required to provide surface water management details in the form of a Drainage Strategy Report based on SuDS principles.

Other guidance within the document includes:

- SuDS requirements as set out in other LBN and Greater London Authority flood management policies.
- General pre-application advice on surface water management.
- Newham LLFA's pre-application advice
- The drainage strategy information required for outline and full or reserved matters applications.

- Newham's sustainable drainage standards.
- Post-development run-off rates and discharge rates (including climate change allowances for discharge calculation).
- Critical Drainage Areas (CDAs).
- Guidance on greenfield rates calculation.

8.4 Examples of SuDS schemes within the London Borough of Newham

This section details recent SuDS and SuDS retrofit schemes which have been implemented within the LBN.

8.4.1 Stratford Gyratory SuDS

In 2018, Newham LLFA and Newham Highways delivered a Sustainable Urban Drainage System (SuDS) retrofit in Broadway, Stratford, in the north-west of Newham (Figure 8-1). The project involved creating 11 rain gardens to provide source control for surface water runoff, retaining water within the site and reducing the amount of runoff leaving the site. This scheme increased the volume of surface water controlled on site (betterment) by 99.6% in the 3.3% AEP surface water rainfall event, and by 97.7% in the 0.1% AEP surface water event.

Figure 8-1: Rain garden planted as part of the Stratford Gyratory SuDS project (2018) (Source: London Borough of Newham Council).

8.4.2 Warrior Square Estate Rain Gardens SuDS

Newham LLFA are currently undertaking a SuDS retrofit project in Warrior Square, Manor Park. As part of the project, two rain gardens are being built in the courtyards of Warrior Square, which are designed to take a 1% AEP plus 30% climate change flood.

8.4.3 Renfew Close SuDS

In 2012, Groundwork London, the Environment Agency and the London Borough of Newham delivered a SuDS retrofit project in a social housing estate. The design included four rain gardens (two of which were designed to retain water for the 1 in 100 year plus 30% climate change event), a shallow rainwater conveyance channel, a shallow detention basin and conveyance channels.

Between 2012 and 2013, the rain gardens were monitored and attenuated 413,214 litres of stormwater, preventing this water from entering the surface water sewer.

8.4.4 Cody Dock – permeable paving SuDS

Between 2014-2015, the Gasworks Dock Partnership and Sureset undertook a SuDS retrofit project in Canning Town (to the south-west of Newham). This included adding 217m^2 of permeable pavement which leads down to part of the Lower Lee River.

8.4.5 West Ham Bus Garage Green Roof SuDS

In 2010, Transport for London (TfL) constructed a new bus garage in West Ham. Over 50% of this roof is a green roof and rainwater harvesting has been implemented within the site, reducing runoff from the garage to the wider vicinity.

8.5 SuDS opportunities for developers

The Greater London Authority commissioned an Integrated Water Management Strategy (IWMS) for the Royal Docks and Beckton Riverside Opportunity Area (OA) (Arup, 2023 currently unpublished). This study reviews the potential opportunities to apply a range of SuDS techniques, along with other water management interventions to reduce leakage and water demand. The applicability of these measures are assessed against six strategic growth areas within the OA, and the ability of interventions to contribute to multiple beneficial outcomes is presented in a Multi-Criteria Analysis (MCA). Following a short-listing exercise, SuDS and other feasible water management options were modelled to identify their potential contribution to the water balance, including whether water neutrality, whereby the area develops through the plan period but without increasing the overall water demand of the OA or Borough. Key findings include:

- Disconnecting surface water from combined sewerage systems which serve the borough is a priority, to release capacity during wet-weather within the sewerage systems and reduce the frequency of Combined Sewer Overflow (CSO) discharges.
- A number of water balance scenarios were tested, with the most ambitious, scenario 4, demonstrating that development within the OA has the potential to be water neutral. This would require a combination of rainwater harvesting (RwH) on new developments and some retrofitting, alongside other surface water management measures, a 50% reduction in leakage and demand management measures. Such a strategy would break the prevailing model of growth exerting an ever-increasing demand for water, increasing pressure on scarce resources and the water environment.
- Rainwater harvesting could, for strategic sites, provide a cost-effective solution to provide both tide-locking surface water detention and contribute to water neutrality by providing a secondary water supply for toilet flushing, washing machines and outside water usage.
- Thames Water have an ambition to deliver 7,000ha of retrofit Blue-Green Infrastructure (BGI) and SuDS in their service area by 2050. This would equate to 60ha. in the OA on a pro-rata basis. The strategic sites in the OA

cover 266ha. and could deliver BGI on around 50% of this land. To achieve these objectives, the Borough is encouraged to be ambitious and to develop partnerships with Thames Water, GLA, developers and property owners.

Whilst the focus of the IWMS is the OA, the opportunities identified may also be applicable to other sites within the Borough, particularly on larger-scale developments.

8.6 Other surface water considerations

8.6.1 Groundwater Vulnerability Zones

The Environment Agency published new groundwater vulnerability maps in 2015. These maps provide a separate assessment of the vulnerability of groundwater in overlying superficial rocks and those that comprise of the underlying bedrock. The map shows the vulnerability of groundwater at a location based on the hydrological, hydro-ecological and soil propertied within a one-kilometre grid square.

The groundwater vulnerability maps should be considered when designing SuDS. Depending on the height of the water table at the location of the proposed development site, restrictions may be placed on the types of SuDS appropriate to certain areas. Groundwater vulnerability maps can be found on **DEFRA's interactive MAGiC map.**

8.6.2 Groundwater Source Protection Zones

The Environment Agency also defines Groundwater Source Protection Zones (GSPZs) near groundwater abstraction points. These protect areas of groundwater used for drinking water. The Environment Agency may object in principle to, or refuse to permit, some activities or developments if they have potential to adversely affect groundwater, through SuDS for example. The GSPZ requires attenuated storage of runoff to prevent infiltration and contamination. GSPZs can be viewed on **DEFRA's interactive MAGiC map** and also as static maps within Appendix A – Flood Risk Mapping.

There are several GSPZs within the LBN, concentrated to the north of the council area. This includes 11 regions designated as Zone 1 (inner protection zone) Source Protection Zones in Stratford, Forest Gate, Manor Park, Little Ilford and Wallend. More information about Groundwater Source Protection Zones can be found on the **UK Government's website.**

8.6.3 Nitrate Vulnerable Zones

Nitrate Vulnerable Zones (NVZs) are areas designated as being at risk from agricultural nitrate pollution. Nitrate levels in waterbodies are affected by surface water runoff from surrounding agricultural land entering receiving waterbodies.

NVZs can be viewed on the **Environment Agency's interactive mapping application** and also as static maps within Appendix A – Flood Risk Mapping. There are currently two NVZs 2021-2024 (pre-appeals) within the LBN:

- Lee NVZ – Surface Water S443.
- Roding (Cripsey Brook to Loxford Water) NVZ – Surface Water S441.

Agricultural nitrate pollution upstream of the LBN could impact the nitrate levels in the River Lee and River Roding within Newham. The level of nitrate contamination will potentially influence the choice of SuDS used for development within the LBN and should be assessed as part of the design process.

9 Summary and Recommendations

This section summarises the risk of flooding from various sources within LBN and policy recommendations for managing the risk.

9.1 Conclusions

- Fluvial and tidal flooding: Some areas of the LBN are at greater risk than others. There have been few recorded fluvial and tidal flood events in the borough. The main watercourses associated with fluvial and tidal flood risk are:
    - River Thames - the tidally influenced River Thames flows along the LBN's southern boundary. Due to the flood defences along the River Thames being designed to protect to a 0.1% AEP flood event, the surrounding areas are not at risk of flooding from the Thames. However, breach modelling suggests that if these defences were to fail, the south and west parts, as well as the eastern boundary, of the LBN will be impacted. Areas within these flood extents include Stratford, West Ham, Canning Town, North Woolwich, Cyprus, Beckton and East Ham.
    - River Roding - the River Roding flows along the eastern boundary of the LBN before converging with the River Thames in the south-eastern corner of the Borough. Areas at risk include Little Ilford, East Ham and Beckton.
    - River Lee and Bow Back Rivers - the River Lee flows along the western boundary of the LBN before converging with the River Thames in the south-western corner of the Borough. Modelled flood extents suggest that properties in Temple Mills, Stratford and Three Mills are at flood risk from the River Lee.
- Surface Water: The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping shows that the risk of surface water flooding is widespread across LBN. Water predominantly flows along topographically low lying areas, including some roads and is channelled into watercourses such as the Rivers Lee and Roding. Surface Water flooding is the results of overground and below ground (sewer) flows. Flooding can flare-up at bottlenecks where sewer capacity is insufficient. Historic data provided by LBN Council showed 255 incidences of recorded flooding within the study area since 2012. The incidents detailed were due to surface water, groundwater and sewer flooding. Details of whether the flooding was internal to properties or affected only highways and curtilage was available for these records.
- Areas at risk of flooding today are likely to become at increased risk in the future and the frequency of flooding will also increase in such areas as a result of climate change. Flood extents will increase; in some locations, this may not

be by very much, but flood depth, velocity and hazard may have more of an impact due to climate change. In particular, fluvial extents increase in Beckton, East Ham, Little Ilford, Stratford and Canning Town. Tidal breach extents increase in the South of the Borough and in the lower reaches of the River Roding and River Lee. Surface water flooding increases in Canning Town, East Ham, West Ham and Little Ilford in particular. It is recommended that LBN Council work with other Risk Management Authorities (RMAs) to review how existing and new development in these areas are to be protected from flood risk when developing climate change plans and strategies for the borough, particularly in line with the TE2100 plan. For example, SuDS and blue-green infrastructure can help manage and even improve surface water flood risk.

- Groundwater: Groundwater emergence mapping indicates that the majority of the Borough is at negligible risk from groundwater emergence. There are some localised areas where groundwater levels are low-moderate, and in these areas there may be a risk to subsurface assets, but surface manifestation of groundwater remains unlikely.
- Canals: There are no purpose-built canals within the LBN. However, the tributaries of the River Lee at Stratford are heavily canalised at Bow Back Creek (including the Pudding Mill, Three Mills Wall and Waterworks River) and are managed by the Canal and River Trust. These watercourses are controlled by a series of locks. There have been two recorded flooding incidents at Three Mills on the Bow Back Creek (Section 5.1.).
- Reservoirs: There are no records of flooding from reservoirs in the study area and the level and standard of inspection and maintenance required under the Reservoirs Act 1975 means that the risk of flooding from reservoirs is relatively low. Defra's Risk of Flooding from reservoirs mapping (Appendix A) shows the areas within LBN which are at risk from reservoir flooding.
- Cumulative Impact Assessment: High level recommendations have been made for sites proposed within in each of the high risk catchments (see Appendix F), and the recommendations should be considered by developers as part of a site specific assessment. These areas include Canning Town, East Ham, Plaistow, West Ham and part of Little Ilford. FRAs should consider the potential cumulative effects of all proposed developments and how this affects sensitive receptors (i.e., surface water flooding).

9.2 Recommendations

The following recommendations are made for the whole of LBN. Policy recommendations related to managing the cumulative impacts of development are made in Chapter 7.

9.2.1 Reduction of flood risk through site allocations and appropriate site design

- To locate new development in areas of lowest risk, in line with the Sequential Test, by steering sites to river and sea Flood Zone 1 and avoiding where possible anything within the 1% AEP event with 40% climate change allowance surface water flood extent. If a Sequential Test is undertaken and a site at flood risk is identified as the only appropriate site for the development, both parts of the Exception Test should be satisfied.
- After application of the Exception Test, a sequential approach to site design will be used to reduce risk. Any re-development within areas of flood risk which provide other wider sustainability benefits will provide flood risk betterment and made resilient to flooding.
- Identification of long-term opportunities to remove development from the floodplain and safeguard the functional floodplain from future development to make space for water.
- To ensure development is 'safe', dry pedestrian egress from the floodplain and emergency vehicular access should be possible for all residential development. If at risk, then an assessment should be made to detail the flood duration, depth, velocity and flood hazard rating in the 1% AEP plus climate change flood event, in line with FD2320.
- Raise residential and commercial finished floor levels 300mm above the 1% AEP plus climate change flood level. Protect and promote areas for future flood alleviation schemes.
- Identify opportunities for brownfield sites (e.g., SuDS retrofit) to reduce risk and provide flood risk betterment.
- Resist vulnerable development, including self-contained basement dwellings, in Flood Zone 3 and areas at high risk of surface water flooding
- Identify opportunities to help fund future flood risk management through developer contributions to reduce risk for surrounding areas.
- Seek opportunities to make space for water to accommodate climate change.

9.2.2 Promote SuDS to mimic natural drainage routes to improve water quality

- SuDS design should demonstrate how constraints have been considered and how the design provides multiple benefits e.g. landscape enhancement, biodiversity, recreation, amenity, leisure and the enhancement of historical features.
- Planning applications for phased developments should be accompanied by a drainage strategy, which takes a strategic approach to drainage provision across the entire site and incorporates adequate provision for SuDS within each phase.
- Use of the SuDS management train to prevent and control pollutants to prevent the 'first flush' polluting the receiving waterbody.

- SuDS are to be designed so that they are easy to maintain, and it should be set out who will maintain the system, how the maintenance will be funded and should be supported by an appropriately detailed maintenance and operation manual.

9.2.3 Reduce surface water runoff from new developments and agricultural land

- Space should be provided for the inclusion of SuDS on all allocated sites, outline proposals and full planning applications.
- Promote biodiversity, habitat improvements and Countryside Stewardship schemes to help prevent soil loss and to reduce runoff from agricultural land.

9.2.4 Enhance and restore river corridors and habitat

- Assess condition of existing assets and upgrade, if required, to ensure that the infrastructure can accommodate pressures/flows for the lifetime of the development.
- Natural drainage features should be maintained and enhanced.
- Identify opportunities for river restoration/enhancement to make space for water.
- A presumption against culverting of open watercourses except where essential to allow highways and/or other infrastructure to cross, in line with CIRIA's Culvert design and operation guide, (C689) and to restrict development over culverts.
- There should be no built development within 8m from the top of a watercourse or Main River for the preservation of the watercourse corridor, wildlife habitat, flood flow conveyance and future watercourse maintenance or improvement.

9.2.5 Mitigate against risk, improved emergency planning and flood awareness

- Work with emergency planning colleagues and stakeholders to identify areas at highest risk and locate most vulnerable receptors.
- Exceedance flows, both within and outside of the site, should be appropriately designed to minimise risks to both people and property.
- For a partial or completely pumped drainage system, an assessment should be undertaken to assess the risk of flooding due to any failure of the pumps to be assessed. The design flood level should be determined if the pumps were to fail; if the attenuation storage was full, and if a design storm occurred.
- An emergency overflow should be provided for piped and storage features above the predicted water level arising from a 1% AEP rainfall event, inclusive of climate change and urban creep.
- Consideration and incorporation of flood resilience measures up to the 0.1% AEP event.

- Ensure robust emergency (evacuation) plans are produced and implemented for major developments.

10 Annex 1 - Updates to the Planning Practice Guidance (25th August 2022)

The Planning Practice Guidance on Flood Risk and Coastal Change was updated on the 25 August 2022, triggered by revisions to the NPPF in 2018, 2019 and 2021; practice experience since the PPG was first published in 2014; Policy review of development in flood risk areas; and other stakeholder and committee reviews.

Key Details of the changes included in the PPG update of 25 August 2022:

General

- 'Design flood' includes Climate Change and surface water risk
- Hierarchical approaches prioritises avoidance and passive approaches, which also applies to residual risk.
- Safety of development now accounts for impact of flooding on the services provided by development
- Inappropriate to consider likelihood of defence breach in terms that passive mitigation/resilience measures (e.g. design) should not be substituted with emergency plans
- Functional floodplain "starting point" for extent uplifted to the 3.3% AEP from 5% AEP
- Lifetime of non-residential development now has a 75yrs starting point
- New culverting and building over culverts is discouraged
- Defra FD2320 research referenced for calculating flood hazard to people

Sequential Test

- Paragraph 162 of the NPPF has been changed such that the Sequential Test must now "steer new development to areas with the lowest risk of flooding **from any source**. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test. The sequential approach (as described in Para 161) should be used in areas known to be at risk now or in the future from **any form of flooding**."
- Prior to the changes to the NPPF the requirement was set out as follows and only required consideration of river and sea flood risk when applying the Sequential Test:

Previous Policy Wording	New Policy Wording (July 2021)
The aim of the Sequential Test is to steer new development to areas with the lowest risk of flooding *(the Planning*	The aim of the Sequential Test is to steer new development to areas with the lowest risk of flooding **from any**

Previous Policy Wording	New Policy Wording (July 2021)
Practice Guidance advised that the exercise should be performed using the flood zones, as describe river and sea flood risk assuming there are no flood risk management measures or defences in place)	**source** (*The Planning Practice Guidance has not yet been updated to describe how this exercise should be performed*)

- Removal of reference to Flood Zones (Diagram 2) when performing Sequential Test and requirement must now consider whether development can be located in the lowest areas (high – medium – low) of flood risk both now and in the future (the test applies to all source of flood risk – whereas previously the test was only performed for present day flood risk for the "Flood Zones" i.e. river and sea flood risk).
- Improved clarity about when test needs to be applied. Potential confusion about 'minor' development has been clarified.
- Clearer roles and responsibilities, with emphasis on the LP to define the area of search and decide if the test is passed.
- Key terms defined (e.g. 'reasonably available').
- Suggests approaches to improve certainty and efficiency.
- Clarification about when it's appropriate to move onto the Exception Test.
- Explicit statement that Table 2 (was Table 3) cannot be used to support performance of Sequential Test.

Exception Test

- Key terms defined (e.g. 'wider sustainability benefits to the community').
- New section on how to demonstrate development has reduced flood risk overall in the wider catchment.
- Table 2 (was Table 3) shows flood zone incompatibility, NOT whether 'development is appropriate'.

Integrated approach to flood risk management

- Catchment based approaches.
- Improved connectivity with other strategies e.g. water cycle studies and drainage and wastewater management plans.
- Encourages measures which deliver multiple benefits – including those which unlock sustainable development.

Impact of development on flood risk elsewhere

- FRAs must detail any increase in risk elsewhere.
- Guidance on compensatory flood storage – requirement for level-for-level storage
- Guidance on mitigating cumulative impacts.

- Clarification that stilts/voids should not be relied upon for compensatory storage.

Safeguarding land and relocation

- Guidance on how to safeguard land needed for future FCERM infrastructure.
- Definition included for unsustainable locations.
- Guidance for control of developments in unsustainable locations.
- More detail and expectation on requirement to exercise Plan process to relocate development that is susceptible to frequent flood risk or coastal erosion.

Sustainable Drainage Systems (SuDS)

- Clearer definition of what SuDS are – this must meet the '4 pillars'.
- Clearer requirement for SuDS Strategy.
- Better recognition of wider SuDS benefits e.g. BNG, carbon sequestration, urban cooling.
- Encouragement for earlier consideration in the design process.
- Encourages policies setting out where SuDS would bring greatest benefits.
- Highlights the need to check the need for other permits for SuDS.

Reducing the causes & impacts of flooding

- Whole new section – links to all the EA's latest NFM tools, maps and research.
- Support for river restoration such as culvert removal and other 'slow the flow' approaches.
- Support for making space for river geomorphology e.g. meander migration.

Coastal Change

- Encourages more precautionary designation of Coastal Change Management Areas (CCMAs).
- Allows more flexibility for existing buildings/land-use to adapt to change.
- Clearer requirement for a 'coastal change vulnerability assessment' with apps for development in CCMAs.
- Highlights need to consider removal of some Permitted Development rights in CCMAs.

Other changes

- Guidance on how to consider flood risk in LDOs.
- More detailed framework for local design code preparation.
- Approach to article 4 in relation to flood risk.
- Greater clarity on the application of the call-in direction process.
- Guidance on development that might affect existing reservoirs.
- Updated links to the latest tools and guidance.

Summary of influential changes to the NPPF and implications for Sequential and Exception Tests

The Sequential Test was originally conceived to direct proposed new development to locations that did not rely on Flood Risk Management features so they are inherently safe and don't place a burden on future generations. This was achieved using a set of "Zone" maps that showed the extent of river and sea flooding for circumstances where no defences were present for events with high, medium and low probability. Following this approach delivers new development that will not require future investment in flood risk management.

The test process recognised that in some circumstances it would not be possible to locate development in locations outside of medium and high-risk flood Zones, as there were no reasonable alternatives. In circumstances where the Sequential Test has been performed but is not satisfied the policy requires that the Exception Test is performed. The Exception Test is a two-part process that requires preparation of evidence to demonstrate that development proposals at risk of flooding deliver wider sustainability benefits and that it can be made safe for the intended lifespan (thus it is a requirement to demonstrate that proposed development will be safe under climate change conditions).

The updated NPPF requires the application of the Sequential Test to any source of flooding. The general implications of this are summarised as follows:

- The Sequential Test (July 2021) must be based on mapping that enables decision making according to a prioritisation based on a risk-based sequence (for river and sea flooding national mapping is available that describes low, medium and high risk flood zones for river and sea flooding based on the assumption that no flood risk management features are present).
- The other sources of flood risk that can potentially be included in the Sequential Test are surface water, groundwater, sewer flooding and reservoir flooding (or other water impounding features such as canals).
- It follows that proposed new development placed in locations at high or medium risk from flooding from other sources now and in the future (note that the explicit requirement to include climate change in the test, as set out in the August 2022 PPG will require the preparation of additional modelling and mapping) should be accompanied by evidence that the Exception Test can be satisfied (in a Level 2 SFRA).

A basic requirement for the Sequential Test to be performed is that appropriate, competent mapping can be prepared to enable logical comparison of the flood risk from different sources at alternative locations, as this is a fundamental requirement to establish a logical "risk sequence".

The following summary:

- describes the implications of including any source of flooding in the Sequential Test;
- highlights matters to be considered; and
- identifies a preferred approach.

Rivers and sea risk – now and in the future

Implications

Source of Flooding	Available Mapping	Implications of making use of mapping in the Sequential Test
Rivers and sea	Flood Map for Planning and detailed models	• The Sequential Test can be carried out using the Flood Map for Planning for present day low (Flood Zone 1), medium (Flood Zone 2) and high risk (Flood Zone 3) as previously was the case. • Where detailed modelling is available, future Flood Zones 2 (0.1% AEP event), 3a (1% AEP event) and 3b (now the 3.3% AEP) will be assessed with climate change allowances. It should be noted that there may be instability issues running the 0.1% AEP event with climate change allowances. • The fluvial models may experience instabilities during 0.1% AEP plus climate change runs which may mean that results cannot be prepared. • Generalised modelling (JFlow) is used to delineate Flood Zones where there is no detailed mapping, but does not include climate change data or risk mapping.

Surface Water Flood Risk

Implications

Source of Flooding	Available Mapping	Implications of making use of mapping in the Sequential Test
Surface Water	Risk of Flooding from Surface Water (RoFSW)	• Mapping based on a generalised modelling methodology. • Generally suitable for showing surface water flow routes at different probability flood events (1 in 30, 1 in 100 and 1 in 1000), although the uncertainty associated with the predicted outlines for the respective probabilities is high. JBA Consulting also hold the 1 in 100 year plus 40% climate change and 1 in 30 plus 35% allowances.

Source of Flooding	Available Mapping	Implications of making use of mapping in the Sequential Test
		• Doesn't always include allowance for drainage features such as culverts and can over or under estimate flooding where there are linear features such as embankments. • Unlike the Zone maps for river and sea flooding the surface water mapping makes an allowance for the assumed performance of a local drainage system. • Normal profile of extent and shape of flooding is a "dendritic" pattern that follows low lying topography and is not an extensive blanket, as is most often the case for river and sea flooding. • The flood risk is likely to be relatively short lived and much more localised than would be the case for river and sea flooding (most likely being caused by local high intensity short duration rainfall events). • It is likely that in many circumstances surface water flood risk zones based on the surface water mapping could affect a relatively small proportion of a proposed allocation site, but in practical terms this might not in itself be a factor that demonstrates that the principle of development could not be supported.

Groundwater Flood Risk

Implications

Source of Flooding	Available Mapping	Implications of making use of mapping in the Sequential Test
Groundwater	Geosmart Groundwater Flood Risk Map NBC historic flood events	GeoSmart mapping (GW5 version 2.1) has been used to assess the risk of Groundwater flooding to the LBN. This mapping provides a preliminary indication of groundwater flood risk on a 5m grid. This mapping shows areas with a >1% AEP of groundwater flooding within the following classes: • Class 4: Negligible risk - There is a negligible risk of groundwater flooding in this area and any groundwater flooding

Source of Flooding	Available Mapping	Implications of making use of mapping in the Sequential Test
		incidence has a chance of less than 1% annual probability of occurrence. • Class 3: Low risk - There is a low risk of groundwater flooding in this area with a chance of greater than 1% annual probability of occurrence. • Class 2: Moderate - There is a moderate risk of groundwater flooding in this area with a chance of greater than 1% annual probability of occurrence. • Class 1: High - There is a high risk of groundwater flooding in this area with a chance of greater than 1% annual probability of occurrence or more frequent. • The underlying challenge is that the data is very uncertain and could not be used with confidence unless supported by more detailed local studies. The mapping provides an indication of where risk might be higher, but it would not be easy to defend sequential decisions based on the available mapping. • Historic flood data is available from LBN, however this does not always list the source of flooding. In addition, it is often difficult to determine the source of historical flood events and groundwater and surface water flooding can often be confused. • There is no climate change mapping available for groundwater and in view of the uncertainty in the present day data it is unlikely that such mapping will be available in the near future.

Reservoir Flood Risk

Implications

Source of Flooding	Available Mapping	Implications of making use of mapping in the Sequential Test
Reservoir flooding risk	Reservoir Flood Mapping (RFM)	• The latest available mapping now shows “wet day” and “dry day” reservoir inundation extents. The “wet day” being a reservoir breach at the same time as a 1 in 1000 river flood (as this is a likely time when a reservoir might fail) and the dry day shows the failure just from the water retained by the dam. • Neither set of mapping describes a risk-based scenario as it does not provide the probability of a dam failure but are intended to describe a “worst credible case”. • More detailed information on flood velocities and depths has been prepared as part of the modelling and mapping study, but this is not publicly available and can only be viewed by those with appropriate security classifications. The flood extents are publicly available. • A dataset exists which shows where the impact of reservoir flooding no longer affects the fluvial flood extent. This is known as a Wet Day Termination Extent. This dataset can be used to provide two zones: 1. Where reservoir flooding is predicted to make fluvial flooding worse. 2. Where reservoir flooding is not predicted to make fluvial flooding worse. • The mapping could be used to direct proposed new development away from locations that could potentially be affected by reservoir flood risk. However, it would not be conceptually similar to the risks pertaining to river and sea flooding and further assessment would be required to understand the magnitude of the potential hazard. • A consideration with respect to the reservoir maps is that placing new development in locations potentially affected by reservoir inundation could potentially change the “risk category” of the reservoir and this could result in the reservoir owner “undertaker” having to invest in substantive remedial works to demonstrate that the reservoir

Source of Flooding	Available Mapping	Implications of making use of mapping in the Sequential Test
		had the appropriate level of safety. This is not strictly related to the sequential test, but should be a consideration that should be appropriately managed when planning new development. • The mapping does not provide climate change information on future flood risk and provision of such mapping is unlikely based on the existing methodology

Impacts on the SFRA

The most relevant points to consider in relation to updating the SFRA process relate to the changes to the Sequential Test requirements and Exception Test requirements, particularly the requirement for updated Climate Change modelling for all sources of flood risk and the functional floodplain starting point at 3.3% AEP. Consideration also needs to be made to the changes to Table 2 (was Table 3) and the flood zone incompatibility. This should be considered during the screening phase prior to the Level 2 SFRA being undertaken.

For more information on the PPG updates, please visit the **gov.uk website**.

A Flood Risk Mapping

All access to flood risk mapping, which has been produced for this study, is to be requested from the LBN Council. A summary of the maps produced for this Level 1 SFRA is detailed in the below tables.

General Mapping
Aquifer bedrock geology
Aquifer superficial deposits
Bedrock geology
Detailed river network
Flood Alert & Warning Areas
Flood defences standardised attributes
Flood Map for Planning
Groundwater flood risk
Historic flood map
Recorded flood outline
Reduction in risk of flooding from rivers and sea
Reservoir wet day
Reservoir dry day
Nitrate Vulnerable Zones
Source Protection Zones
Superficial deposits

Surface Water - Present Day				
	RoFfSW	ICM Silvertown	ICM Newham Central	ICM Little Ilford
Extent	3.3%	3.3%	3.3%	3.3%
	1%	1%	1%	1%
	0.1%	0.1%	0.1%	0.1%

Surface Water - Climate Change				
	RoFfSW	ICM Silvertown	ICM Newham Central	ICM Little Ilford
Extent	3.3% +20%CC	3.3% +20%	3.3% +20%	3.3% +20%
	3.3% +35%CC	3.3% +35%CC	3.3% +35%CC	3.3% +35%CC
	1% +25%CC	1% +25%CC	1% +25%CC	1% +25%CC
	1% +40%CC	1% +40%CC	1% +40%CC	1% +40%CC

Tidal Breach Thames Model				
	Downriver 2005 epoch	Downriver 2115 epoch	Upriver 2005 epoch	Upriver 2100 epoch
Extent	0.5%	0.5%	0.5%	0.5%
	0.1%	0.1%	-	-
Depth	0.5%	0.5%	0.5%	0.5%

Tidal Breach Thames Model				
	0.1%	0.1%	-	-
Velocity	0.5%	0.5%	0.5%	0.5%
	0.1%	0.1%	-	-
Hazard	0.5%	0.5%	0.5%	0.5%
	0.1%	0.1%	-	-

Fluvial Modelling	
River Roding Extent	River Lee Extent
3.3% Defended	3.3% Defended
0.5% Defended	0.5% Defended
1% Defended	1% Defended
0.1% Defended	0.1% Defended
3.3% +26%CC	3.3% +17%CC
3.3% +36%CC	3.3% +27%CC
3.3% +64%CC	1% +17%CC
1% +26%CC	1% +54%CC
1% +36%CC	0.5% +17%CC
1% +64%CC	0.5% +27%CC
0.5% +26%CC	-
0.5% +36%CC	-
0.5% +64%CC	-

B Data Sources used in the SFRA

C SFRA User Guide

D Flood Alerts and Flood Warnings

E Summary of Flood Risk across the London Borough of Newham

F Cumulative Impact Assessment (CIA)

G Modelling Technical Note

Offices at

Bristol
Coleshill
Doncaster
Dublin
Edinburgh
Exeter
Glasgow
Haywards Heath
Leeds
Limerick
Newcastle upon Tyne
Newport
Peterborough
Portsmouth
Saltaire
Skipton
Tadcaster
Thirsk
Wallingford
Warrington

Registered Office
1 Broughton Park
Old Lane North
Broughton
SKIPTON
North Yorkshire
BD23 3FD
United Kingdom

+44(0)1756 799919
info@jbaconsulting.com
www.jbaconsulting.com
Follow us:

Jeremy Benn Associates Limited

Registered in England 3246693

JBA Group Ltd is certified to:
ISO 9001:2015
ISO 14001:2015
ISO 27001:2013
ISO 45001:2018