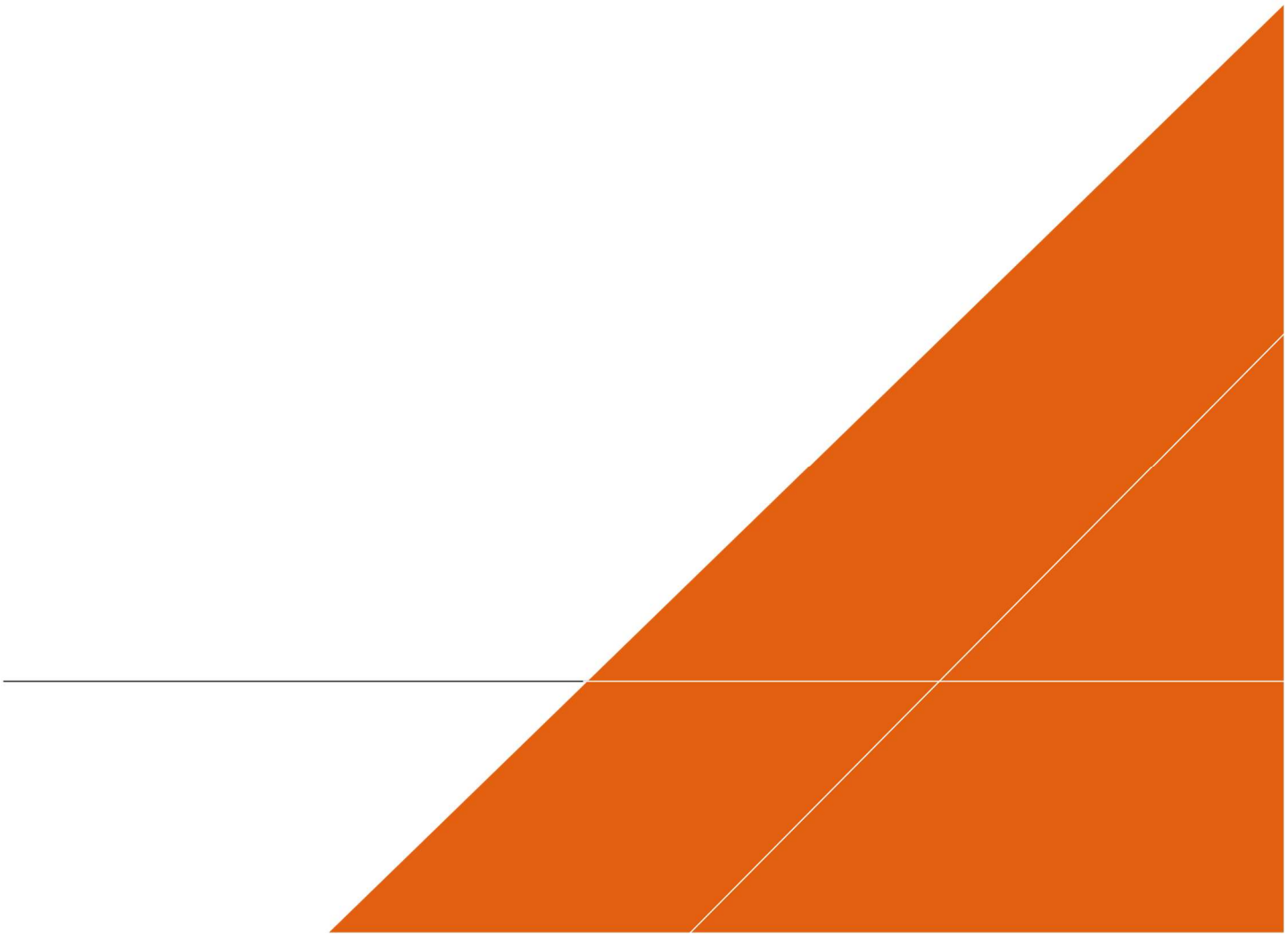
ARCADIS Design & Consultancy for natural and built assets

BE FIRST REGENERATION LTD
INNOVATIVE SITES PROGRAMME
BULL LANE, RM10 7EH

Flood Risk Review

10046791-AUK-XX-XX-RP-CW-0051-01-Bull Lane Flood Risk Review

MARCH 2021



Author	Gemma Cater
Checker	Matt Langdon
Approver	Ian Joyner
Report No	10046791-ARC-XX-XX-RP-CW-XXXX-01
Date	MARCH 2021

VERSION CONTROL

Issue	Revision No.	Date Issued	Description of Revision: Page No.	Description of Revision: Comment	Reviewed by:
1	0	19/03/2021	-	First Issue	IJ

This report dated 19 March 2021 has been prepared for Be First Regeneration Ltd (the "Client") in accordance with the terms and conditions of appointment (the "Appointment") between the Client and **Arcadis UK Ltd** ("Arcadis") for the purposes specified in the Appointment. For avoidance of doubt, no other person(s) may use or rely upon this report or its contents, and Arcadis accepts no responsibility for any such use or reliance thereon by any other third party.

CONTENTS

EXECUTIVE SUMMARY 2

1. INTRODUCTION 3
1.1 Background 3
1.2 Aim and Objectives 3
1.3 Data Sources 3
1.4 Terminology 3
1.5 Limitations 4

2. SITE OVERVIEW 5
2.1 Site Description 5
2.2 Site Topography 5

3. SOURCES OF FLOOD RISK 7
3.1 Flooding from Rivers and the Sea 7
3.2 Flooding from Surface Water 8
3.3 Flooding from Groundwater 9
3.4 Flooding from Artificial Sources 9
3.5 Future Redevelopment 10

4. SUMMARY 11

5. REFERENCES 12

APPENDIX A – PLANNING POLICY AND FLOOD RISK

Executive Summary

The site, adjacent to Bull Lane, is currently occupied by garages and hard standing and may be considered for potential future redevelopment.

Flood risk to the site from a range of potential sources has been considered in this Flood Risk Review. The site has a 'very low' risk of flooding from rivers and the sea, equivalent to an annual chance less than 1 in 1,000 (0.1%). The site has an elevated risk of surface water flooding, associated with mapped flooding along the A1112 Rainham Road North, which affects the site access and may have implications for the proposed drainage strategy on site. Overall, accounting for the fact that mapped flood risk only extends to the main portion of the site in an extreme event, overall risk from this source is concluded as 'medium'.

No other local sources of flooding are considered to pose an onerous risk to the site in the context of its potential redevelopment.

According to the National Planning Policy Framework (NPPF), a Flood Risk Assessment (FRA) is not necessary to support any future development of the site as it is located in Flood Zone 1 on the Flood Map for Planning (Rivers and Sea), is less than 1 hectare (ha) in area and this Flood Risk Review demonstrates that the site is not at risk of flooding from other local sources.

A Drainage Strategy should be prepared to support future redevelopment of the site to ensure that proposals meet national and local requirements and off-site flood risk is not increased as a result of redevelopment proposals. The Drainage Strategy should address how the local elevated risk of surface water flooding will be accommodate in the design of proposed foul and surface water drainage systems.

1. Introduction

1.1 Background

Arcadis (UK) Limited ('Arcadis') has been commissioned by Be First Regeneration Ltd on behalf of London Borough of Barking and Dagenham (LBBD) ('the Client') to undertake a desktop Flood Risk Review for land adjacent to Bull Lane, Dagenham, London, RM10 7EH ('the site').

This Flood Risk Review is required to document the risk of flooding and consider potential constraints on future redevelopment, which it is understood may include residential uses.

1.2 Aim and Objectives

The aim of this Flood Risk Review is to assess and document the potential risk of flooding to the site from all sources (including rivers, the sea, surface water, groundwater and artificial sources) in the context of the site's potential for future development.

Specific objectives of the Flood Risk Review are to:

- Review available sources of published flood risk data, supplemented by targeted data collection/consultation with the Environment Agency (EA) and the applicable Lead Local Flood Authority (LLFA) where necessary.
- Consider all relevant forms of flood risk (e.g. rivers, the sea, surface water, groundwater and artificial sources), with a risk rating assigned (e.g. HIGH, MEDIUM, LOW) to each form of flooding.
- Confirm the site's Flood Zone designation and consider NPPF[1] acceptability in accommodating residential development, with reference to the Sequential and Exception Tests.

No site inspection, topographic survey or flood estimation/modelling has been undertaken by Arcadis to inform this desktop review.

1.3 Data Sources

The following data sources have informed the preparation of this Flood Risk Review:

- EA lidar topographic data (2m lidar tile TQ48NW) (Ref. 1)
- EA Long Term Flood Risk Maps (Ref. 2), including the 'Risk of Flooding from Rivers and Sea Map', 'Risk of Flooding from Surface Water Map' and 'Risk of Flooding from Reservoirs Map'
- EA 'Flood Map for Planning' (Ref. 3)
- EA 'Recorded Flood Outlines' dataset (Ref. 4)
- LBBD Strategic Flood Risk Assessment (SFRA) (Ref. 5)
- LBBD Preliminary Flood Risk Assessment (PFRA) (Ref. 6) and Addendum (Ref. 7)
- LBBD Local Flood Risk Management Strategy (LFRMS) (Ref. 8)
- British Geological Survey (BGS) Geology of Britain Viewer (Ref. 9)
- Department for Environment, Food and Rural Affairs (DEFRA) Magic Mapping (for EA Aquifer Designations) (Ref. 10)
- The London Plan 2021 (Ref. 11)

1.4 Terminology

Flood risk is a product of both the likelihood and consequences of flooding. Throughout this report, flood events are defined according to their likelihood of occurrence. Floods are described according to an 'annual chance', meaning the chance of a particular flood occurring in any one year. This is directly linked to the probability of a flood. For example, a flood with an annual chance of 1 in 100 (a 1 in 100 chance of occurring in any one year on average), has an annual probability of 1%.

[1] A summary of NPPF requirements with respect to flood risk is included in Appendix A.

1.5 Limitations

This report has been prepared for the Client in accordance with the terms and conditions of appointment. Arcadis cannot accept any responsibility for any use of or reliance on the contents of this report by any third party. The copyright of this document, including the electronic format shall remain the property of Arcadis.

This report has been compiled from several sources, which Arcadis believes to be trustworthy. However, Arcadis is unable to guarantee the accuracy of information provided by others. The report is based on information available at the time. Consequently, there is a potential for further information to become available, which may change this report's conclusion and for which Arcadis cannot be responsible.

2. Site Overview

2.1 Site Description

The site is located at approximate National Grid Reference (NGR) TQ497862 in a suburban area within LBBD. It occupies an area of approximately 0.05 hectares (ha) and is broadly rectangular on plan, with a narrow strip of land to the east connecting the site to the A1112 Rainham Road North, as illustrated in Figure 1.

The site is currently an area of hardstanding, with a row of garages situated along its western edge.



Figure 1 - Site Location (site boundary outlined in red)

Contains Ordnance Survey data © Crown copyright and database right 2021

2.2 Site Topography

As illustrated in Figure 2, lidar data indicates that the site is generally flat, with ground levels typically between 10m and 10.5m Above Ordnance Datum (AOD). The site gradually slopes gently downwards to the east, in line with the prevailing topography. The site appears to sit within a minor dry valley which approximately follows the route of the A1112, with higher ground at approximately 14.0m AOD beyond the site to the east and west.



Figure 2 – Site Topography (filtered lidar data; site boundary outlined in red)
Contains Environment Agency information © 2021 Environment Agency and/or database right.

3. Sources of Flood Risk

3.1 Flooding from Rivers and the Sea

Historical Flooding

The PFRA and SFRA indicates that there are no historical flood outlines or recorded incidences of fluvial flooding at the site or immediate surrounds. This is corroborated by the EA 'Recorded Flood Outlines' dataset.

Flood Mapping

The Risk of Flooding from Rivers and Sea Map is informed by the EA National Flood Risk Assessment (NaFRA), which takes account of flood defence survey information and modelled river levels, factoring in a risk of overtopping of failure of raised defences where they exist, to provide a probabilistic assessment of flooding on a relatively coarse 50m grid. The Flood Map for Planning (Rivers and Sea), which is intended to inform the planning process, does not account for the impact of flood defences, but is created using detailed flood modelling (where available). The map also shows areas benefitting from defences.

The Risk of Flooding from Rivers and Sea Map shows that the site is outside the extent of flooding associated with rivers and the sea and has a 'very low' risk of flooding, equivalent to an annual chance demonstrably less than 1 in 1,000 (0.1%). Accordingly, the Flood Map for Planning (Rivers and Sea) shows that the site is located in Flood Zone 1, equivalent to an annual chance of flooding less than 1 in 1,000 (0.1%).

Overall, the site is considered to be at 'very low' risk of flooding from rivers and the sea and this form of flooding is not considered to pose an onerous risk to the site in the context of its potential future redevelopment.

3.2 Flooding from Surface Water

The Risk of Flooding from Surface Water Map is informed by 'direct rainfall' modelling undertaken at a high (2m) resolution. It illustrates those areas at elevated risk of surface water flooding in low spots down-gradient of sloping ground or in the topographic valleys associated with current or former watercourses. An extract of the map is shown in Figure 3.

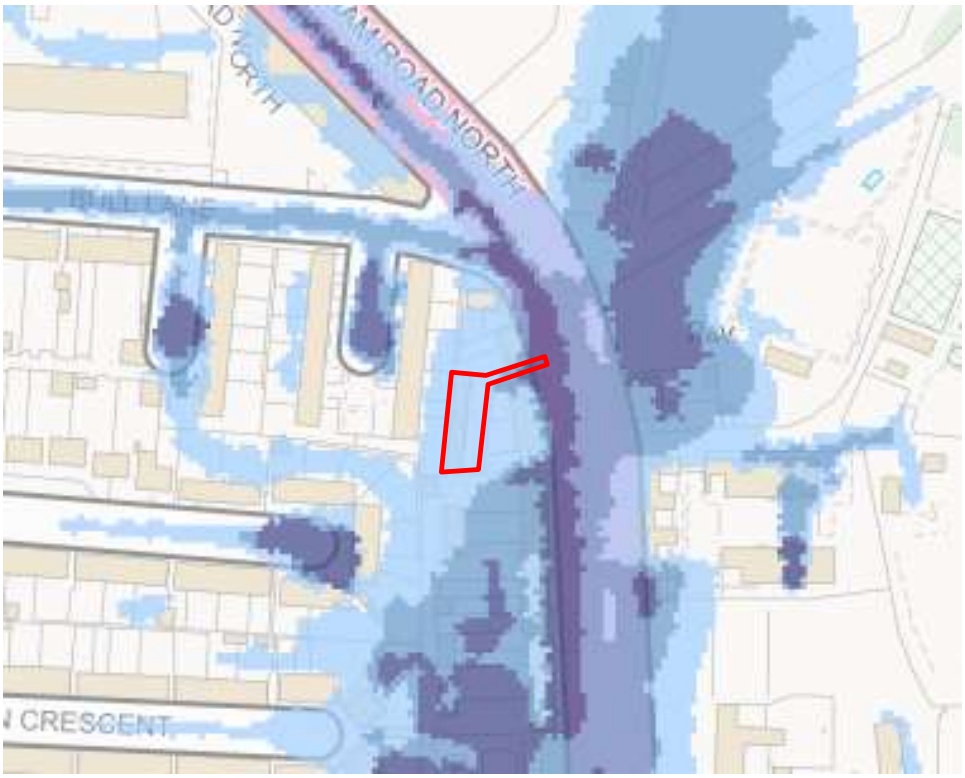


Figure 3 – Risk of Flooding from Surface Water Map
Contains Environment Agency information © Environment Agency and/or database right

The map indicates that the site is located close to an area of potentially elevated surface water flood risk. This is associated with the dry valley within which the site and surrounds are located, and it is noted that the areas of highest risk coincide with the A1112 immediately east of the site.

In all events modelled, including a 'high' likelihood surface water flood event, with an annual chance of 1 in 30 (3.3%) floodwater is shown to accumulate along the western edge of the A1112, and extend onto the access to the site. Flooding is mapped as being shallow (<0.3m deep) in this relatively frequent flood, hence although access may be affected following heavy rainfall, floodwater is not shown to extend onto the majority of the site beyond this access.

In a 'medium' likelihood surface water flood event, with an annual chance of 1 in 100 (1%) flooding is shown to extend to the full length of the access road on the site, but depths only exceed 0.3m on the A1112 as the access meets the road.

In an extreme 'low' likelihood surface water flood event, with an annual chance of 1 in 1,000 (0.1%), floodwater is shown to extend to cover the entirety of the site, with depths exceeding 0.3m in the north-eastern corner, closest to the site access.

According to the records of historical surface water flooding in the PFRA, there have been no recorded incidents of surface water flooding at the site.

Overall, taking into account the available mapped information, the site is considered to be at 'medium' risk of surface water flooding as this form of flooding could have implications for site access and influence the method of surface water drainage. Given the majority of the site is only shown to be inundated in an extreme event, it is not considered that this risk will preclude development, but consideration should be given to raising proposed buildings to prevent inundation following heavy rainfall.

3.3 Flooding from Groundwater

Groundwater flood risk is not as well-defined as other sources of flooding and an assessment of risk often requires consideration of geological conditions. Groundwater flooding can occur from two general mechanisms (i) 'clearwater flooding', where the water table in unconfined aquifers rises above the ground surface, associated with permeable bedrock such as chalk and common in areas where 'winterbourne' streams are present, which may run dry for much of the year; and (ii) 'river-groundwater interaction', where river levels interact with permeable superficial deposits along river valleys, potentially flooding areas away from the river without necessarily overtopping the river banks.

According to BGS mapping, the site is underlain by bedrock comprising London Clay and classified by the EA as an 'unproductive' aquifer. The superficial deposits beneath the site are classified as Hackney Gravel Member – Sand and Gravel. The unproductive nature of the London Clay means that the likelihood of clearwater flooding is remote. While the superficial sand and gravel deposits are likely to be permeable in nature, the absence of a watercourse in the vicinity means the risk of river-groundwater interactions is considered to be relatively low.

The SFRA states that the Borough of Barking and Dagenham does have some risk of groundwater flooding, due to the prevalence of impermeable ground and the combination of London Clay bedrock overlain by superficial gravel deposits. However, the report concludes that groundwater flooding which occurs in the borough is usually minor in nature.

Overall, the site is considered to be at 'low' risk of groundwater flooding and this form of flooding is not considered to pose an onerous risk to the site in the context of its potential future redevelopment.

3.4 Flooding from Artificial Sources

Sewers

Flooding from sewers can result from lack of sewer capacity, blockages within the sewer network or failure of infrastructure such as pumps. Any area that benefits from sewerage infrastructure has a potential risk of flooding, but the likelihood and consequences are most likely increased by topographic constraints such as low spots or flow paths that could influence the behaviour of floodwater originating from sewers.

In the absence of site-specific information on sewer flooding, the Risk of Flooding from Surface Water Map can aid understanding by indicating low spots that may be vulnerable were local sewers to cause flooding. As the site is shown to be adjacent to an area of elevated surface water flood risk, which extends onto the site with varying severity in less frequent events, flooding of local sewers could similarly pose a risk to the site or exacerbate existing risks. While unlikely to constrain development onerously, this risk should be considered in the design of foul drainage infrastructure on site (such as through consideration of non-return valves and additional capacity within proposed foul drainage systems). Measures to prevent ingress by surface water will similarly provide protection against foul water ingress should sewer flooding occur.

Reservoirs

The Risk of Flooding from Reservoirs Map illustrates the potential flood extent, were large raised reservoirs to fail and release the water that they hold. The map shows that the site is not within this flood extent.

Canals

The PFRA states there are no canals within the borough.

Overall, it is considered that the risk of flooding from artificial sources is 'low' and this form of flooding is not considered to pose an onerous risk to the site in the context of its potential future redevelopment. Nevertheless, the potential for sewer flooding as a result of the local surface water flood risk should be addressed in a Drainage Strategy and be considered in the proposed treatment of foul drainage infrastructure at the site.

3.5 Future Redevelopment

A Flood Risk Assessment (FRA) would not usually be necessary to support the development of the site as it is located in Flood Zone 1 and is less than 1ha in area. However, this Flood Risk Review has demonstrated that the site has an elevated risk of flooding from surface water and LBBD may request an FRA is prepared to consider this an demonstrate appropriate mitigation. Specific planning application validation requirements should however be confirmed with LBBD at the time a future planning application is prepared.

A Drainage Strategy would be required to consider available connections and the capacity of the local sewer network, informed by consultation with Thames Water where necessary. A Drainage Strategy should be designed to meet the London Plan (Ref. 11, Policy SI 13) requirement that developers should aim to achieve greenfield runoff rates, with a preference for green over grey features which follow the drainage hierarchy. The Drainage Strategy should be developed in consultation with LBBD and should detail methods to manage site drainage post-development, accounting for climate change. As noted in this review, the Drainage Strategy should consider the implications of the elevated risk of surface water flooding (particularly on the site access and adjacent A1112 Rainham Road North) and consider whether additional mitigation measures are required.

Overall, flood risk is considered unlikely to substantively constrain redevelopment potential at the site.

4. Summary

This desktop Flood Risk Review has investigated the risk of flooding to the site based on a review of relevant data and information in the public domain. The following has been concluded:

- The site is located outside the floodplain of any nearby watercourses and is at 'very low' risk of flooding from rivers and the sea, equivalent to an annual chance of less than 1 in 1,000 (0.1%).
- The site is adjacent to an area of elevated surface water flood risk along the A1112 Rainham Road North. Surface flooding is mapped as extending onto the site access in a 'high' and 'medium' likelihood event, with an annual chance of 1 in 30 (3.3%) and 1 in 100 (1%) respectively and affect the entire site in an extreme 'low' likelihood event with an annual chance of 1 in 1,000 (0.1%). Mapped surface water flooding has potential to affect site access and influence the design of site drainage systems. It would be prudent to consider elevating buildings on site to prevent ingress following heavy rainfall. Overall, considering that frequent flooding is not shown to affect the wider site other than the access, and given the lack of flood history, the overall risk is concluded as 'medium'.
- No other sources of flooding are considered to pose an onerous risk of flooding to the site in the context of its potential redevelopment and the site is considered to be acceptable in principle for all types of redevelopment with respect to flood risk.
- The findings of this Flood Risk Review suggest that an FRA is not necessary to support the development of the site, although the presence of local elevated surface water flood risk could mean that the Local Planning Authority requests one.
- It is recommended that a Drainage Strategy is designed in consultation with LBBD and Thames Water and that it includes appropriate allowance for climate change and consideration of the elevated risk of surface water flooding highlighted in this review.

Table 1 presents a summary of the risk of flooding by source. It should be noted that differing levels of information have been available to assess the risk of flooding for each source, and the ratings for flooding from rivers, the sea and surface water, for example are necessarily more detailed where they are informed by published flood maps and models.

Table 1 – Summary of Flood Risk by Source

Source of Flooding	Qualitative Flood Risk Rating
Rivers	Very Low
The Sea	Very Low
Surface Water	Medium
Groundwater	Low
Artificial Sources (Infrastructure Failure)	Low

5. References

1. Department of Environment, Food and Rural Affairs, 2021. Defra Data Service Platform. Accessed March 2021 via: https://environment.data.gov.uk/DefraDataDownload/?Mode=survey

2. Environment Agency, 2021. Long term flood risk information. Accessed March 2021 via: https://flood-warning-information.service.gov.uk/long-term-flood-risk/

3. Environment Agency, 2021. Flood Map for Planning. Accessed March 2021 via: https://flood-map-for-planning.service.gov.uk/

4. Environment Agency, 2021, Recorded Flood Outlines dataset. Accessed March 2021 via: https://data.gov.uk/dataset/16e32c53-35a6-4d54-a111-ca09031eaaaf/recorded-flood-outlines

5. Jacobs, 2008. London Borough of Barking and Dagenham Strategic Flood Risk Assessment (SFRA) Level 1. Accessed March 2021 via: https://www.lbbd.gov.uk/monitoring-and-evidence-base-library

6. JBA Consulting and Jacobs, 2011. London Borough of Barking and Dagenham Preliminary Flood Risk Assessment. Accessed March 2021 via: https://webarchive.nationalarchives.gov.uk/20140328094444/http://www.environment-agency.gov.uk/research/planning/135542.aspx#1

7. London Borough of Barking and Dagenham, 2017. Addendum to the Preliminary Flood Risk Assessment.

8. London Borough of Barking and Dagenham, 2017. London Borough of Barking and Dagenham Local Flood Risk Management Strategy. Accessed March 2021 via: https://www.lbbd.gov.uk/flooding-strategy

9. British Geological Survey, 2019. Geology of Britain Viewer. Accessed March 2021 via: http://mapapps.bgs.ac.uk/geologyofbritain/home.html

10. Department for Environment, Food and Rural Affairs. Magic Map Interactive Map. Accessed March 2021 via: https://magic.defra.gov.uk

11. The London Plan, 2021. Accessed March 2021 via: https://www.london.gov.uk/what-we-do/planning/london-plan/new-london-plan/london-plan-2021

12. Ministry of Housing, Communities and Local Government, updated 2019, National Planning Policy Framework. Accessed March 2021 via https://www.gov.uk/guidance/national-planning-policy-framework

13. Ministry of Housing, Communities and Local Government, updated 2019, Planning Practice Guidance. Accessed March 2021 via https://www.gov.uk/government/collections/planning-practice-guidance

APPENDIX A – Planning Policy and Flood Risk

The National Planning Policy Framework

With regard to flood risk and surface water drainage, the National Planning Policy Framework (NPPF) (Ref. 12) and its accompanying flood risk and coastal change Planning Practice Guidance (PPG) (Ref. 13) set out the Government's planning policy for England and advises on '*how to take account of and address the risks associated with flooding and coastal change in the planning process*'. The principal aim of the NPPF is to achieve sustainable development by accounting for flooding at all stages of the planning process, avoiding inappropriate development in areas at risk of flooding and directing development away from areas where risks are highest. Where development is necessary in areas at risk of flooding, the NPPF aims to ensure it is safe, without increasing flood risk to third parties. Early adoption of, and adherence to, the principles set out in the NPPF with respect to flood risk, can ensure that detailed designs and plans for development take due account of flood risk and the need for appropriate mitigation, if required.

The Sequential and Exception Tests

The PPG identifies four Flood Zone classifications, detailed in Table A1 below.

Table A1 – Flood Zones

Flood Zone	Annual Probability of Flooding
1 – Low Probability	Fluvial and Tidal <0.1% (AEP)
2 – Medium Probability	Fluvial 0.1-1.0% AEP Tidal 0.1-0.5% AEP
3a – High Probability	Fluvial > 1.0% AEP Tidal > 0.5% AEP
3b – The Functional Floodplain	Fluvial and Tidal >5.0% AEP *Starting point for consideration. Local planning authorities should identify Functional Floodplain, which should not be defined solely by rigid probability parameters.

Source: PPG, Flood Risk and Coastal Change

The NPPF specifies that the suitability of all new development in relation to flood risk should be assessed by applying the Sequential Test to demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development proposed. The PPG provides guidance on the compatibility of each land use classification in relation to each of the Flood Zones, as summarised in Table A2.

Table A2 – Flood Risk Vulnerability Classification

Flood Zone	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception Test required	✓	✓
Zone 3a	Exception Test required	✓	✗	Exception Test required	✓
Zone 3b	Exception Test required	✓	✗	✗	✗
Key:	✓ Development is appropriate		✗ Development should not be permitted		

Source: PPG, Flood Risk and Coastal Change

When the Exception Test is triggered, this requires the development proposals to demonstrate wider sustainability benefits to the community that outweigh flood risk, and that the development will be safe for its lifetime, without increasing flood risk elsewhere and where possible reduce overall flood risk.

Arcadis UK

Arcadis Rydon House
Pynes Hill
Exeter
EX2 5AZ

United Kingdom

T: +44 (0) 2920 729 800

arcadis.com