

# **The Printworks, High Road West**

## **Flood Risk Assessment**

**HRW-BHE-PW-XX-RP-CW-0001**

**0049225**

16 August 2023

Revision P07

| Revision | Description                               | Issued by | Date       | Checked |
|----------|-------------------------------------------|-----------|------------|---------|
| P01      | First draft submission (Printworks)       | SM        | 30.06.2021 | JF      |
| P02      | Final draft submission (Printworks)       | SM        | 08.07.2021 | JF      |
| P03      | For Planning (Printworks)                 | SM        | 29.07.2021 | JF      |
| P04      | Revised for Planning (Printworks) - DRAFT | SM        | 16.06.2023 | NV      |
| P05      | Revised for Planning (Printworks) – DRAFT | SM        | 05.07.2023 | NV      |
| P06      | Revised for Planning (Printworks) - DRAFT | SM        | 24.07.2023 | NV      |
| P07      | For Planning (Printworks)                 | SM        | 16.08.2023 | DP      |

[https://burohappold.sharepoint.com/sites/049225/Shared Documents/34\\_Water/03 Reports/Flood Risk Assessment/02 Printworks/Revised Planning/HRW-BHE-PW-XX-RP-CW-0001.docx](https://burohappold.sharepoint.com/sites/049225/Shared Documents/34_Water/03 Reports/Flood Risk Assessment/02 Printworks/Revised Planning/HRW-BHE-PW-XX-RP-CW-0001.docx)

This report has been prepared for the sole benefit, use and information of Goodsyrd Tottenham Limited for the purposes set out in the report or instructions commissioning it. The liability of Buro Happold Limited in respect of the information contained in the report will not extend to any third party.

author

Sigrid Moeller

date

16 August 2023

approved

David Palmer

signature



date

16 August 2023

# Contents

|          |                                                            |           |
|----------|------------------------------------------------------------|-----------|
| <b>1</b> | <b>Executive Summary</b>                                   | <b>6</b>  |
| <b>2</b> | <b>Introduction</b>                                        | <b>8</b>  |
| 2.1      | Background                                                 | 8         |
| 2.2      | Site Description                                           | 8         |
| 2.3      | Proposed Development                                       | 10        |
| <b>3</b> | <b>Planning Context</b>                                    | <b>11</b> |
| 3.1      | Overview                                                   | 11        |
| 3.2      | National Planning Policy Framework                         | 11        |
| 3.2.1    | Flood Zone Assessment                                      | 11        |
| 3.2.2    | Climate Change                                             | 12        |
| 3.3      | The London Plan                                            | 13        |
| 3.4      | London Borough of Haringey Strategic Flood Risk Assessment | 13        |
| 3.5      | London Borough of Haringey Surface Water Management Plan   | 14        |
| 3.6      | London Borough of Haringey Local Plan                      | 14        |
| 3.6.1    | Strategic Policies DPD                                     | 14        |
| 3.6.2    | Development Management DPD                                 | 14        |
| <b>4</b> | <b>Appraisal of Flood Risk</b>                             | <b>16</b> |
| 4.1      | National Planning Policy Framework                         | 16        |
| 4.1.1    | Flood Zone                                                 | 16        |
| 4.1.2    | Flood Risk Vulnerability Classification                    | 16        |
| 4.2      | Fluvial and Tidal Flooding                                 | 17        |
| 4.3      | Surface Water Flooding                                     | 17        |
| 4.3.1    | Baseline                                                   | 17        |
| 4.3.2    | Proposed                                                   | 18        |
| 4.4      | Flooding from Combined Sewers                              | 19        |
| 4.4.1    | Baseline                                                   | 19        |
| 4.4.2    | Proposed                                                   | 20        |

|          |                                                     |           |
|----------|-----------------------------------------------------|-----------|
| 4.5      | Groundwater Flooding                                | 20        |
| 4.6      | Flooding from Reservoirs                            | 21        |
| <b>5</b> | <b>Summary and Conclusion</b>                       | <b>23</b> |
|          | <b>Appendix A Planning Practice Guidance Tables</b> |           |

#### Table of Tables

|                                                                                              |           |
|----------------------------------------------------------------------------------------------|-----------|
| <b>Table 3-1: Climate change allowances for peak rainfall intensity</b>                      | <b>12</b> |
| <b>Table 4-1: Definition of surface water flood risk according to the Environment Agency</b> | <b>18</b> |
| <b>Table 4-2: Summary of proposed surface water drainage strategy</b>                        | <b>19</b> |

#### Table of Figures

|                                                                                                                                                       |           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Figure 2-1: Site location plan</b>                                                                                                                 | <b>9</b>  |
| <b>Figure 2-2: Levels across the site (Environment Agency data LiDAR)</b>                                                                             | <b>9</b>  |
| <b>Figure 2-3: General arrangement of ground floor of proposed development (Source: Re-Form Landscape drawing 0862-RFM-PW-XX-DR-L-0001, Rev. P01)</b> | <b>10</b> |
| <b>Figure 3-1: Drainage hierarchy</b>                                                                                                                 | <b>13</b> |
| <b>Figure 4-1: Flood Map for Planning, Flood Zone 2 and 3 (Environment Agency data)</b>                                                               | <b>16</b> |
| <b>Figure 4-2: Surface Water Flood Map (Environment Agency data)</b>                                                                                  | <b>18</b> |
| <b>Figure 4-3: Increased Potential for Elevated Groundwater (Greater London Authority)</b>                                                            | <b>21</b> |
| <b>Figure 4-4: Maximum extent of flooding from reservoir failure (Environment Agency data)</b>                                                        | <b>22</b> |

# Glossary

| Term | Definition                         |
|------|------------------------------------|
| BGS  | British Geological Society         |
| CDA  | Critical Drainage Area             |
| EA   | Environment Agency                 |
| FRA  | Flood Risk Assessment              |
| LBH  | London Borough of Haringey         |
| LLFA | Lead Local Flood Authority         |
| NPPF | National Planning Policy Framework |
| SFRA | Strategic Flood Risk Assessment    |
| SuDS | Sustainable Drainage Features      |
| SWMP | Surface Water Management Plan      |
| TW   | Thames Water                       |

# 1 Executive Summary

This Flood Risk Assessment (FRA) has been carried out as part of the planning application for the proposed development of the site known as The Printworks, High Road West, in the London Borough of Haringey (LBH). The proposed development will contain purpose-built student accommodation, commercial, business and service uses, as well as hard and soft landscaping, parking, and associated works.

This FRA has been prepared in accordance with the National Planning Policy Framework (July 2021), the London Plan (March 2021), the London Borough of Haringey (LBH) Local Plan (2017), the LBH Strategic Flood Risk Assessment (SFRA) (February 2015) and the LBH Surface Water Management Plan (SWMP) (August 2011).

The FRA contains an assessment of the risk associated with each of the following flood sources:

- The sea (tidal);
- Rivers (fluvial);
- Surface water;
- Failure of drainage infrastructure;
- Groundwater; and
- Reservoirs and artificial sources.

According to the national flood map produced by the Environment Agency (EA), the Printworks site is located entirely within Flood Zone 1. The nearest watercourse to the proposed development is the Moselle River, which is culverted below White Hart Lane to the south of the site. Tidal and fluvial flood risk are considered to be low for the proposed development.

In accordance with the NPPF, all of the land uses for the proposed development are appropriate for Flood Zone 1. The proposed development consists of residential accommodation, which is classified as *More Vulnerable*. The proposed commercial, business and service uses, alongside the parking, the hard and soft landscaping and associated works, are considered *Less Vulnerable* in accordance with the NPPF.

The majority of the site has a very low risk of surface water flooding. There are areas central on the Printworks site with a *low* to *medium* to risk of surface water flooding. This corresponds to localised depressions in the topography.

Surface water is proposed to be discharged by gravity to the existing Thames Water (TW) surface water sewer in the High Road, to the east of the site, at a discharge rate of 2.0 l/s for the 1 in 100 year event, inclusive of a climate change allowance. This is less than the calculated greenfield discharge rate of 2.03 l/s and represents a significant reduction in the peak rate of surface water runoff entering the TW sewer. With the proposed Foul and Surface Water Drainage Strategy in place, the risk of flooding from surface water and the surcharge of combined sewers is considered to be low.

Foul water is proposed to be discharged to the existing TW foul sewers at a peak rate of 13.32 l/s, which represents an increase from the estimated foul water discharge from the existing site. A pre-development enquiry has been submitted for the new foul water discharge rate. A response from TW regarding the proposed drainage strategy is being awaited. However, since all surface water is proposed to be discharged to a dedicated surface water sewer and

there are no known issues associated with lack of capacity of the existing TW foul water sewer network, the risk of flooding from the foul sewers is considered to be low.

There are no documented records of groundwater flooding within the proposed development site according to the LBH SWMP and the SFRA. The overall risk of groundwater rising above ground level and causing flooding to the site is considered to be low due to the impermeable nature of the underlying London Clay. However, the site is located in an area with increased potential for elevated groundwater. No basements are proposed for the development and the risk of groundwater flooding to the proposed development is considered to be low.

The map showing the risk of flooding from reservoirs, produced by the EA, indicates that the site is not located within the maximum extent of flooding that would occur if an upstream reservoir were to fail. The risk of flooding caused by the failure of a reservoir is therefore considered to be low and mitigation is not required.

It is concluded that the risk of flooding from all sources, for the entire design life is considered to be low and that the proposed development will not increase the risk of flooding elsewhere. Moreover, it is considered that the inclusion of the installation of SuDS within the proposed development will reduce the risk associated with surface water flooding.

## 2 Introduction

### 2.1 Background

This site-specific Flood Risk Assessment (FRA) has been prepared by Buro Happold as part of planning application for the site known as the Printworks, hereafter referred to as the 'proposed development'. This assessment has been developed in accordance with the National Planning Policy Framework (NPPF).

The purpose of this report is to assess and describe the impact of the proposed works in terms of flood risk. In order to comply with the NPPF, this FRA will identify the potential flood risks and demonstrate appropriate flood mitigation measures to ensure that the risk to the site is acceptable for the level of development proposed. A summary of the proposed drainage strategy is included within this report.

### 2.2 Site Description

The proposed development is located within the London Borough of Haringey (LBH).

The site comprises the High Road properties which are a mix of retail/commercial and residential use above, with the properties being a mix of locally and statutorily listed buildings. The La Royal Banqueting Suite – a commercial events venue at 819-821 High Road extends to the rear of the High Road properties to the west of the site, with the remaining rear area comprising informal surface car parking, rear extensions and associated structures.

The levels across the site range from approximately 11.8mAOD to the east of the site to 13.5mAOD the west of the site (see Figure 2-2). The nearest watercourse is the River Moselle, approximately 70m to the south of the site. This watercourse is classified as a Main River, which is understood to flow below ground in a culvert, from west to east along the alignment of White Hart Lane.

The online GeoIndex tool produced by the BGS indicates that the bedrock geology underlying the site is the London Clay Formation. The site is on the border between two superficial deposits, the Taplow Gravel Member and the Kempton Park Gravel Member.

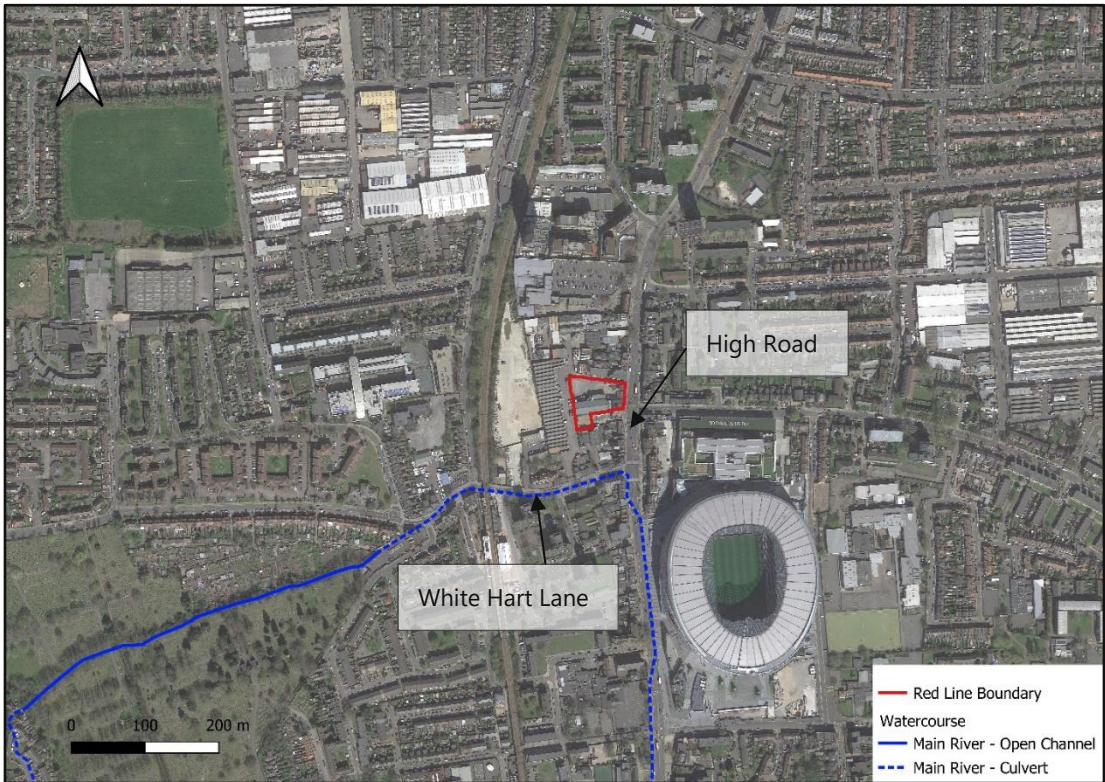


Figure 2-1: Site location plan



Figure 2-2: Levels across the site (Environment Agency data LiDAR)

## 2.3 Proposed Development

The proposed development is described as follows:

Full planning application for the demolition of existing buildings and structures to the rear of 819-829 High Road; the demolition of 829 High Road; and redevelopment for purpose-built student accommodation (Sui Generis) and supporting flexible commercial, business and service uses (Class E), hard and soft landscaping, parking, and associated works. To include the change of use of 819-827 High Road to student accommodation (Sui Generis) and commercial, business and service (Class E) uses.

The ground floor plan of the proposed development is shown in Figure 2-3. Refer to the full package of development drawings submitted as part of the planning application for further details.



**Figure 2-3: General arrangement of ground floor of proposed development (Source: Re-Form Landscape Architecture, 1002-RFM-XX-00-DR-L-0001, Rev. P1)**

## 3 Planning Context

### 3.1 Overview

This Flood Risk Assessment (FRA) has been prepared in accordance with the policies and guidance applicable to the proposed development, outlined within the following publications:

- National Planning Policy Framework (March 2012, revised July 2021);
- National Planning Policy Framework Planning Practice Guidance website (March 2014, revised August 2022);
- The London Plan: The Spatial Development Strategy for Greater London (March 2021);
- London Borough of Haringey Local Plan Strategic Policies DPD (2017);
- London Borough of Haringey Local Plan Development Management DPD (2017);
- London Borough of Haringey Strategic Flood Risk Assessment (February 2015); and
- London Borough of Haringey Surface Water Management Plan (August 2011).

### 3.2 National Planning Policy Framework

#### 3.2.1 Flood Zone Assessment

The NPPF<sup>1</sup> aims to avoid inappropriate development in areas at highest risk of flooding. The Planning Practice Guidance<sup>2</sup> to the NPPF contains a series of tables that help identify the risk of flooding to a development, see Appendix A for the tables. A summary is provided below:

- Table 1 defines four Flood Zones based on the annual probability of river or sea flooding;
- Table 2 identifies where development is appropriate for each flood risk vulnerability classification and whether the Exception Test is required; and
- Annex 3 identifies specific land use types for each of the five flood risk vulnerability classifications (Essential Infrastructure, Highly Vulnerable, More Vulnerable, Less Vulnerable and Water Compatible Uses). For example, residential units are classified as More Vulnerable.

The Flood Zones defined in the NPPF are as follows:

**Flood Zone 1** Low Probability:

< 1 in 1,000 annual probability of river or sea flooding in any given year (<0.1% Annual Exceedance Probability (AEP)).

---

<sup>1</sup> Secretary of State for Ministry of Housing, Communities and Local Government, National Planning Policy Framework, July 2021,

<sup>2</sup> Ministry of Housing, Communities & Local Government, Flood Risk and Coastal Change, March 2014  
<https://www.gov.uk/guidance/flood-risk-and-coastal-change> (Accessed 14th June 2023)

**Flood Zone 2** Medium probability:

Between 1 in 100 and 1 in 1,000 annual probability of river flooding in any year (1% - 0.1% AEP), or  
Between 1 in 200 and 1 in 1,000 annual probability of sea flooding in any year (0.5% - 0.1% AEP).

**Flood Zone 3a** High probability:

> 1 in 100 annual probability of river flooding in any year (>1% AEP), or  
> 1 in 200 annual probability of sea flooding in any year (>0.5% AEP).

**Flood Zone 3b** Functional floodplain:

> 1 in 30 annual probability of flooding in any year (>3.3% AEP), or  
Land that is designed to flood, even if it would only flood in more extreme events.

**3.2.2 Climate Change**

Allowances for the predicted effects of climate change should be taken into account when preparing site-specific FRA. The guidance published by the EA in February 2016 (last updated May 2022) to support the NPPF contains sensitivity ranges that are recommended to be applied to peak rainfall intensities, peak river flows, sea level rise, offshore wind speeds and extreme wave heights. The general trend is for each parameter to increase in the future, which in turn increases the risk of flooding to any site. The recommended allowances for peak rainfall intensity are given in Table 3-1.

**Table 3-1: Climate change allowances for peak rainfall intensity (1% annual exceedance rainfall event) for the London Management Catchment**

| Allowance Category  | 2050s | 2070s |
|---------------------|-------|-------|
| Central allowance   | +20%  | +25%  |
| Upper end allowance | +40%  | +40%  |

The EA guidance states that one should use '2050s' for development with a lifetime up to 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125.

It is recommended by the EA that for developments with a lifetime beyond 2100, both the central and upper end allowances are assessed in order to understand the range of the impact. The guidance further states that the development must be designed so that for the upper end allowance in the 1% annual exceedance probability event:

- There is no increase in flood risk elsewhere; and
- The development will be safe from surface water flooding.

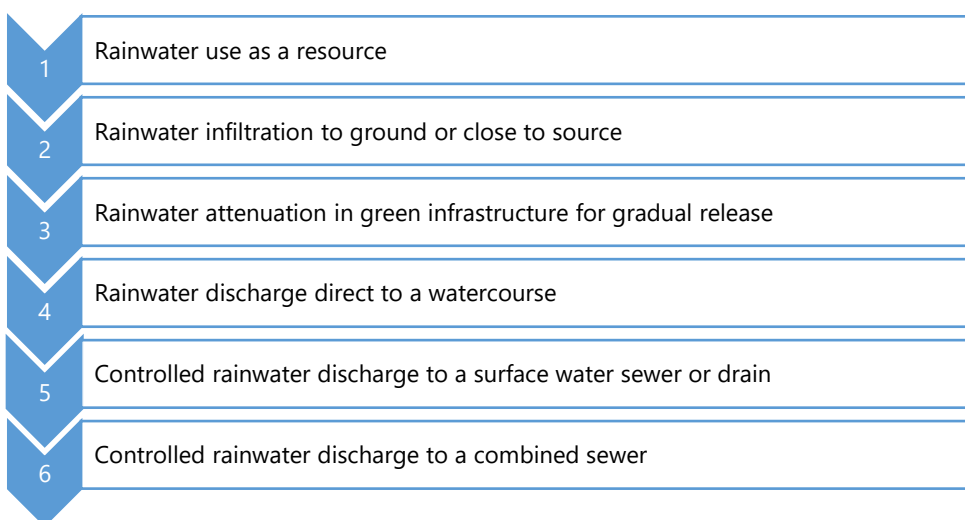
The Surface Water Drainage Strategy, also prepared by Buro Happold, has therefore made an allowance for a 40% increase in peak rainfall intensity as this 'upper end' allowance represents the more conservative scenario.

### 3.3 The London Plan

The Greater London Authority produced the London Plan with the latest version issued in March 2021. It is a strategic plan for London, which sets out an integrated economic, environmental, transport and social framework for the development of London over the next 20-25 years. It entails specific policies on flood risk management and the use of sustainable drainage.

The London Plan requires that current and expected flood risk from all sources across London should be managed in a sustainable and cost-effective way in collaboration with the EA, the Local Lead Flood Authority (LLFA), developers and infrastructure providers. It further requires identification of areas where particular and cumulative flood risk issues exist and develops actions and policy approaches aimed at reducing these risks. Boroughs should cooperate and jointly address cross-boundary flood risk issues, including with authorities outside London. Development proposals should ensure that flood risk is minimised and mitigated, and that residual risk is addressed.

The London Plan also calls for developments to utilise SuDS and expresses a preference for green over grey features. Developments should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible, in line with the following drainage hierarchy:



**Figure 3-1: Drainage hierarchy**

The London Plan makes reference to the Mayor's Regional Flood Risk Appraisal and requests that this is used alongside the SFRA as well as the Local Flood Risk Management Strategies, where necessary, to identify areas where particular and cumulative flood risk issues exist so that appropriate actions and policy approaches can be developed to reduce these risks.

### 3.4 London Borough of Haringey Strategic Flood Risk Assessment

Strategic Flood Risk Assessments (SFRA) are required to be carried out by Local Authorities to guide developers on the authority's strategies to avoid, reduce and manage flood risk. The LBH SFRA considers the risk of flooding from the following potential sources:

- Rivers (fluvial) and the Sea (tidal);
- Groundwater;

- Sewer and Surface Water;
- Artificial Drainage Bodies; and
- Infrastructure Failure.

The risk of flooding to the proposed development from each flood source listed above will be assessed in Section 4.

The purpose of the SFRA is therefore to collate information across the borough to determine the variation in risk from all sources of flooding. It should be noted that the assessment of flood risk associated with mains failure is not a requirement for the planning process and is therefore excluded from the assessment.

### 3.5 London Borough of Haringey Surface Water Management Plan

The LBH Surface Water Management Plan (SWMP) outlines the preferred surface water management strategy for the borough. In this context surface water flooding describes flooding from sewers, drains, groundwater, and runoff from land, small watercourses and ditches that occurs as a result of heavy rainfall.

The guidance provided in the SWMP is in accordance with the approach and policies contained within the LBH SFRA and the London Plan. In addition, the SWMP provides records of groundwater flooding within LBH.

### 3.6 London Borough of Haringey Local Plan

#### 3.6.1 Strategic Policies DPD

The Strategic Policies document sets out key policies for development within the borough up to 2026. Policy SP5 includes the following requirements regarding flood risk management:

*All development shall:*

- *Improve the water environment, water quality and drainage systems;*
- *Take account of flood risk vulnerability classification as set out in paragraph 100 of the NPPF and will apply the NPPF Sequential Test and Exception Test;*
- *Implement measures to prevent (or mitigate as last resort) local surface water and downstream flooding;*
- *Implement Sustainable Drainage Systems from strategic to individual site level to improve water attenuation, quality and amenity;*

The measures taken to manage flood risk described within this report have been developed in accordance with the requirements of Policy SP5.

#### 3.6.2 Development Management DPD

The Development Management document sets out criteria based policies against which planning applications will be assessed, in line with the key principles of the Strategic Policies.

Policy DM24 covers flood risk management and includes the following requirements, which are in line with the approach set out in the NPPF:

- A. *The Council will ensure that all proposals for new development avoid and reduce the risk of flooding to future occupants and do not increase the risk of flooding.*
- B. *All proposals for new development within Flood Zone 2 and 3a will be required to provide sufficient evidence for the Council to assess whether the requirements of the Sequential Test and Exception Test, where required, have been satisfied. Proposals must be informed by a site specific Flood Risk Assessment (FRA) taking account of all potential sources of flooding and should:*
  - a) *Demonstrate the application of a sequential approach for the development of individual sites to ensure that the most vulnerable land uses are located in areas of the site that are at lowest risk of flooding;*
  - b) *Preserve overland flood and flow routes and ensure there is no net loss of flood storage. Adequate flood storage and compensation should be provided on site, or if this is not possible, provided off site where circumstances allow;*
  - c) *Where appropriate, set out the mitigation measures that will be incorporated on site to manage residual flood risk including:*
    - i. *Finished floor levels set no lower than 300mm above the 1 in 100 chance in any given year, including an allowance for climate change, flood level; and*
    - ii. *Ensure safe access and egress for future users of the development or an appropriate emergency evacuation plan.*
  - d) *Contribute to naturalising watercourses where opportunities arise.*
- C. *All proposals for new development will be required to:*
  - a) *Manage and reduce surface water run-off; and*
  - b) *Manage water and waste water discharges.*
- D. *With the exception of water compatible uses and essential infrastructure, development in areas designated in Haringey's Strategic Flood Risk Assessment as being within Flood Zone 3b will not be permitted.*

Policy DM26 covers Critical Drainage Areas, and includes the following:

- A. *All proposals for new development within a Critical Drainage Area (CDA) will be required to incorporate measures to reduce the overall level of flood risk in the CDA.*
- B. *Proposals for new development within Local Flood Risk Zones must include a statement describing how flood risk issues have been addressed. The Council may require a further site-specific Flood Risk Assessment to assess risk, particularly from surface water flooding.*

## 4 Appraisal of Flood Risk

### 4.1 National Planning Policy Framework

#### 4.1.1 Flood Zone

The Flood Zone mapping produced by the Environment Agency (EA) shows that the proposed development lies entirely within Flood Zone 1. This is shown in Figure 4-1.

Flood Zone 1 is defined as an area with an annual probability of flooding from rivers or the sea of less than 0.1%.

By definition, the risk of flooding from rivers or the sea in Flood Zone 1 is classified as low. In line with EA guidance, the focus of this FRA will therefore be on the management of surface water run-off and the risk of flooding from other sources.

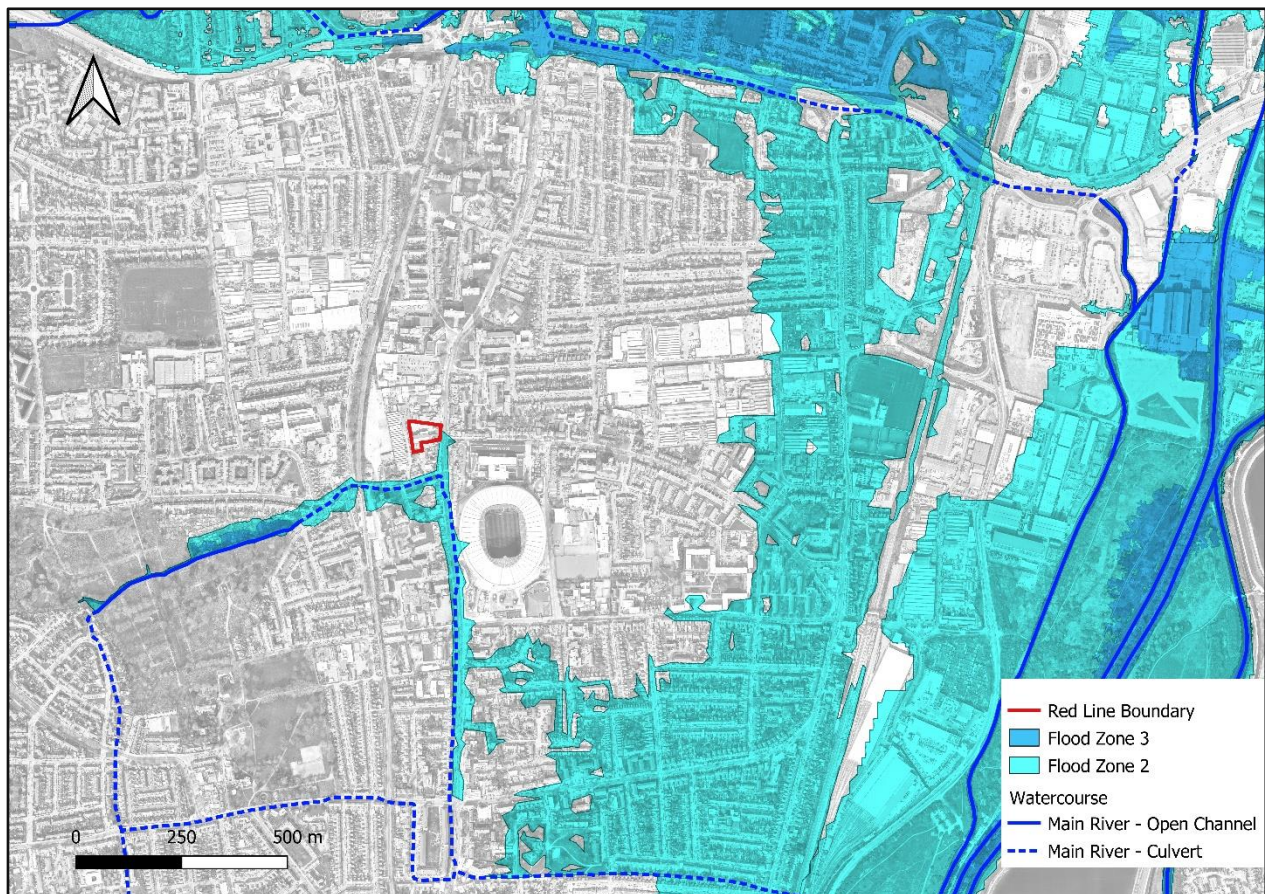


Figure 4-1: Flood Map for Planning, Flood Zone 2 and 3 (Environment Agency data)

#### 4.1.2 Flood Risk Vulnerability Classification

The NPPF Planning Practice Guidance contains a series of tables which identify where development should be permitted, based on the Flood Zone in which the development is located and the proposed uses of that development. These tables are included in Appendix A.

The proposed development consists of residential accommodation, which is classified as *More Vulnerable*. The proposed commercial, business and service uses, alongside the parking, the hard and soft landscaping and associated works, are considered *Less Vulnerable* in accordance with the NPPF. All of the above land uses are considered appropriate for development within Flood Zone 1, in accordance with the NPPF.

## 4.2 Fluvial and Tidal Flooding

Fluvial flooding occurs when sustained or intense rainfall events increase the flow in rivers causing the water level to rise above the level of the banks and into the surrounding areas.

Tidal flooding occurs when particularly high tides coincide with storm surges. Storm surges are caused by low atmospheric pressure events resulting in temporary localised raising of sea levels.

The nearest watercourse is the River Moselle, approximately 70m south of the site. River Moselle is a designated EA Main River. It can be seen crossing Tottenham Cemetery and is understood to be culverted under White Hart Lane. For the sections of the proposed development is located within Flood Zone 1, which is defined as having a low risk of flooding from rivers and the sea, additional measures to reduce the risk is not required.

## 4.3 Surface Water Flooding

Surface water flooding occurs when intense rainfall is unable to naturally soak into the ground due to impermeable ground covering such as concrete or tarmac, or low permeability ground conditions preventing infiltration. This excess surface water can flow through built-up areas and open space and pond in lower-lying areas causing localised flooding.

### 4.3.1 Baseline

According to the EA surface water flood map, the majority of the site is classified as having a very low probability of surface water flooding. As can be seen from Figure 4-2, part of the site has a *low* to *medium* risk of surface water flooding. This area corresponds to localised depressions in the topography between existing buildings where localised ponding of surface water is likely to occur. Parts of White Hart Lane and the High Road close to the site are also shown to have a medium to high risk of surface water flooding, as the highways act as overland flow paths for surface water.

In addition to the EA surface water flood mapping, the Haringey Development Management document indicates that the site is located within an area that has been identified as at greater risk of surface water flooding, and therefore defined as a Critical Drainage Area (CDA).

The existing site consists almost entirely of impermeable paving or roofing. During a rainfall event, there is therefore very little potential for infiltration, and almost all of the rain falling on the site would be converted to surface water run-off which, in turn, can result in surface water flooding.

In the absence of more detailed site information, it is assumed that all surface water is currently discharged unrestricted without attenuation, directly to the 152mm surface water sewer on Brunswick Square, the road just north of the site.

The existing surface water discharge rate is estimated to be **47.5 l/s**. See the Surface Water Drainage Strategy, also prepared by Buro Happold, for further details.



**Figure 4-2: Surface Water Flood Map (Environment Agency data)**

Table 4-1 provides an overview of the different risk levels associated with surface water flooding.

**Table 4-1: Definition of surface water flood risk according to the Environment Agency**

| Risk Level | Definition                                             |
|------------|--------------------------------------------------------|
| Low        | Annual probability of flooding of between 0.1% and 1%. |
| Medium     | Annual probability of flooding of between 1% and 3.3%. |
| High       | Annual probability of flooding of greater than 3.3%.   |

Note: Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

### 4.3.2 Proposed

Under the proposed Surface Water Drainage Strategy surface water will be managed separately from foul water. It is proposed that the majority of the surface water from the site, including the buildings, paved areas and communal areas is discharged via gravity to the TW surface water drainage network.

There is an existing 152mm TW surface water sewer located in Brunswick Square to the north of the site, however this sewer has insufficient capacity to accommodate the surface water flows from the development and therefore it is proposed that a connection is made to the 610mm sewer located on High Road.

It is proposed that the attenuation volume is provided below ground via bioretention and geocellular storage in the hard-landscaped area along the north of the site, as well as in the two courtyard areas at L00. The attenuation is provided using proprietary modular geocellular system with a void ratio of 95%.

Attenuation and flow restriction devices are proposed to reduce the rate of surface water discharge, for the critical 1 in 100 year rainfall event including a 40% increase to allow for climate change in accordance with the latest EA guidance, with a runoff rate of **2.0 l/s**. This is below the calculated greenfield rate for the 1 in 100 year event for the site, calculated to be 2.03 l/s, and represents a significant improvement from estimated existing surface water runoff rates.

Table 4-2 provides a summary of the proposed surface water drainage strategy. Further details are provided in the Surface Water Drainage Strategy report, also prepared by Buro Happold.

**Table 4-2: Summary of proposed surface water drainage strategy**

| Area       | Discharge Point                                                                           | Peak Discharge Rate (l/s) | Total Attenuation Volume (m <sup>3</sup> ) |
|------------|-------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------|
| Printworks | Gravity connection to TW sewer to the east of proposed development area in the High Road. | <b>2.0</b>                | 326 m <sup>3</sup>                         |

The total volume of attenuation provided on the site is 326m<sup>3</sup> based on a restricted surface water discharge rate of 2.0 l/s, which is below the greenfield discharge rate of 2.03 l/s.

The reduction in surface water runoff rate represents an improvement in surface water flood risk, both to the site and the adjacent land. It is therefore considered that the requirements for development within CDAs outlined within Policy DM26 of the LBH Development Management DPD is satisfied.

#### 4.4 Flooding from Combined Sewers

Flooding from combined sewers may occur during periods of intense rainfall when high volumes of surface water runoff exceed the capacity of the drainage system water can be forced back up through surface water sewers or combined sewer overflows.

##### 4.4.1 Baseline

In the absence of more detailed information, it is assumed that foul water from the existing buildings on the Printworks development site is discharged to the 250mm foul sewer network on Brunswick Park unrestricted via pipework contained within the site boundary.

The existing commercial buildings at the Printworks cover approximately 2,774m<sup>2</sup>. It is therefore estimated that the foul water discharge rate from the existing site is **0.36 l/s**.

There are no known issues associated with lack of capacity of the existing TW foul water sewers. In addition, it is understood that surface water from the existing site is discharged to the dedicated TW surface water sewers. The risk of flooding from surcharge of the existing TW foul water network is therefore considered to be low.

#### 4.4.2 Proposed

Under the proposed Foul Water Drainage Strategy, foul water will be discharged directly to the existing TW foul water sewers by gravity. The total peak foul water flow from the proposed development has been calculated based on the number of commercial and residential units.

The estimated peak foul water discharge rate from the Printworks site is **13.32 l/s**. This will be discharged to a 250mm foul water pipe located in Brunswick Square north of the site. A further foul sewer is to be installed at the south of the site which is proposed to pass underneath a proportion of the Printworks building to the west before running along the western perimeter and discharge to a re-graded 250mm sewer on Brunswick Square.

The existing 250mm sewer on Brunswick Square will need to be lowered and re-graded in order to collect the upstream discharges from the south of the development.

The foul water flows anticipated to be generated from the site represent an increase from the estimated foul water discharged to the TW sewer network from the existing development. A pre-development enquiry has been submitted to TW in order to present the proposed drainage strategy and to understand the potential impact of the foul water flows on the existing TW network from the proposed development. At the time of writing a response is yet to be received from TW for the latest enquiry.

There are no known issues associated with lack of capacity of the TW foul water sewer network. In addition, all surface water is proposed to be discharged to a dedicated surface water sewer. It is therefore considered that the risk of the TW foul sewer surcharging and flooding the proposed development is low.

#### 4.5 Groundwater Flooding

Groundwater flooding generally occurs in low-lying areas above permeable rock aquifers where the water table meets, and rises above, the ground surface. According to the BGS, groundwater flooding “occurs as a result of water rising up from the underlying rocks or from water flowing from dormant springs. This tends to occur after long periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels”.

Unlike flooding from rivers and the sea, groundwater flooding does not generally pose a significant risk to life, but is more associated with significant damage to property, with flooding persisting over a number of weeks for some types of groundwater flooding.

There are no documented records of groundwater flooding within the proposed development site according to the LBH SWMP.

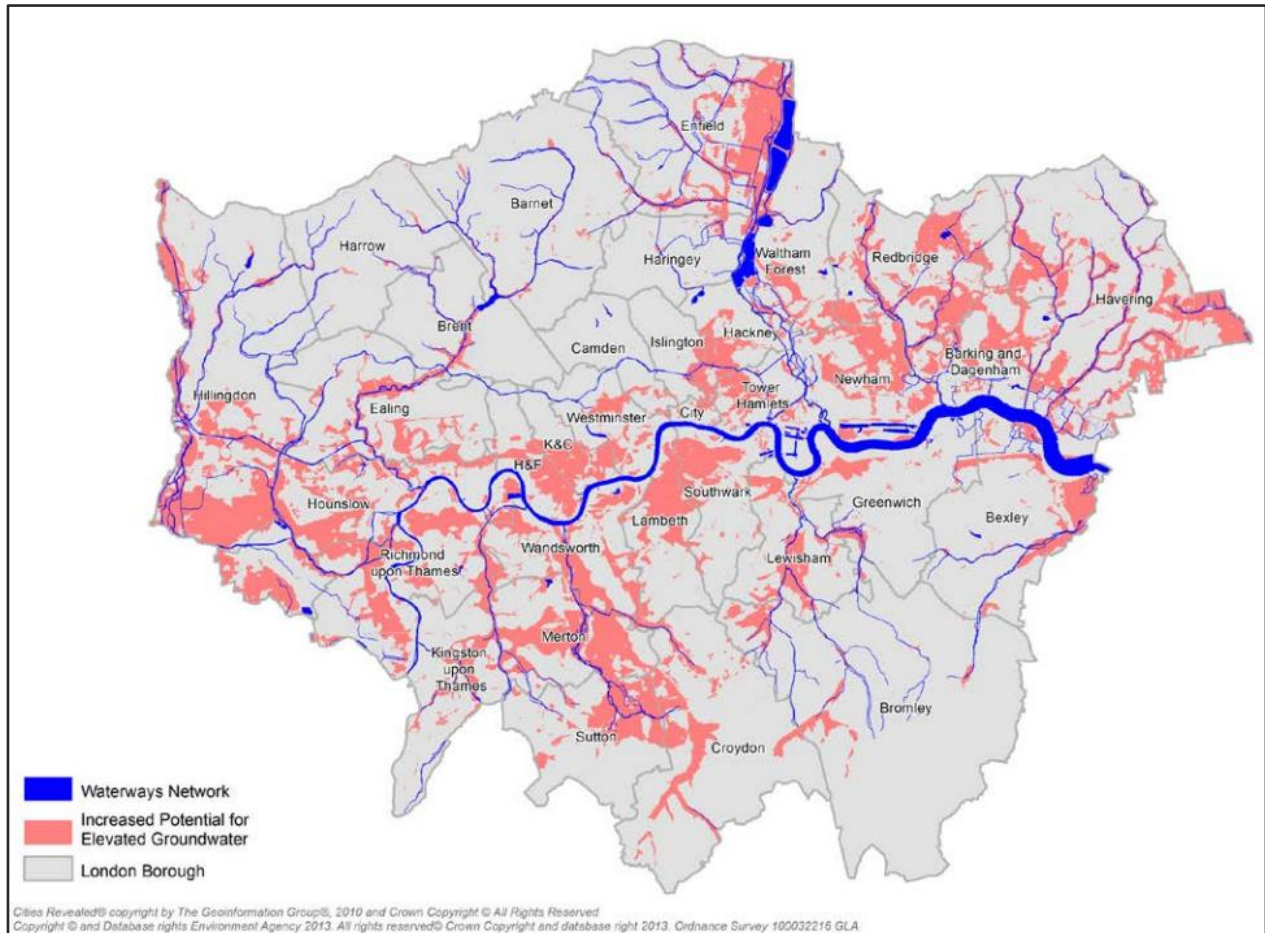
The online GeolIndex tool produced by the BGS indicates that the bedrock geology underlying the site is the London Clay Formation. The site is on the border between two superficial deposits, the Taplow Gravel Member and the Kempton Park Gravel Member.

The London Regional Flood Risk Appraisal<sup>3</sup> contains a map showing areas with increased potential for elevated groundwater (see Figure 4-3). The site is on the boundary of an area with increased potential for elevated groundwater. There is no basement proposed as part of the development and the overall risk of groundwater rising

---

<sup>3</sup> Greater London Authority (2018). *London Regional Flood Risk Appraisal*.

above ground level and causing flooding to the Site is considered to be low due to the impermeable nature of the underlying London Clay.



**Figure 4-3: Increased Potential for Elevated Groundwater (Greater London Authority)**

#### 4.6 Flooding from Reservoirs

There are several non-natural sources of flood risk including flooding from canals, reservoirs and man-made lakes. These sources of flooding can occur when the facility is overwhelmed by high rainfall or when a dam or bank fails. Flooding from such sources can happen suddenly and can cause significant damage and danger to life.

The map showing the risk of flooding from reservoirs produced by the EA indicates that the maximum extent of flooding that would occur if an upstream reservoir were to fail. As seen in Figure 4-4, the risk to the site is low. The probability of reservoir failure is further considered to be unlikely.

Canals may flood in a similar fashion to reservoirs, for instance by overtopping as facilities become overwhelmed or as a result of bank failure. As with reservoirs, water can be released quickly from canal floods. There are no canals within proximity of the site. The risk of flooding from canals is therefore considered to be low and mitigation is not required.

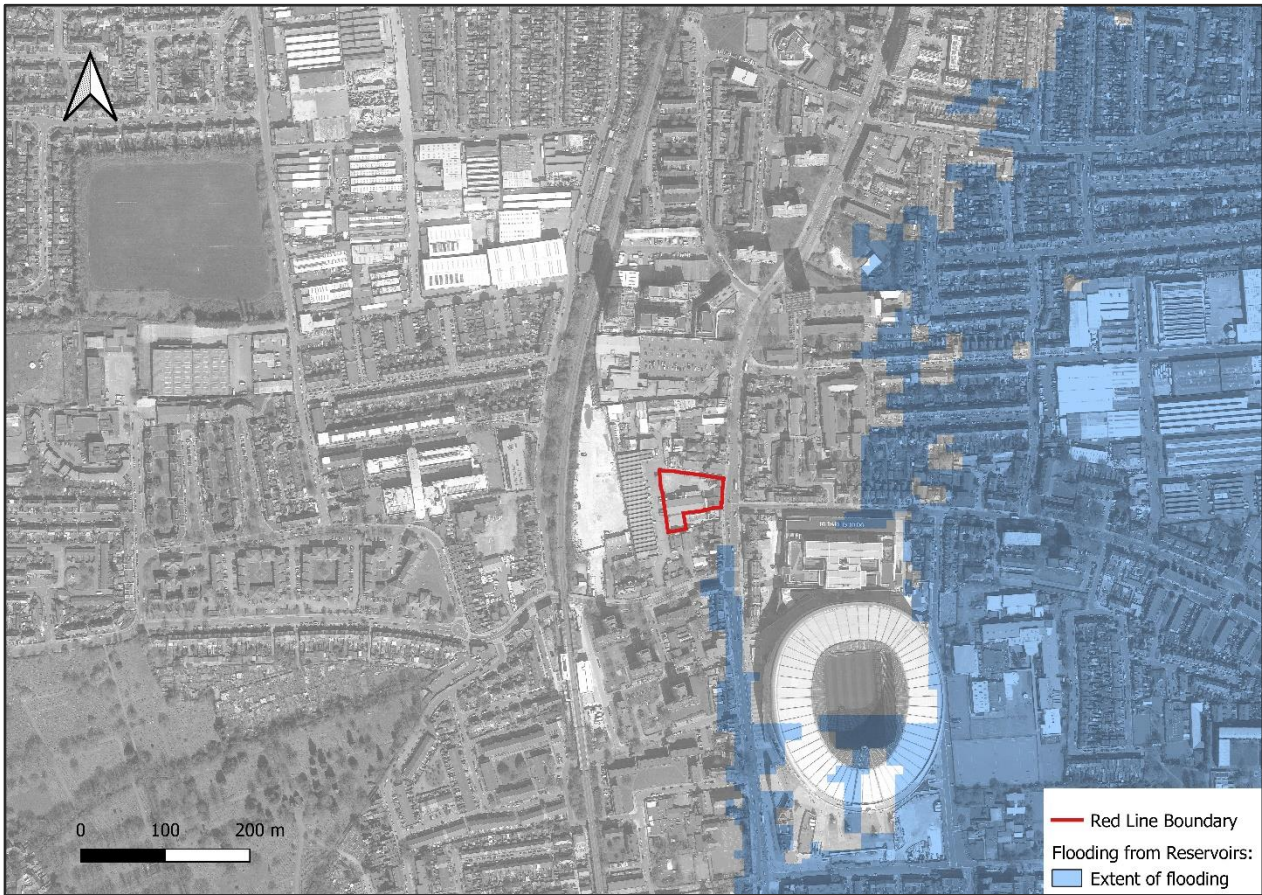


Figure 4-4: Maximum extent of flooding from reservoir failure (Environment Agency data)

## 5 Summary and Conclusion

This FRA has been carried out as part of the full planning application and listed building consent for the proposed development for High Road West for the Printworks. The proposed development will contain purpose-built student accommodation, commercial, business and service uses, as well as hard and soft landscaping, parking, and associated works.

According to the national flood map produced by the EA, the entire site is located within Flood Zone 1, which is classified as having a low risk of flooding from rivers and the sea. The nearest watercourse to the proposed development is the Moselle River, which is culverted below White Hart Lane to the south of the site. Tidal and fluvial flood risk are considered to be low for the proposed development.

In accordance with the NPPF, all of the land uses for the proposed development are appropriate for Flood Zone 1. The proposed development consists of residential accommodation, which is classified as *More Vulnerable*. The proposed commercial, business and service uses, alongside the parking, the hard and soft landscaping and associated works, are considered *Less Vulnerable* in accordance with the NPPF.

The surface water flood map produced by the EA indicates that the site is predominantly classified as having a very low probability of surface water flooding. The majority of the site has a very low risk of surface water flooding. There are areas central on the Printworks site with a *low to medium* to risk of surface water flooding. This corresponds to localised depressions in the topography.

Surface water is proposed to be discharged by gravity to the existing TW surface water sewer in the High Road, to the east of the site, at a discharge rate of 2.0 l/s for the 1 in 100 year event, inclusive of a climate change allowance. This is less than the calculated greenfield discharge rate of 2.03 l/s and represents a significant reduction in the peak rate of surface water runoff currently estimated to enter the TW sewer. With the proposed Foul and Surface Water Drainage Strategy in place, the risk of flooding from surface water and the surcharge of combined sewers is considered to be low.

Since the proposed surface water drainage strategy represents an improvement in surface water flood risk, both to the site and the adjacent land, it is considered that the requirements for development within CDAs outlined within Policy DM26 of the LBH Development Management DPD is satisfied.

Foul water from the proposed development is proposed to be discharged to the existing TW foul sewers at a peak rate of 13.32 l/s, which represents a significant increase from the estimated foul water discharge from the existing site. A pre-development enquiry has been submitted for the new foul water discharge rate. A response from TW regarding the proposed drainage strategy is being awaited. However, since all surface water is proposed to be discharged to a dedicated surface water sewer and there are no known issues associated with lack of capacity of the existing TW foul water sewer network, the risk of flooding from the foul sewers is considered to be low.

There are no documented records of groundwater flooding within the proposed development site according to the LBH SWMP and the SFRA. The site is located in an area with increased potential for elevated groundwater. However, no basements are proposed as part of the development and the risk of groundwater flooding to the proposed development is considered to be low.

The map showing the risk of flooding from reservoirs, produced by the EA, indicates that the site is not located within the maximum extent of flooding that would occur if an upstream reservoir were to fail. The risk of flooding caused by the failure of a reservoir is therefore considered to be low and mitigation is not required.

The overall approach to flood risk management is considered to be in accordance with the requirements of Policy SP5 of the LBH Strategic Policies DPD and Policy DM24 of the LBH Development Management DPD.

It is concluded that the risk of flooding from all sources, for the entire design life is considered to be low and that the proposed development will not increase the risk of flooding elsewhere. Moreover, it is considered that the inclusion of the installation of SuDS within the proposed development will reduce the risk associated with surface water flooding.

# Appendix A Planning Practice Guidance Tables

**Table 1: Flood zones**

(Note: These flood zones refer to the probability of river and sea flooding, ignoring the presence of defences)

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Zone 1 - low probability</b></p> <p><b>Definition</b><br/>This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (&lt;0.1%).</p> <p><b>Appropriate uses</b><br/>All uses of land are appropriate in this zone.</p> <p><b>Flood risk assessment requirements</b><br/>For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a flood risk assessment. This need only be brief unless the factors above or other local considerations require particular attention.</p> <p><b>Policy aims</b><br/>In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems<sup>1</sup>.</p> |
| <p><b>Zone 2 - medium probability</b></p> <p><b>Definition</b><br/>This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.</p> <p><b>Appropriate uses</b><br/>Essential infrastructure and the water-compatible, less vulnerable and more vulnerable uses, as set out in table 2, are appropriate in this zone. The highly vulnerable uses are only appropriate in this zone if the Exception Test is passed.</p> <p><b>Flood risk assessment requirements</b><br/>All development proposals in this zone should be accompanied by a flood risk assessment.</p> <p><b>Policy aims</b><br/>In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage systems.</p>                                                                                                        |
| <p><b>Zone 3a - high probability</b></p> <p><b>Definition</b><br/>This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (&gt;1%), or a 1 in 200 or greater annual probability of flooding from the sea (&gt;0.5%) in any year.</p> <p><b>Appropriate uses</b><br/>The water-compatible and less vulnerable uses of land (table 2) are appropriate in this zone. The highly vulnerable uses should not be permitted in this zone.</p> <p>The more vulnerable uses and essential infrastructure should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood.</p>                                                                                                                                                                                                                                                                                                                                                        |

<sup>1</sup> Sustainable drainage systems cover the whole range of sustainable approaches to surface drainage management. They are designed to control surface water run off close to where it falls and mimic natural drainage as closely as possible.

**Flood risk assessment requirements**

All development proposals in this zone should be accompanied by a flood risk assessment.

**Policy aims**

In this zone, developers and local authorities should seek opportunities to:

- reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems;
- relocate existing development to land in zones with a lower probability of flooding; and
- create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.

**Zone 3b - the functional floodplain****Definition**

This zone comprises land where water has to flow or be stored in times of flood.

Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood in an extreme (0.1%) flood, should provide a starting point for consideration and discussions to identify the functional floodplain.

**Appropriate uses**

Only the water-compatible uses and the essential infrastructure listed in table 2 that has to be there should be permitted in this zone. It should be designed and constructed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows; and
- not increase flood risk elsewhere.

Essential infrastructure in this zone should pass the Exception Test.

**Flood risk assessment requirements**

All development proposals in this zone should be accompanied by a flood risk assessment.

**Policy aims**

In this zone, developers and local authorities should seek opportunities to:

- reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems;
- relocate existing development to land with a lower probability of flooding.

**Table 2: Flood risk vulnerability and flood zone 'compatibility'**

| Flood risk vulnerability classification (see table 2) |                               | Essential infrastructure | Water compatible | Highly vulnerable       | More vulnerable         | Less vulnerable |
|-------------------------------------------------------|-------------------------------|--------------------------|------------------|-------------------------|-------------------------|-----------------|
| Flood zones (see table 1)                             | Zone 1                        | ✓                        | ✓                | ✓                       | ✓                       | ✓               |
|                                                       | Zone 2                        | ✓                        | ✓                | Exception test required | ✓                       | ✓               |
|                                                       | Zone 3a                       | Exception test required  | ✓                | x                       | Exception test required | ✓               |
|                                                       | Zone 3b functional floodplain | Exception test required  | ✓                | x                       | x                       | x               |

**Key:**

- ✓ Development is appropriate.
- x Development should not be permitted.

**Notes to table 2 :**

This table does not show:

- a. the application of the Sequential Test which guides development to Flood Zone 1 first, then Zone 2, and then Zone 3;
- b. flood risk assessment requirements; or
- c. the policy aims for each flood zone.

### Annex 3: Flood risk vulnerability classification

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Essential infrastructure</b> <ul style="list-style-type: none"><li>• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.</li><li>• Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.</li><li>• Wind turbines.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Highly vulnerable</b> <ul style="list-style-type: none"><li>• Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding.</li><li>• Emergency dispersal points.</li><li>• Basement dwellings.</li><li>• Caravans, mobile homes and park homes intended for permanent residential use<sup>2</sup>.</li><li>• Installations requiring hazardous substances consent<sup>3</sup>. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as “essential infrastructure”)<sup>4</sup>.</li></ul>       |
| <b>More vulnerable</b> <ul style="list-style-type: none"><li>• Hospitals.</li><li>• Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.</li><li>• Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.</li><li>• Non-residential uses for health services, nurseries and educational establishments.</li><li>• Landfill and sites used for waste management facilities for hazardous waste<sup>5</sup>.</li><li>• Sites used for holiday or short-let caravans and camping, <i>subject to a specific warning and evacuation plan</i>.<sup>6</sup></li></ul>                                                                                                                                                                                                                                                  |
| <b>Less vulnerable</b> <ul style="list-style-type: none"><li>• Police, ambulance and fire stations which are <i>not</i> required to be operational during flooding.</li><li>• Buildings used for shops, financial, professional and other services,</li><li>• restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in “more vulnerable”, and assembly and leisure.</li><li>• • Land and buildings used for agriculture and forestry.</li><li>• • Waste treatment (except landfill and hazardous waste facilities).</li><li>• • Minerals working and processing (except for sand and gravel working).</li><li>• • Water treatment works which do not need to remain operational during times of flood.</li><li>• • Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).</li></ul> |

<sup>2</sup> For any proposal involving a change of use of land to a caravan, camping or chalet site, or to a mobile home site or park home site, the Sequential and Exception Tests should be applied.

<sup>3</sup> See Circular 04/00: *Planning controls for hazardous substances* (paragraph 18) at: [www.communities.gov.uk/publications/planningandbuilding/circularplanningcontrols](http://www.communities.gov.uk/publications/planningandbuilding/circularplanningcontrols)

<sup>4</sup> In considering any development proposal for such an installation, local planning authorities should have regard to planning policy on pollution in the National Planning Policy Framework

<sup>5</sup> For definition, see *Planning for Sustainable Waste Management: Companion Guide to Planning Policy Statement 10* at [www.communities.gov.uk/publications/planningandbuilding/planningsustainable](http://www.communities.gov.uk/publications/planningandbuilding/planningsustainable)

<sup>6</sup> See footnote 3

### **Water-compatible development**

- Flood control infrastructure.
- Water transmission infrastructure and pumping stations.
- Sewage transmission infrastructure and pumping stations.
- Sand and gravel working.
- Docks, marinas and wharves.
- Navigation facilities.
- Ministry of Defence defence installations.
- Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
- Water-based recreation (excluding sleeping accommodation).
- Lifeguard and coastguard stations.
- Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

### **Notes to Annex 3**

a. This classification is based partly on Department for Environment, Food and Rural Affairs and Environment Agency research on *Flood Risks to People (FD2321/TR2)*<sup>7</sup> and also on the need of some uses to keep functioning during flooding.

b. Buildings that combine a mixture of uses should be placed into the higher of the relevant classes of flood risk sensitivity. Developments that allow uses to be distributed over the site may fall within several classes of flood risk sensitivity.

c. The impact of a flood on the particular uses identified within this flood risk vulnerability classification will vary within each vulnerability class. Therefore, the flood risk management infrastructure and other risk mitigation measures needed to ensure the development is safe may differ between uses within a particular vulnerability classification.

---

<sup>7</sup> See website for further details. [www.defra.gov.uk/science/Project\\_Data/DocumentLibrary/FD2320\\_3364\\_TRP.pdf](http://www.defra.gov.uk/science/Project_Data/DocumentLibrary/FD2320_3364_TRP.pdf)

Sigrid Moeller  
Buro Happold Limited  
17 Newman Street  
London  
W1T 1PD  
UK

T: +44 (0)207 927 9700

F: +44 (0)870 787 4145

Email: [Sigrid.Moeller@burohappold.com](mailto:Sigrid.Moeller@burohappold.com)