

NORTHUMBERLAND DEVELOPMENT PROJECT **HOTEL**

S73 APPLICATION

FLOOD RISK ASSESSMENT

Northumberland Development Project Hotel S73 Application

Flood Risk Assessment

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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 prepared on behalf of Tottenham Hotspur Property Company Limited ("THFC") ("the Applicant") in support of an application for minor material amendments to the London Borough of Hackney ("LBH") made under Section 73 ("S73") ("S73 Application") of the Town and Country Planning Act 1990 (as amended), following the grant of planning permission for the Northumberland Park Development Project ("NDP") ("the Site") on 15 April 2016 (LPA ref HGY/2015/3000).

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) Development Plan Documents (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 NDP Hotel site is mainly located within Flood Zone 1 with a small section of the site boundary to the west within Flood Zone 2. The hotel itself is located within Flood Zone 1. The nearest watercourse is the River Moselle, approximately 35m to the west of the site. This watercourse is classified as a Main River, which is understood to flow below ground in a culvert, from north to south along the alignment of High Road.

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 sleeping accommodation, which is classified as *More Vulnerable*. The proposed commercial and service uses, alongside the parking, the hard and soft landscaping and associated works, are considered *Less Vulnerable* in accordance with the NPPF.

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, though part of the north-east of the site has an area of *low* risk of surface water flooding.

Surface water from the site is separated into two catchments. The surface water at podium level is proposed to be drain via a series of ACO drainage channels before flowing to the network at ground level which also receives the surface runoff from the hard landscape at ground level, this then discharging to the 225mm Thames Water (TW) sewer in Park Lane via an existing connection to MH0001. It is proposed for the NDP Hotel catchment to discharge at the previously agreed discharge rate of 4.4l/s to the TW network at MH9006, whilst making additional allowance for attenuation to accommodate the 1 in 100 year + 40% climate change storm event. A surface water attenuation tank is required underneath the proposed raised planters in the vehicle drop off area on Park Lane.

Foul water is proposed to be discharged at a peak rate of 10.93 l/s, which represents an increase of 10.93 l/s as the NDP Hotel site currently does not have any foul water flows. The foul drainage is proposed to be discharge to the existing 1000mm TW sewer on Park Lane at MH0001E. TW were consulted as part of the wider NDP development, which accounted for foul discharge from the future hotel construction at this location as part of the original drainage strategy. 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. At the time of writing, a response is yet to be received.

With the proposed Drainage Strategy in place, the risk of flooding from surface water and the surcharge of combined 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 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. It is therefore recommended that the proposed basement is constructed watertight to prevent the risk of groundwater ingress.

The map showing the risk of flooding from reservoirs, produced by the EA, indicates that the southern sections of the site are located within the maximum extent of flooding that would occur if an upstream reservoir were to fail. Consideration should therefore be given to the active and passive flood risk mitigation for the basement. The risk of flooding caused by the failure of a reservoir is however considered to be low.

2 Introduction

2.1 Background

This site-specific FRA has been prepared by Buro Happold as part of planning application for the site known as the NDP Hotel, hereafter referred to as the 'proposed development'. This assessment has been developed in accordance with the 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.

The NDP Hotel site is part of a wider development known as the Northumberland Development Project. Full planning permission was granted for demolition works and construction of Plot 1 (The Stadium), Plot 2 (The Tottenham Experience) and Plot 3 (Hotel), and outline planning permission for Plot 4 (The Extreme Sports Building), Plot 5 (The Residential Building and Flexible B1/D1 Space) and Plot 6 (The Community Health Building). An FRA was submitted and consented in 2010 (URS) and a later assessment was submitted for planning in 2015 (AECOM), building on the previous FRA. The NDP Hotel is however a stand-alone planning application, and this FRA has therefore been developed to assess only the NDP Hotel site itself and reflect changes in policy and guidance.

2.2 Site Description

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

The site comprises 11,246 m² for residential purposes, inclusive 460 m² of amenity space, and 16,132 m² for the NDP Hotel, inclusive of bar/restaurants, music recording studio, gym and all-day dining.

The levels across the site range from approximately 2.8mAOD to the north of the site to 11.1mAOD in the south-east of the site according to the Environment Agency (EA) LiDAR data (see Figure 2-2). It should be noted that the LiDAR data is from 2019 and therefore reflects the new THFC Stadium, but later developments on the podium level within the NDP Hotel site are not captured in accordance with a topographic survey from High Road and Park Lane. The LiDAR data gives an indication of levels for the two roads in proximity of the site and the surrounding areas.

The nearest watercourse is the River Moselle, approximately 35m to the west of the site. This watercourse is classified as a Main River, which is understood to flow below ground in a culvert, from north to south along the alignment of High Road.

The online GeoIndex tool produced by the BGS indicates that the bedrock geology underlying the site is the London Clay Formation. The superficial deposits are made up of Kempton Park Gravel Member.

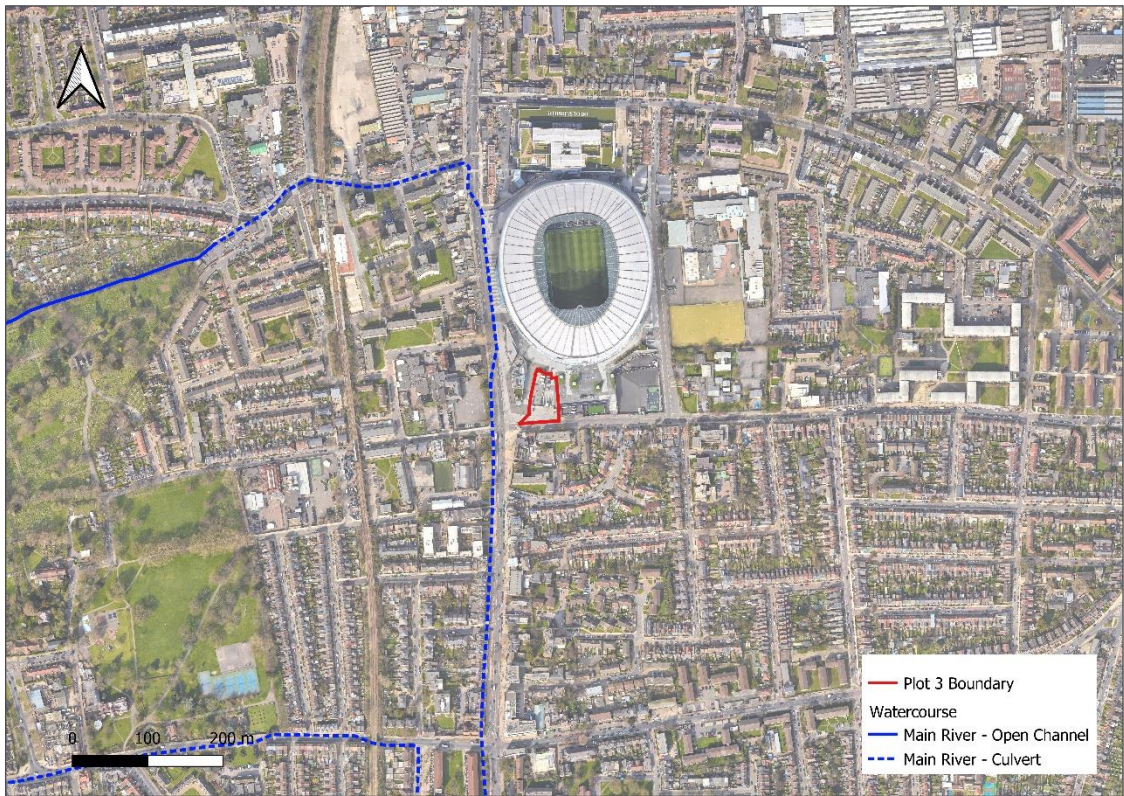


Figure 2-1: Site location plan



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

2.3 Proposed Development

Planning Permission was granted for the NDP on 15 April 2016 (LPA ref HGY/2015/3000). This 'Hybrid Consent' gave full planning permission for Plot 1 (The Stadium), Plot 2 (The Tottenham Experience) and Plot 3 (Hotel) and outline planning permission for Plot 4 (The Extreme Sports Building), Plot 5 (The Residential Buildings and Flexible B1/D1 Space) and Plot 6 (The Community Health Building).

Plots 1 and 2 have been built out and various reserved matters have been approved for other plots.

This application is to bring forward revised proposals for the hotel building (originally approved in full). The revisions are intended to enhance the deliverability of the proposals and help them to better respond to the revised future context in the local area.

The proposed development is described as follows:

Application under Section 73 of the Town and Country Planning Act for variations to Condition A4 (Consented Drawings and Documents) and Condition A7 (Maximum Quantity/Density) of the hybrid planning permission HGY/2015/3000 (as amended) for the proposed demolition and comprehensive redevelopment of the Northumberland Park Development Project (the amendments consist of revisions to the design, height and maximum floorspace at Plot 3 Hotel and other changes).

This Section 73 Application will seek to vary Conditions A4 and A7 of the NDP Hybrid Consent, approved on 15 April 2016 (LPA ref. HGY/2015/3000). It relates solely to Plot 3 (Hotel) and proposes the following amendments to the approved scheme for Plot 3:

- Changes to the building form and layout of the building
- Increase to the height of the building (an increase of approximately 17 metres to 117 metres)
- An increase in the area of the communal areas without any changes to the maximum permitted number of hotel bedrooms (no.180) or dwellings (no.49) in the hotel. The overall floorspace of the hotel building would increase 18,820 sq.m. to 26,388 sq.m.

The NDP Hotel development contains residential units and hotel accommodation, alongside commercial uses such as bars, restaurants and clubs. See Table 2-1 for a summary. In addition to this, parking areas and public realm is also included as part of the proposal.

Table 2-1: Summary of Proposed Development

Use	Floorspace (m ²) (GIA)	Hotel Rooms / Units
Hotel	16,132 (incl Commercial)	180
Commercial (Bar, Restaurant, Club)	2,549	-
Residential	11,246	49

Within the site boundary, indicated by a red line Figure 2-3, it is illustrated how the NDP Hotel only takes up a certain amount of the site boundary at the podium level with public realm to the south.

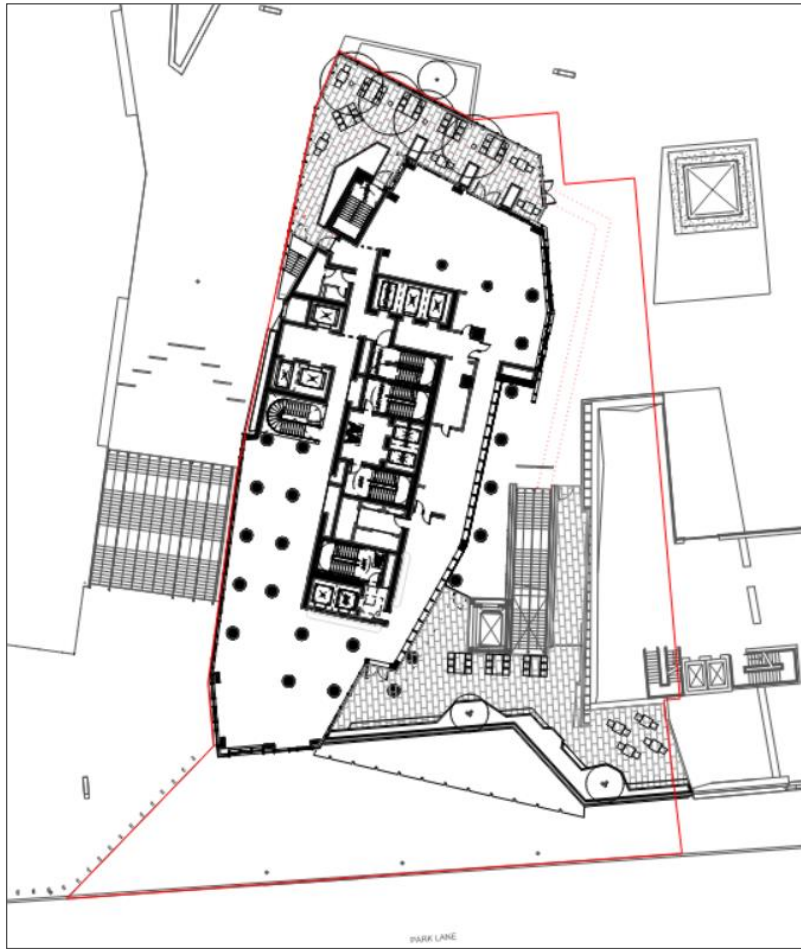


Figure 2-3: Landscape General arrangement Podium Level (source: Arup, 27888002-ARP-01-DR-L-15102)

3 Planning Context

3.1 Overview

This 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 NPPF¹ aims to avoid inappropriate development in areas at highest risk of flooding. The Planning Practice Guidance² to the NPPF contains a series of tables that help identify the risk of flooding to a development, see Appendix A 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)).

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

² Ministry of Housing, Communities & Local Government, Flood Risk and Coastal Change, March 2014
<https://www.gov.uk/guidance/flood-risk-and-coastal-change> (Accessed 9th 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 July 2021) 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 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:

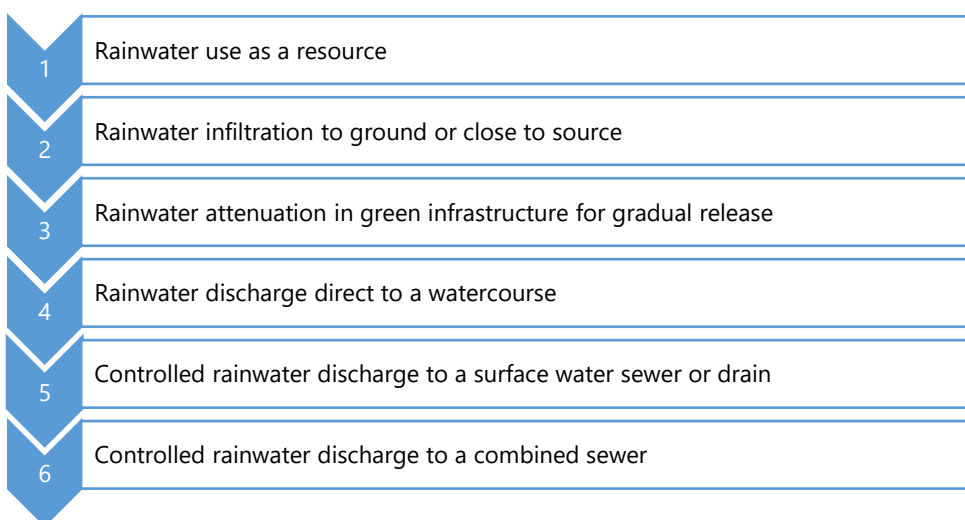


Figure 3-1: Drainage hierarchy

The London Plan makes reference to the Mayor's Regional Flood Risk Appraisal (MRFRA) and requests that this is used alongside the SFRA as well as the Local Flood Risk Management Strategies. The MRFRA document can be used, 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. This document has also been referred to as part of this FRA.

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 EA shows that the proposed development lies mostly within Flood Zone 1. A section to the south-east of the site is just within Flood Zone 2. Only public realm is proposed within this section. See Figure 2-3 and 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%. Flood Zone 2 is defined as an area with an annual probability of flooding from rivers or the sea between 1% and 0.1%.

By definition, the risk of flooding from rivers or the sea in Flood Zone 1 is classified as low. The risk of flooding from river and the sea in Flood Zone 2 is classified as medium. As the hotel itself is located within Flood Zone 1, the focus of this FRA will therefore be on the management of surface water run-off and the risk of flooding from other sources, in line with EA guidance.

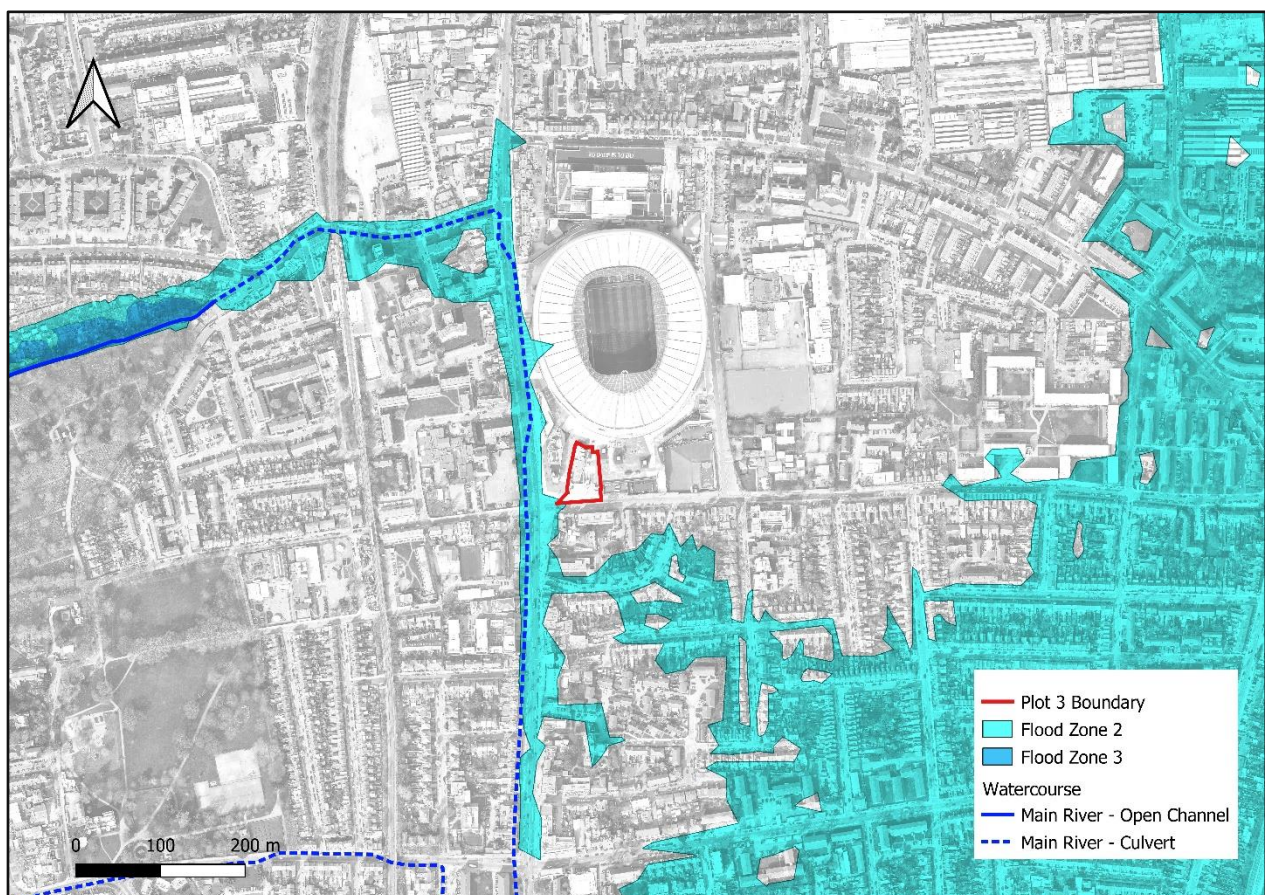


Figure 4-1: Flood Map for Planning, Flood Zone 2 and 3 (Environment Agency data)

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 contains a hotel, which are classified as *More Vulnerable*. Parking areas and public open space are further classified as *Less Vulnerable* within the NPPF. All of the above land uses are considered appropriate for the corresponding Flood Zone, 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 35m to the west 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 and High Road. For the sections of the proposed development 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 north-east of the site has an area of *low* risk of surface water flooding. This area corresponds to localised depressions in the topography between existing buildings where localised ponding of surface water may occur. Parts of High Road and Park Lane 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. It should be noted that the EA surface water map has been produced prior to developments in the area and the surface water flood map therefore reflects a different configuration of buildings than what is currently present on the surrounding area of the site. However, even with changes in levels implemented as part of the wider proposal there is unlikely to be any change in major conveyance routes along the roads, as shown in Figure 4-2. Therefore, the risk from surface water to the site is understood to be low.

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). It is therefore important that surface water is managed to not increase the risk of flooding elsewhere.

The existing site consists almost entirely of impermeable paving. 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.

As part of the wider NDP Development the discharge rate for the NDP Hotel was agreed in principle with the Environment Agency and TW stipulated that the discharge would be restricted by the capacity of the existing connections.

The existing surface water discharge rate for the Hotel area is estimated to be **4.4 l/s**. See the 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 Drainage Strategy surface water will be managed separately from foul water. Within the boundary of the S73 variation for the hotel, the surface water drainage strategy for the hard landscaped areas on the ground level 00 and podium level 01 remains unchanged with these areas proposed to drain via a series of ACO drainage channels at podium level before discharging to the network at ground level before discharge to the 225mm TW sewer in Park Lane at Outfall 06. Material changes to the locations of the ACO drainage channels to pick up the surface water runoff in these areas are to change to accommodate the hotel development, but the fundamental catchment area and discharge locations remain unchanged.

It is proposed for the hotel to discharge at the previously agreed discharge rate of 4.4l/s to the TW network whilst making additional allowance for attenuation to accommodate the 1 in 100 year + 40% climate change storm event.

An initial storage volume estimate indicates that approximately 61m³ of attenuation is required to restrict surface water from the hotel development site to 4.4l/s.

Table 4-2 provides a summary of the proposed surface water drainage strategy. Further details are provided in the 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 ³)
NDP Hotel	225mm sewer in Park Lane	4.4	61

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

There are currently no foul water flows from the site.

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 units within the hotel and associated services.

The estimated peak foul water discharge rates from the NDP Hotel site is **10.93 l/s**. This will be discharged to the existing infrastructure installed as part of the NDP development in 2019. See the Drainage Strategy, Buro Happold, for further details.

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 as there are no foul water flows from the site currently. TW were consulted as part of the wider NDP which accounted for foul discharge from the future hotel construction at this location as part of the original drainage strategy. 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. At the time of writing, a response is yet to be received from TW on the latest pre-development 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 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 Kempton Park Gravel Member and the Enfield Silt member.

The London Regional Flood Risk Appraisal³ contains a map showing areas with increased potential for elevated groundwater (see Figure 4-3). The site is close to an area with increased potential for elevated groundwater. As a basement is included in the proposal it is recommended that this is constructed to be watertight to remove the risk of ingress from groundwater. 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.

³ Greater London Authority (2018). *London Regional Flood Risk Appraisal*.

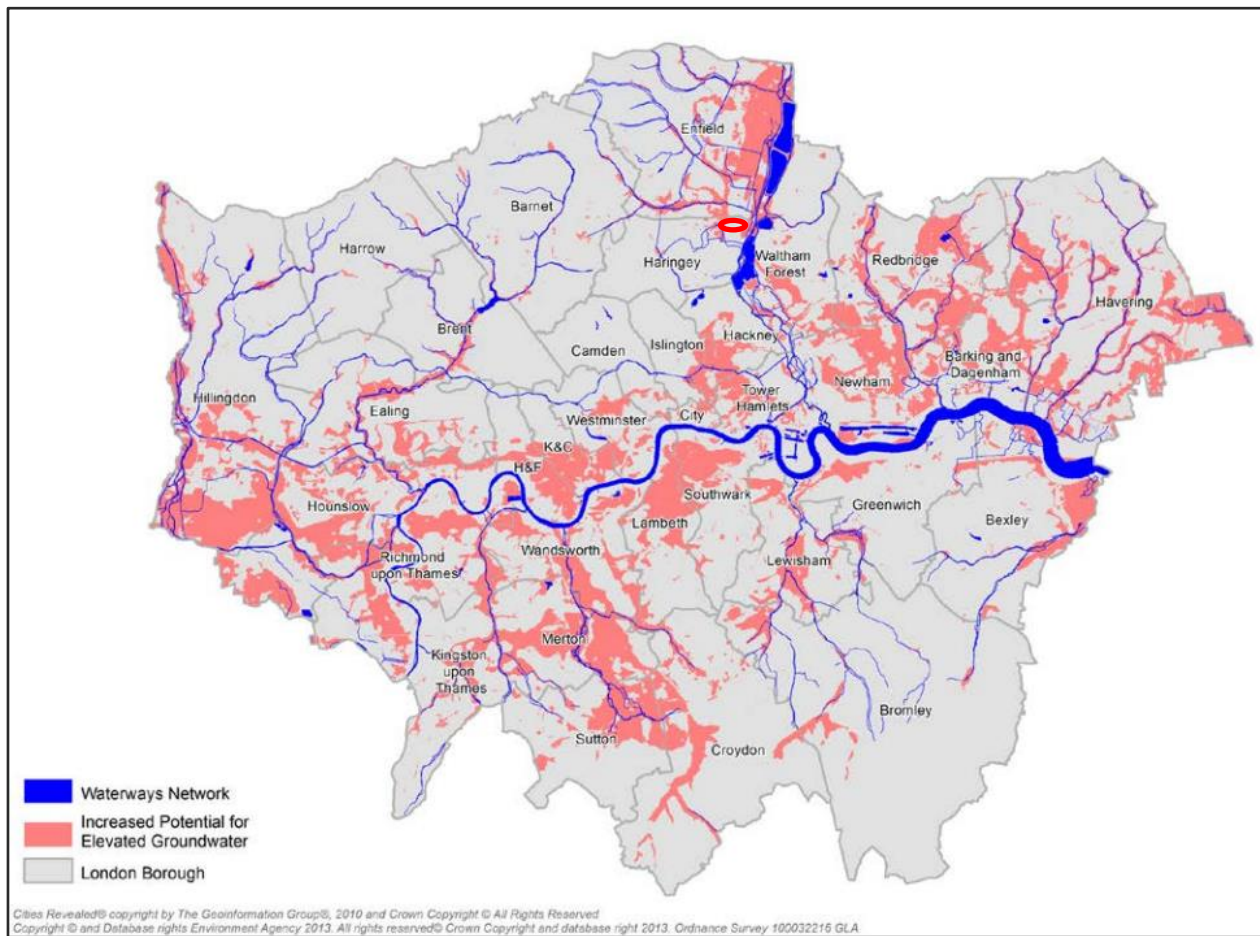


Figure 4-3: Increased Potential for Elevated Groundwater (Greater London Authority)

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 southern parts of the site are just at the edge of the area considered within the maximum extent of flooding if an upstream reservoir failed. The proposal does not include *More Vulnerable* land use within the basement, ground floor or first floor. However, utilities are proposed within the basement. To ensure functioning of the building during an unlikely reservoir breach event, consideration should be given to passive flood risk mitigation measures, such as watertight doors to utility rooms. However, as can be seen in Figure 4-5 the site is mainly affected when there is also flooding from rivers.

Reservoirs must be maintained in accordance with the Reservoir Act 1975 and the Flood and Water Management Act 2010. The latter made changes to the Reservoir Act 1975 and introduced a more risk-based approach to reservoir regulation. The probability of reservoir failure is considered unlikely as reservoirs are required to be inspected and maintained.

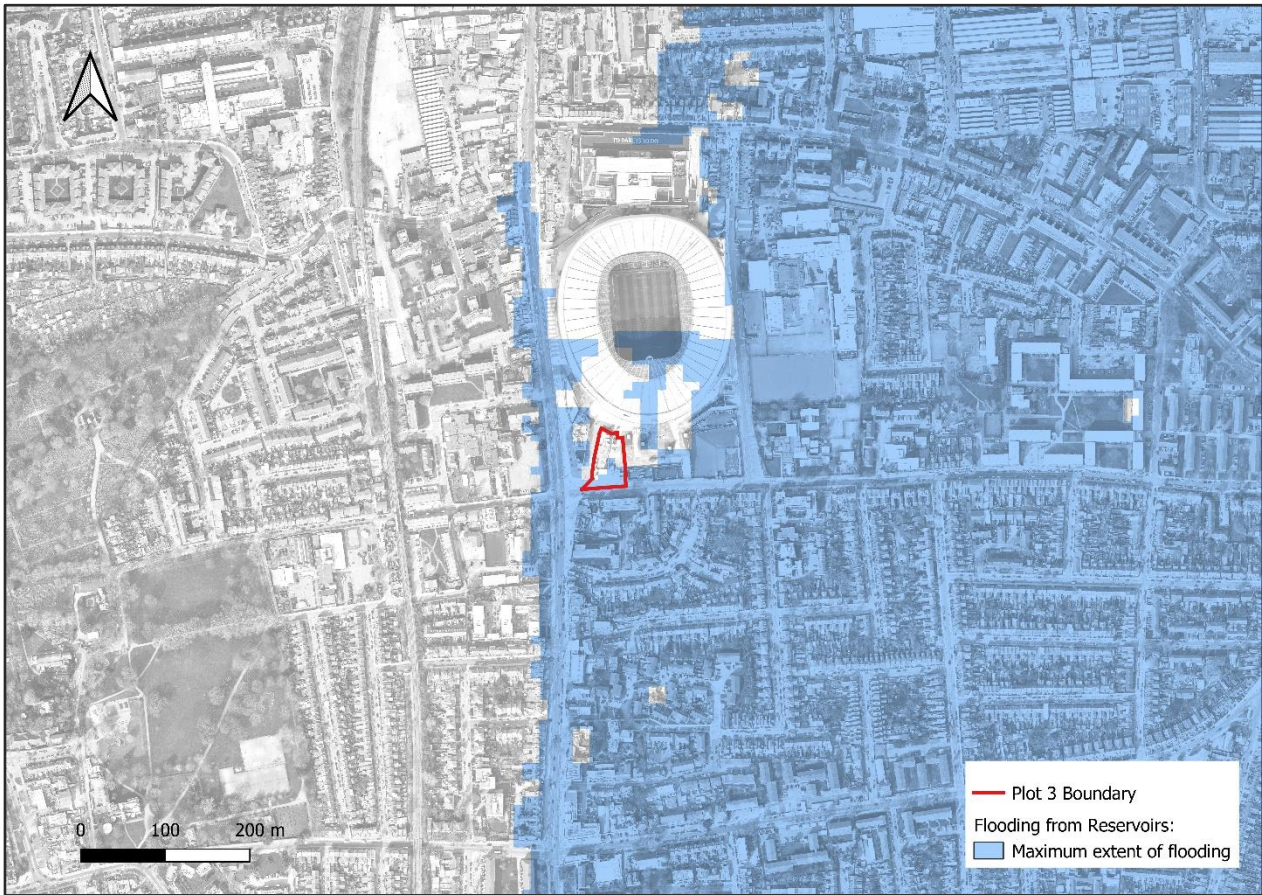
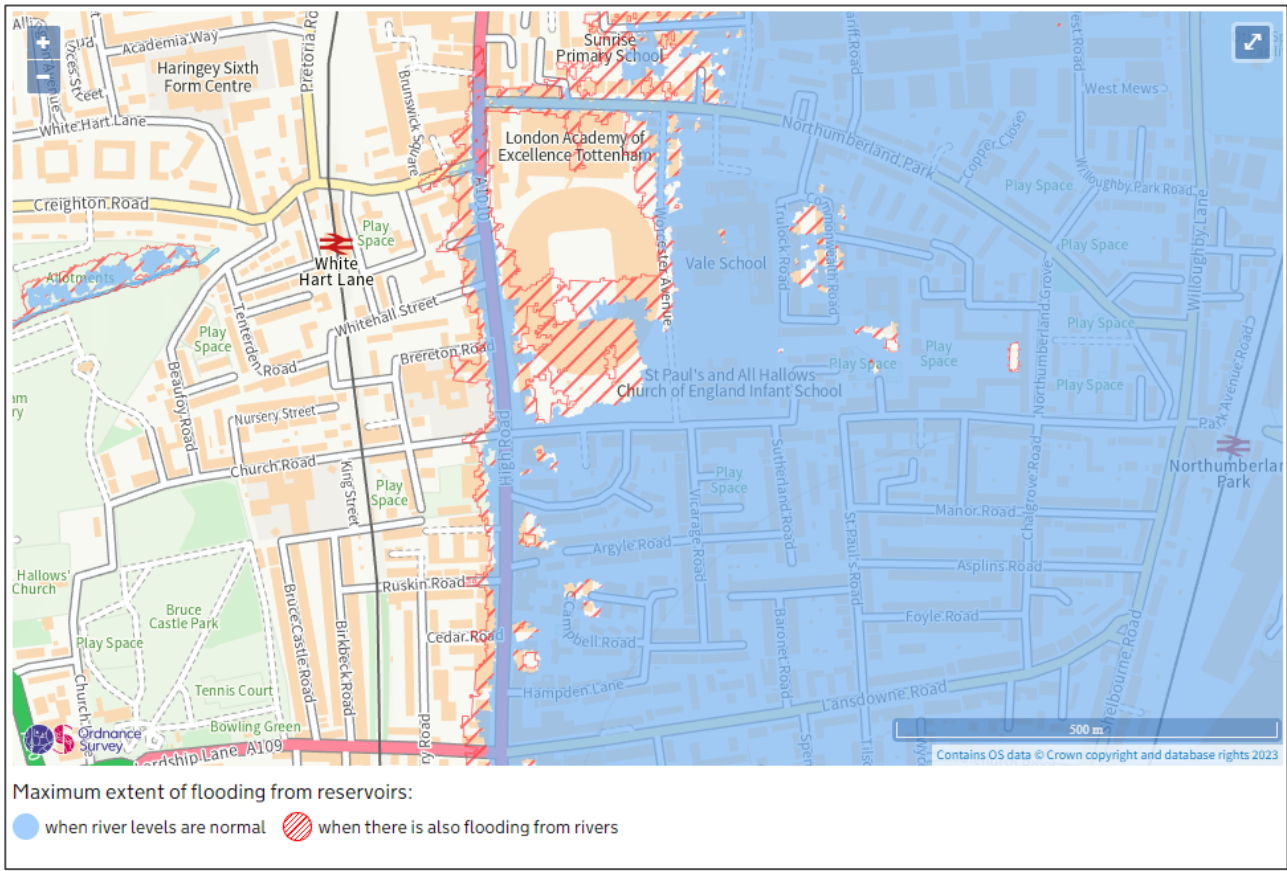


Figure 4-4: Maximum extent of flooding from reservoir failure (Environment Agency data)



5 Summary and Conclusion

This FRA has been carried out as part of the planning application for the development known as NDP Hotel (Plot 3 in the wider application). The proposed development will provide hotel accommodation and residential units, alongside commercial units, basement parking and public realm.

According to the national flood map produced by the Environment Agency (EA), the NDP Hotel site is mainly located within Flood Zone 1 with a small section of the site boundary to the west within Flood Zone 2. The hotel itself is located within Flood Zone 1. The nearest watercourse is the River Moselle, approximately 35m to the west of the site. This watercourse is classified as a Main River, which is understood to flow below ground in a culvert, from north to south along the alignment of High Road.

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 sleeping accommodation, which is classified as *More Vulnerable*. The proposed commercial and service uses, alongside the parking, the hard and soft landscaping and associated works, are considered *Less Vulnerable* in accordance with the NPPF. The public realm is considered appropriate for the small section of the site that is within Flood Zone 2.

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, though part of the north-east of the site has an area of *low* risk of surface water flooding.

Surface water is proposed to be discharged by drain via a series of ACO drainage channels at podium level before discharging to the network at ground level before discharge to the 225mm TW sewer in Park Lane at Outfall 06. It is proposed for the hotel to discharge at the previously agreed discharge rate of 4.4l/s to the TW network whilst making additional allowance for attenuation to accommodate the 1 in 100 year + 40% climate change storm event.

Foul water is proposed to be discharged at a peak rate of 10.93 l/s, which represents an increase of 10.93 l/s as the NDP Hotel currently does not have any foul water flows. The foul drainage is proposed to be discharged to the existing infrastructure installed as part of the NDP infrastructure constructed in 2019. TW were consulted as part of the wider NDP development, which accounted for foul discharge from the future hotel construction at this location as part of the original drainage strategy. 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. At the time of writing, a response is yet to be received.

There are no documented records of groundwater flooding within the proposed development site according to the LBH Surface Water Management Plan (SWMP). 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. It is therefore recommended that the proposed basement is constructed watertight to prevent the risk of groundwater ingress.

The map showing the risk of flooding from reservoirs, produced by the EA, indicates that the southern sections of the site are located within the maximum extent of flooding that would occur if an upstream reservoir were to fail. Consideration should therefore be given to passive flood risk mitigation for the basement to ensure the functioning of the building in an unlikely event of reservoir failure. The risk of flooding caused by the failure of a reservoir is however considered to be low.

It is concluded that the actual risk of flooding from all sources, for the entire design life is considered to be low when required mitigation measures are included 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)

Zone 1 - low probability Definition This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%). Appropriate uses All uses of land are appropriate in this zone. Flood risk assessment requirements 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. Policy aims 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 systems¹.
Zone 2 - medium probability Definition 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. Appropriate uses 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. 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.
Zone 3a - high probability Definition This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year. Appropriate uses 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. 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.

¹ 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

Essential infrastructure • Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly vulnerable • Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use². • Installations requiring hazardous substances consent³. (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”)⁴.
More vulnerable • Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non-residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste⁵. • Sites used for holiday or short-let caravans and camping, <i>subject to a specific warning and evacuation plan</i>.⁶
Less vulnerable • Police, ambulance and fire stations which are <i>not</i> required to be operational during flooding. • Buildings used for shops, financial, professional and other services, • restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in “more vulnerable”, and assembly and leisure. • • Land and buildings used for agriculture and forestry. • • Waste treatment (except landfill and hazardous waste facilities). • • Minerals working and processing (except for sand and gravel working). • • Water treatment works which do not need to remain operational during times of flood. • • Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).

² 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.

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

⁴ 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

⁵ For definition, see *Planning for Sustainable Waste Management: Companion Guide to Planning Policy Statement 10* at www.communities.gov.uk/publications/planningandbuilding/planningsustainable

⁶ 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)*⁷ 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.

⁷ See website for further details. www.defra.gov.uk/science/Project_Data/DocumentLibrary/FD2320_3364_TRP.pdf

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