

TFL_PSF_9131 SITE INVESTIGATIONS: SMALL SITES INITIATIVE QUEENSBURY CAR PARK, HARROW, HA8 6AT

Flood Risk Review

JANUARY 2020



Queensbury Car Park, Harrow, HA8 6AT

Flood Risk Review

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Executive Summary

The site (Queensbury Station Car Park) is part of TfL Small Sites Initiative, and hence may be considered for potential future redevelopment.

Flood risk to the site from all potential sources has been considered in this Flood Risk Review. The site is located in Flood Zone 1 on the Environment Agency (EA) Flood Map for Planning (Rivers and the Sea) and therefore has a 'very low' risk of flooding from rivers and the sea, equivalent to an annual chance less than 1 in 1,000 (0.1%). However, the site is shown to be at 'high' risk of surface water flooding according to the EA Risk of Flooding from Surface Water map. Areas at high risk of surface water flood risk such as this are defined in the West London Strategic Flood Risk Assessment (SFRA) as being located within Flood Zone 3a (surface water) and treated as such with regards to planning policy.

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

According to the SFRA, a Flood Risk Assessment (FRA) would be necessary to support future redevelopment of the site due to its location in Flood Zone 3a (surface water). The Planning Practice Guidance indicates that the site would be suitable for most types of development, including residential uses subject to a detailed assessment and passing the appropriate planning tests (requirement dependant on proposed use).

On the basis of this review, flood risk from surface water is considered to be a potential constraint to development at the site. Further investigation and consultation with London Borough of Brent is recommended to support any planning application at the site.

Alongside an FRA, a Drainage Strategy should also be prepared to support future redevelopment of the site to ensure that proposals meet national and local requirements and off-site flood risk is not increased as a result of redevelopment proposals.

1 Introduction

1.1 Background

Arcadis Consulting (UK) Limited ('Arcadis') has been commissioned by Transport for London (TfL) ('the Client') to undertake technical surveys for the eastern half of Queensbury Station Car Park, HA8 6AT ('the Site'). The site is on the boundary between London Borough of Brent and London Borough of Harrow.

TfL is aiming to divest a number of small sites to enable regeneration. The aim of this flood risk review is to assess the flood risk status of the site and confirm the suitability for various forms of development on the site, including residential.

1.2 Aim and Objectives

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

Specific objectives of the Flood Risk Review are to:

- Review available sources of published flood risk data, supplemented by targeted data collection/consultation with the Environment Agency (EA) and the applicable Lead Local Flood Authority (LLFA).¹
- Consider all relevant forms of flood risk (e.g. rivers, the sea, surface water, groundwater and artificial sources), with a risk rating assigned (e.g. HIGH, MEDIUM, LOW) to each form of flooding.
- Confirm the site's Flood Zone designation and consider National Planning Policy Framework (NPPF)² acceptability in accommodating residential development, with reference to the Sequential and Exception Tests.

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

1.3 Data Sources

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

- EA lidar topographic data (1m tile tq1889) (Ref. 1)
- EA Long Term Flood Risk Maps, including the 'Risk of Flooding from Rivers and Sea Map', 'Risk of Flooding from Surface Water Map' and 'Risk of Flooding from Reservoirs Map' (Ref. 2)
- EA 'Flood Map for Planning (Rivers and Sea)' (Ref. 3)
- EA 'Recorded Flood Outlines' dataset (Ref. 4)
- West London Strategic Flood Risk Assessment (SFRA) (Ref. 5)
- London Borough of Brent (LBB) Flood Risk Management Strategy (FRMS) (Ref. 6)
- LBB Surface Water Management Plan (SWMP) (Ref. 7)
- LBB Preliminary Flood Risk Assessment (PFRA) (Ref. 8)
- LBB PFRA Addendum (Ref. 9)
- British Geological Survey (BGS) Geology of Britain Viewer (Ref. 10)
- Defra Magic Maps (for EA Aquifer Designations) (Ref. 11)

¹ A request has been sent to the LLFA for flood information that they may hold for the site and a response is currently pending. It is recommended that the findings of this review are revisited once a response has been received.

² A summary of NPPF requirements with respect to flood risk is included in Appendix A.

1.4 Terminology

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

1.5 Limitations

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2 Site Overview

2.1 Site Description

The site is located at approximate National Grid Reference TQ 18826 89807 within the urban setting on the border between the London Boroughs of Brent and Harrow. It occupies an area of approximately 0.09 hectares (ha) and is roughly rectangular on plan, as illustrated in Figure 1.

The site is bounded to the north by Turner Road, to the east by commercial properties and Queensbury underground station, to the south by the railway line, embankment and associated infrastructure and to the west by additional car parking. The land coverage currently comprises hardstanding car parking.



Figure 1 - Site Location (site outlined in red)

Contains Ordnance Survey data © Crown copyright and database right 2020

2.2 Site Topography

LiDAR data, shown in extract in Figure 2, indicates that the site slopes down to the south with typical levels ranging 47.6m Above Ordnance Datum (AOD) in the north to 46.3m AOD in the south.

Off-site, ground levels generally slope down to the south, however, the rail embankment that is located along the southern boundary of the site is at least 4m above the site ground levels (circa. 52m AOD). Cumberland Road runs perpendicular to the railway embankment, passing beneath the railway line. The underpass has a level of 45.7m AOD at the crossing with the road sloping down in a southerly direction following local topography.

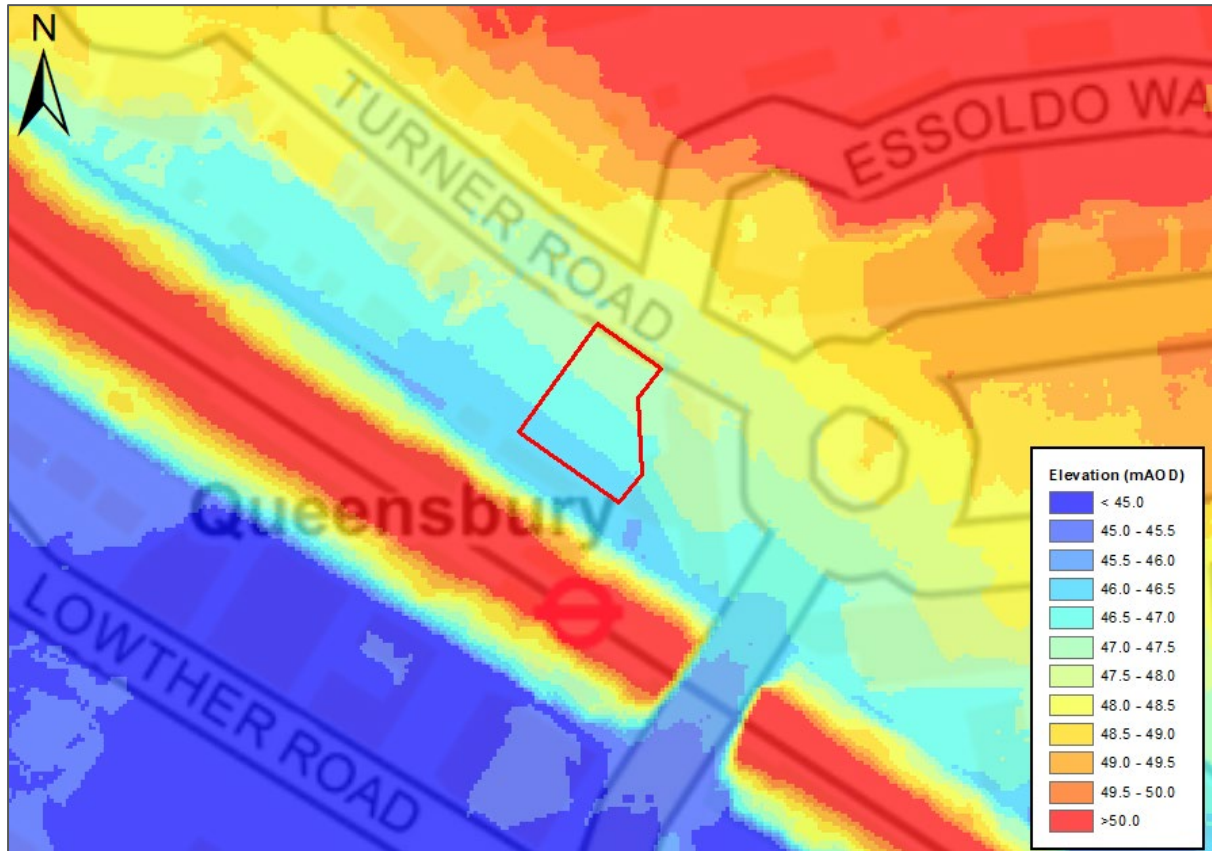


Figure 2 – Site Topography (filtered LiDAR data; site boundary outlined in red)

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3 Sources of Flood Risk

3.1 Flooding from Rivers and the Sea

Catchment Overview

The site is located within the catchment of the Wealdstone Brook, which drains a total area of approximately 25,000km² to its confluence with the River Brent, 4km southeast of the site.

The Kenton Brook, an EA classified Main River, is located 300m south of the site where it flows in a southerly direction as an open channel for 650m to Kenton Road at which point it enters a culverted section for a further 500m prior to discharging into the Wealdstone Brook.

Flood Mapping

The Risk of Flooding from Rivers and Sea Map is informed by the EA National Flood Risk Assessment (NaFRA), which takes account of flood defence survey information and modelled river levels, factoring in a risk of overtopping of failure of raised defences where they exist, to provide a probabilistic assessment of flooding on a relatively coarse 50m grid. The Flood Map for Planning (Rivers and Sea), which is intended to inform the planning process, does not account for the impact of flood defences, but is created using detailed flood modelling (where available). The map also shows areas benefitting from defences. Extracts of these maps are shown in Figure 3 and Figure 4 respectively.

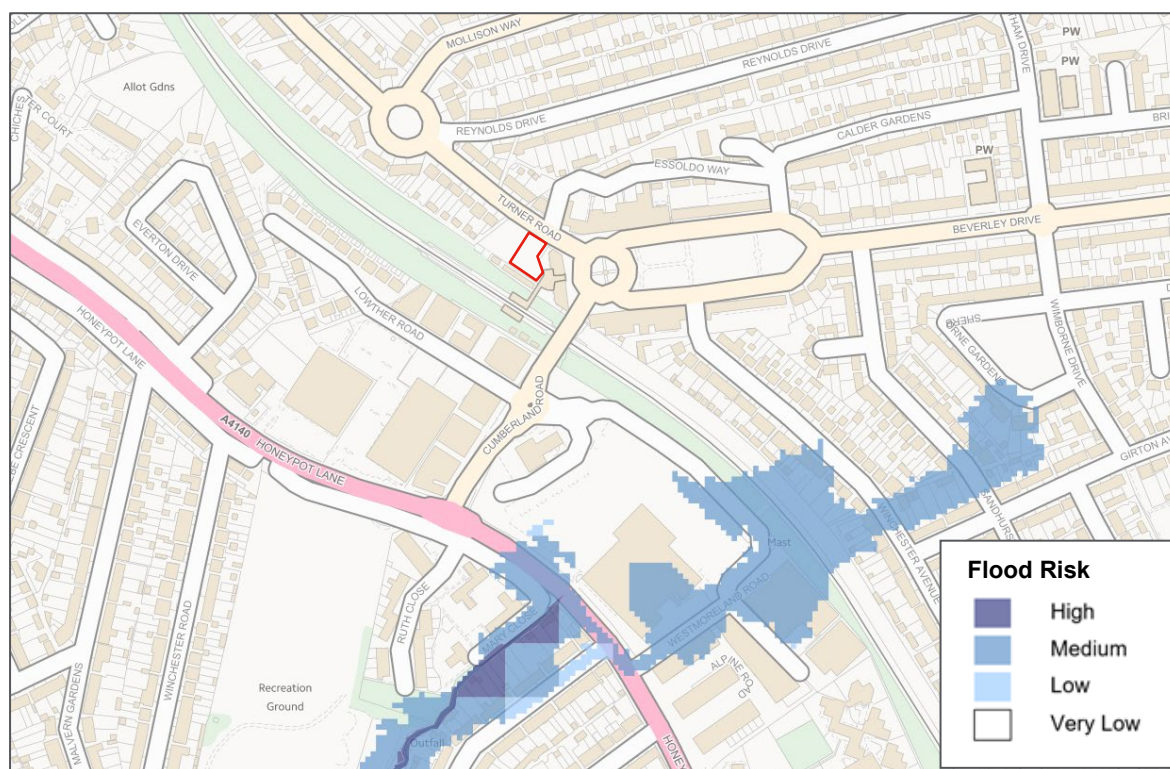


Figure 3 – Risk of Flooding from Rivers and Sea Map

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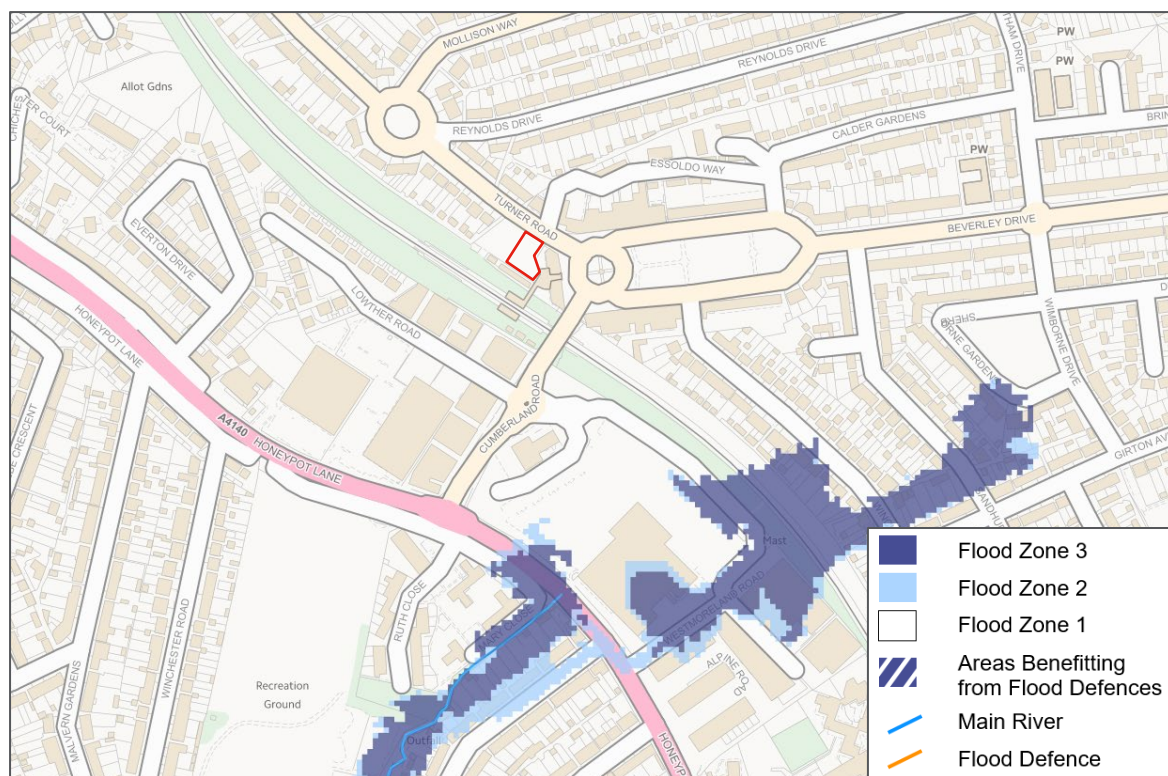


Figure 4 – Flood Map for Planning (Rivers and Sea)

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The Risk of Flooding from Rivers and Sea Map estimates the risk of flooding to the site to be ‘very low’, equivalent to an annual chance of flooding less than 1 in 1000 (0.1%).

The Flood Map for Planning (Rivers and Sea) shows the site is located in Flood Zone 1, equivalent to an annual chance of flooding which is less than 1 in 1000 (0.1%).

Historical Flooding

Mapping in the PFRA and SFRA shows that there are no records of fluvial flooding at the site and this is corroborated by the EA’s Recorded Flood Outline dataset.

Flood Defences

There are no formal flood defences in the vicinity of the site.

The site is considered to have a ‘very low’ risk of flooding from rivers and the sea, and this form of flooding is not considered to pose an onerous risk to the site in the context of its potential future redevelopment.

3.2 Flooding from Surface Water

The EA Risk of Flooding from Surface Water Map is informed by ‘direct rainfall’ modelling undertaken at a high (2m) resolution. It illustrates those areas at elevated risk of surface water flooding in low spots down-gradient of sloping ground or in the topographic valleys associated with current or former watercourses. An extract of the map is shown in Figure 5 below. The modelling used to produce this mapping does not take into account drainage infrastructure.

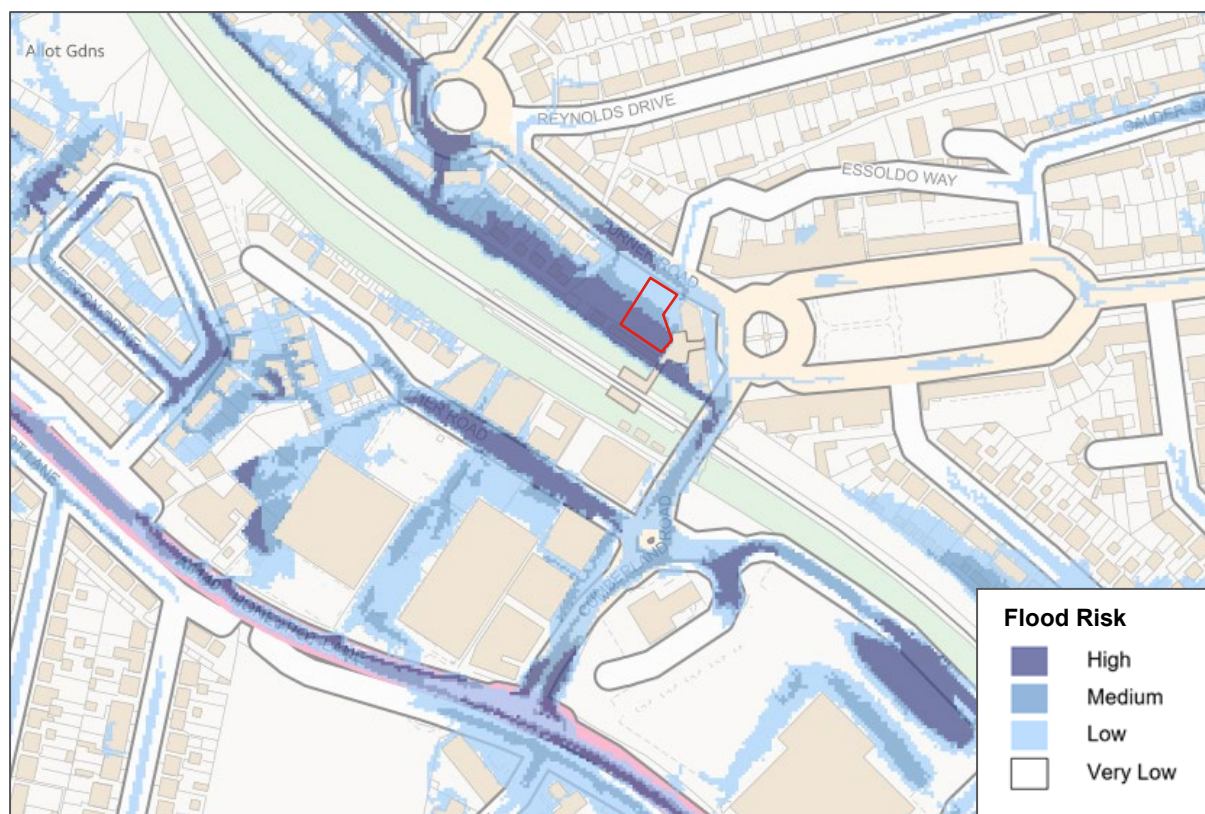


Figure 5 – Risk of Flooding from Surface Water Map

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The map indicates that the site is at 'low', 'medium' and 'high' risk of surface water flooding, following the topography from north to south, corresponding to an annual probability of flooding of 1 in 1000 (0.1%), 1 in 100 (1%) and 1 in 30 (3.33%) respectively. According to the EA mapping, during a 'high' likelihood (1 in 30) event, flood depths across the southern half of the site area expected to be between 300 and 900mm. In the 1 in 100 (1%) year flood event, flood depths on site are expected to be over 900mm in the southern half of the site and up to 900mm in the northern half.

The EA mapping shows that the topography if the area of the site and its surrounds would result in surface water flow routes along Turner Road and running parallel to the railway embankment, from the northwest. Flows then either continues down Turner Road, flowing beneath the railway line via the Cumberland Road underpass directly, or flow onto the site. The railway embankment to the south of the site cuts across the surface water flow path resulting in a build-up of surface water at the site. This water then flows off the site, behind Queensbury Station, before joining the flow at Cumberland Road through the underpass. It has not been possible to identify from available information, such as Google Street View and aerial photography, whether this flow route behind the Queensbury Station would exist or whether the current buildings would block this flow route. If the route is blocked, then surface water flood risk at the site may be increased.

The site is located within a Critical Drainage Area (CDA), which are areas recognised as vulnerable to surface water flooding, as identified within the SWMP. Within the SWMP, it is noted that the primary source of flooding in the Winchester Avenue CDA is from overland flow ponding adjacent to the railway embankment, as shown in the EA Risk of Flooding from Surface Water Map. According to the SWMP, there are two surface water drainage pipes (approximately 1m in diameter) which cross beneath the railway embankment in the CDA, although the exact location of these has not been provided. The presence of any surface water drainage beneath the embankment would likely result in a reduction in ponded flood depths on-site compared to those shown in the EA Risk of Flooding from Surface Water Map, although detailed modelling would be required to assess this. It is recommended that further investigation into drainage infrastructure beneath the railway line is undertaken prior to any development proposal.

The site is not within a Local Flood Risk Zone (LFRZ) which are designated in the SWMP as areas considered to be significant risk of flooding from local (non-main river) sources.

As part of the SFRA, any land within the EA modelled surface water flood risk extent, up to and including the 1 in 100 year (1%) return period, has been classified as Flood Zone 3a (surface water). The SFRA states that any areas of Flood Zone 3 defined within the SFRA should be treated as such with regards to the needs of the NPPF and Planning Policy Guidance (PPG). The site is located within Flood Zone 3a (surface water) and will therefore be subject to the requirement for an FRA for any planning application.

Mapping in the PFRA shows recorded incidents of surface water flooding across the borough. The nearest surface water historic flood incident occurred 300m to the southwest of the site, alongside the railway embankment. This incident occurred in July 2007 during a time of significant floods across the borough and country.

The site is considered to have a 'high' risk of surface water flooding which will require further consideration at planning stage.

3.3 Flooding from Groundwater

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

According to BGS mapping, the site is underlain by London Clay bedrock with no superficial deposits. The London Clay bedrock is classified as 'Unproductive' on account of its low permeability. No superficial deposits are shown beneath the site or recorded in nearby borehole records.

According to the SFRA, the site and surrounds are not located in a zone of Increased Potential for Elevated Groundwater (IPEG). The site is also shown to be within an area considered of low susceptibility (<25%) to groundwater flooding.

Mapping within the PFRA shows a recorded incident of groundwater flooding 550m south of the site. The PFRA states that, overall, the risk of groundwater flooding to the borough is considered low with areas at highest risk are those adjacent to watercourses.

The unproductive nature of the London Clay bedrock, the absence of superficial deposits at the site and distance of the site from any watercourse means that the likelihood of risk of either clearwater flooding or river-groundwater interaction causing groundwater to rise to the surface at the site is remote

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

3.4 Flooding from Artificial Sources

Sewers

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

Mapping in the SFRA shows incidents of flooding from sewers by postcode, therefore, it is not possible to identify if any of the recorded incidents occurred at the site. The mapping shows that there have been between 1 to 20 recorded incidents of sewer flooding in the HA8 6 postal area.

In the absence of site-specific information on sewer flooding, the Risk of Flooding from Surface Water Map can aid understanding. As discussed in Section 3.2, and, in the event of sewer flooding occurring on Turner Road, this would act to direct water towards the site. It is therefore concluded that sewer flooding could pose a risk to the site. However, it is likely that mitigation will be required as part of any new development to address potential surface water flooding issues at the site and these mitigation measures will also reduce the potential risk from sewer flooding.

Reservoirs

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

The review has not identified any other sources of artificial flooding, such as canals, in the vicinity of the site.

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

3.5 Future Redevelopment

There is some ambiguity regarding the Flood Zone classification for this site. Whilst the site is located in EA Flood Zone 1 due to its low risk of flooding from rivers and sea, the SFRA states that any land within the EA modelled surface water flood risk extent, up to and including the 1 in 100 year (1%) return period, would be classified as Flood Zone 3a (surface water) and treated as such with regards to planning policy. Therefore, given the high surface water flood risk at the site, a Flood Risk Assessment (FRA) would be required to support development proposals. According to PPG, the site is suitable for 'Water Compatible' and 'Less Vulnerable' development types but is not suitable for 'Highly Vulnerable' development types on account of its Flood Zone designation.

The Exception Test would need to be satisfied should 'Essential Infrastructure' and 'More Vulnerable' (e.g. residential) uses be proposed. See Appendix A for more information on the PPG and the Sequential and Exception Tests. The requirements of these tests are re-stated in the specific development guidance published in the West London SFRA.

It is recommended that investigations are undertaken to understand the drainage infrastructure beneath the railway embankment. For example, detailed modelling may demonstrate that drainage infrastructure, where present, could cause a reduction in surface water flooding at the site compared to that shown in the EA mapping.

Based on the information reviewed as part of this report, and in the absence of detailed modelling, surface water flooding at the site is a potentially significant constraint on future development. Consultation should be sought with the LBB early in the planning process to understand the level of assessment required within the FRA based on the proposed use of the site. The FRA should demonstrate that any proposed development would not be subject to an unreasonable risk of flooding and would not increase flood risk to third parties.

Surface water drainage and runoff from the site, including available connections with and capacity of the local sewer network, should be investigated with Thames Water. Further investigation should include the calculation of current rainfall-runoff rates and volumes, greenfield runoff rates for the site and confirmation of the available capacity of the local and wider sewer networks. This should be undertaken as part of developing a Drainage Strategy designed to meet the London Plan (Ref. 12, Policy 5.15) requirement that developers should aim to achieve greenfield runoff rates and use Sustainable Drainage Systems (SuDS) unless there are practical reasons for not doing so. LBB provide guidance for the application of SuDS in the West London SFRA which includes a Drainage Strategy checklist to be submitted with any minor or major development. Climate change allowances, detailed in the SFRA, also need to be incorporated into the Drainage Strategy. The suitability of these allowances should be confirmed with LBH during consultation.

Overall, in the absence of detailed modelling, surface water flood risk is considered to be a potential constraint on development at this site and requires further investigation.

4 Summary

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

- There is some ambiguity as to the Flood Zone classification for the site. The site is located in the EA Flood Zone 1 due to the low risk of flooding from rivers and sea, however, the site has a high surface water flood risk, with an annual chance of flooding that is greater than 1 in 30 (3.33%). The SFRA states that areas at high risk of surface water flooding should be classified as Flood Zone 3a (surface water) and treated as such with regards to planning policy.
- According to EA mapping, surface water flooding could pond to depths of between 300mm and 900mm across the southern half of the site during a 'high' likelihood flood event (i.e. 1 in 30 year (3.33%)).
- The potential presence of drainage infrastructure beneath the railway embankment, to the south of the site, means flood risk at the site could be lower than that shown in EA mapping. Further investigations are recommended to further understand the risk prior to development.
- No other sources of flooding are considered to pose an onerous risk of flooding to the site in the context of its potential redevelopment.
- An FRA will be required to support redevelopment proposals on account of the site's location within Flood Zone 3a (surface water). The findings of this Flood Risk Review indicate that surface water flooding has the potential to be a constraint to site development.
- It is recommended that a Drainage Strategy is designed in consultation with LBB and Thames Water and that it includes appropriate allowance for climate change.

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

Table 1 – Summary of Flood Risk by Source

Source of Flooding	Qualitative Flood Risk Rating
Rivers	Very Low
The Sea	Very Low
Surface Water	High
Groundwater	Very Low
Artificial Sources	Low

5 References

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APPENDIX A – Planning Policy and Flood Risk

The National Planning Policy Framework

With regard to flood risk and surface water drainage, the National Planning Policy Framework (NPPF) (Ref. 13) and its accompanying flood risk and coastal change Planning Practice Guidance (PPG) (Ref. 14) set out the Government's planning policy for England and advises on '*how to take account of and address the risks associated with flooding and coastal change in the planning process*'. The principal aim of the NPPF is to achieve sustainable development by accounting for flooding at all stages of the planning process, avoiding inappropriate development in areas at risk of flooding and directing development away from areas where risks are highest. Where development is necessary in areas at risk of flooding, the NPPF aims to ensure it is safe, without increasing flood risk to third parties. Early adoption of, and adherence to, the principles set out in the NPPF with respect to flood risk, can ensure that detailed designs and plans for development take due account of flood risk and the need for appropriate mitigation, if required.

The Sequential and Exception Tests

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

Table A1 – Flood Zones

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

Source: PPG, Flood Risk and Coastal Change

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

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Table A2 – Flood Risk Vulnerability Classification

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

Source: PPG, Flood Risk and Coastal Change

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

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