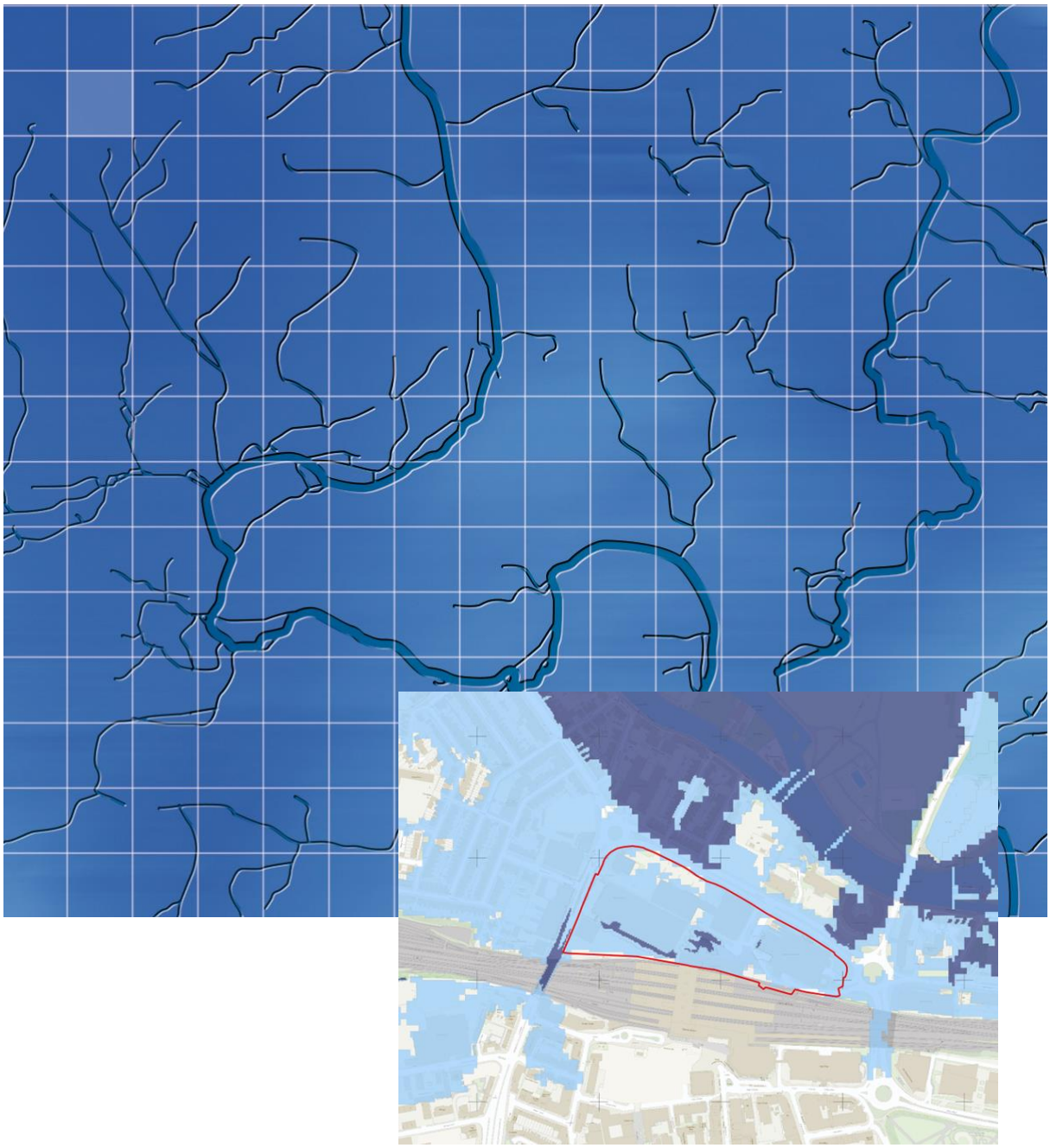
Reading Borough Council

May 2025

North of the Station (CR11e)

Level 2 Strategic Flood Risk Assessment



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North of the Station (CR11e) Level 2 Strategic Flood Risk Assessment

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1.0	02/05/25	Draft	Jasmine Lucas (*Graduate Consultant*)	Daniel Hamilton (*Principal Consultant*)

For and on behalf of Wallingford HydroSolutions Ltd.

The WHS Quality & Environmental Management system is certified as meeting the requirements of ISO 9001:2015 and ISO 14001:2015 providing environmental consultancy (including monitoring and surveying), the development of hydrological software and associated training.

Registered Office Maclean Building, Benson Lane, Wallingford OX10 8BB
www.hydrosolutions.co.uk

North of the Station (CR11e) Level 2 SFRA
Flood Risk Overview

Fluvial Flood Risk	**M**
Pluvial Flood Risk	**M**
Other Sources of Flood Risk	**M**
Confidence in Assessment	**H**

Flood Risk

Fluvial flood risk represents the greatest risk with a significant proportion of the site lying in Flood Zone 2 based on the EA's fluvial flood map. Only a small proportion of the site is located in Flood Zone 3a.

In this location the fluvial flood map is based on detailed modelling in the form of the River Thames model (Pangbourne to Sonning) (2021). The outputs of this model were further assessed and show flood depths and velocities to be moderate. In this respect fluvial flood risk is considered moderate.

The risk from other sources of flooding is considered to be moderate.

The overall confidence in the assessment is high. This is based on the availability of recent detailed modelling in the vicinity of the site.

Conclusions and Recommendations

Overall, a new mixed-use development at the site should be possible, however there are some barriers. The proposed development will consist of both housing (more vulnerable) and employment (less vulnerable) infrastructure. The latter is permissible within Flood Zones 2 and 3a. More vulnerable infrastructure is permissible in Flood Zone 2 but must pass an Exception Test if located in Flood Zone 3a as specified in the latest NPPF. Neither development categorisations are permissible in Flood Zone 3b.

Given that Flood Zone 3a only covers a small proportion of the site, it should be possible to locate the majority of More Vulnerable Development outside of its extent. However, given site levels some infrastructure may need to be raised above the design flood level. If this is the case, the impacts of the raising will need to be assessed to ensure that the development will be safe for its lifetime, without increasing flood risk elsewhere. This will need to consider the current land use on site and how this affects baseline flood risk.

Contents

1 Introduction

1.1 Background

Wallingford HydroSolutions Ltd has been commissioned by Reading Borough Council (RBC) to undertake a Level 2 Strategic Flood Risk Assessment (SFRA) at North of the Station (CR11e) in accordance with the National Planning Policy Framework (NPPF), Planning Practice Guidance (PPG) and associated guidance from the Environment Agency (EA).

Where there is a risk of flooding at the site, this risk has been quantified with the latest available datasets and any associated limitations with the assessment have been identified.

Where applicable, recommendations for improving our understanding of flood risk and/or mitigating the risk has also been included in this report.

1.2 Assessment of Flood Risk

For the site, a detailed assessment of the nature of flood hazard was undertaken. This included using the relevant fluvial modelling data to assess:

- The proportion of the site inundated for a range of return periods
- The speed of onset
- Flood depth
- Flood velocity
- Flood Hazard

The sites were assessed against a range of return periods, however the design event, the 100-year (plus central climate change) event, was considered most important for planning purposes.

In addition to the analysis of modelling data, the location, standard and condition of existing flood defences was assessed. Other sources of flooding were also reviewed at each site. This included an assessment of surface water flooding and an assessment of groundwater flooding based on available hydrogeological information from BGS and Soilscapes. Potential access/egress routes were identified with respect to the risk posed from all sources of flooding.

Following a review of flood risk, flood defences and the identification of access/egress routes, an assessment was made on whether a future site-specific FRA would be able to show that the site can be allocated for development. The assessment takes into account the flood risk vulnerability of the development, the scale of development proposed along with any requirements for the Exception Test. In this context, any mitigative actions in the form of ground raising and compensatory storage are identified.

The site assessments also include guidance for the preparation of FRAs, including information about the use of SuDS.

1.3 Report Structure

This FRA follows the structure summarised below:

1 - Introduction (this section)

2 - Site Description

3 - Flood Risk

4 – Detailed Review of Primary Flood Risk

5 – Development Viability and FRA Recommendations

2 Site Description

2.1 General Location Plan

The North of the Station (CR11e) site is a 6.71 ha site located directly north of Reading station in central Reading, see Figure 1. The site currently consists of a commercial retail park and a large multi-storey car park. It is surrounded by urban land use.

In the Replacement Local Development Plan (RLDP) it is proposed to be used for mixed-use development in the form of commercial, retail, community and leisure, residential, and offices. The Local Plan indicates the development may contain between 1,190-1,790 dwellings and 50,000-80,000 m^2 of offices, retail and leisure.

2.2 Topography

Based on 1m LiDAR data, in general the site slopes slightly from west to east, however there is a sudden change in level along the southern site boundary due to part of the raised railway line, see Figure 2. The ground levels within the site boundary range from 37.3 to 44.0 m AOD. The average ground level is approximately 38.0 m.

2.3 Nearby Watercourses

The site is located approximately 125 m southwest of the River Thames at its closest point. The River Thames runs from northwest to southeast in this part of Reading, see Figure 1. The Local Plan also highlights that Vastern Ditch is culverted beneath the site.

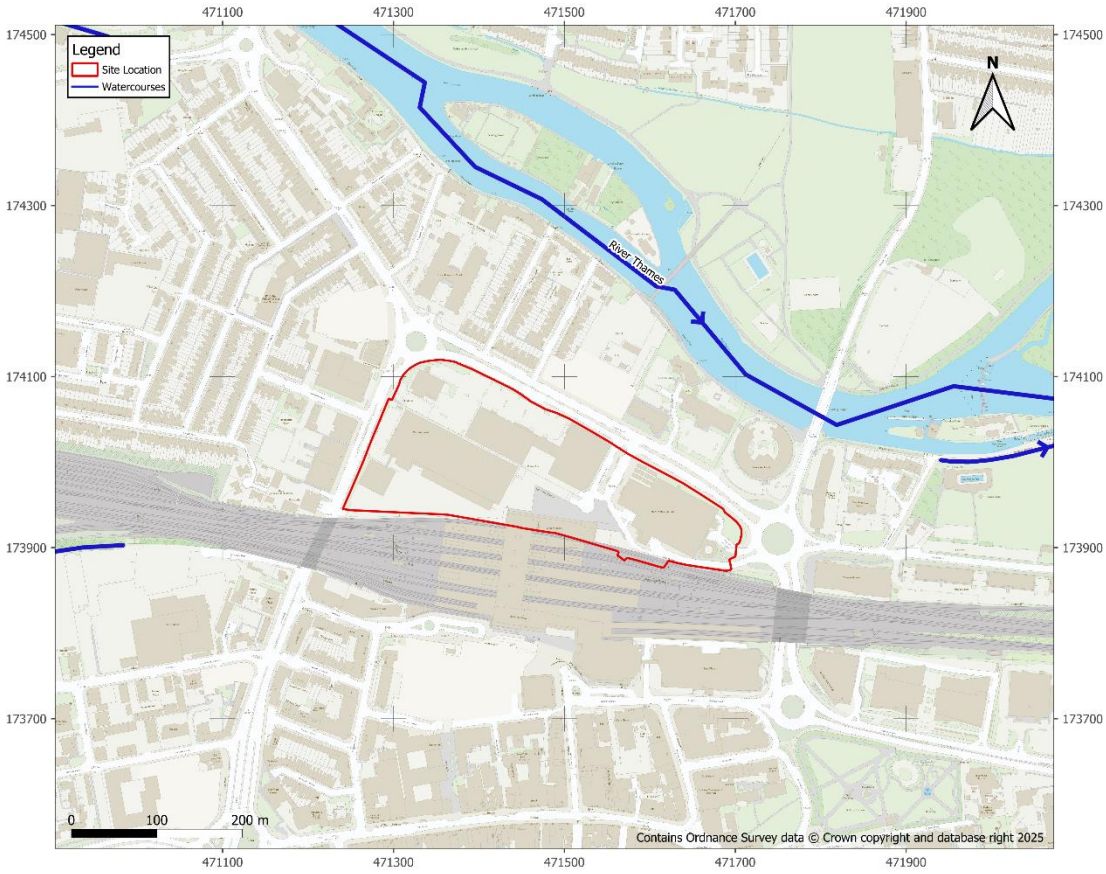

Figure 1 - Site Location

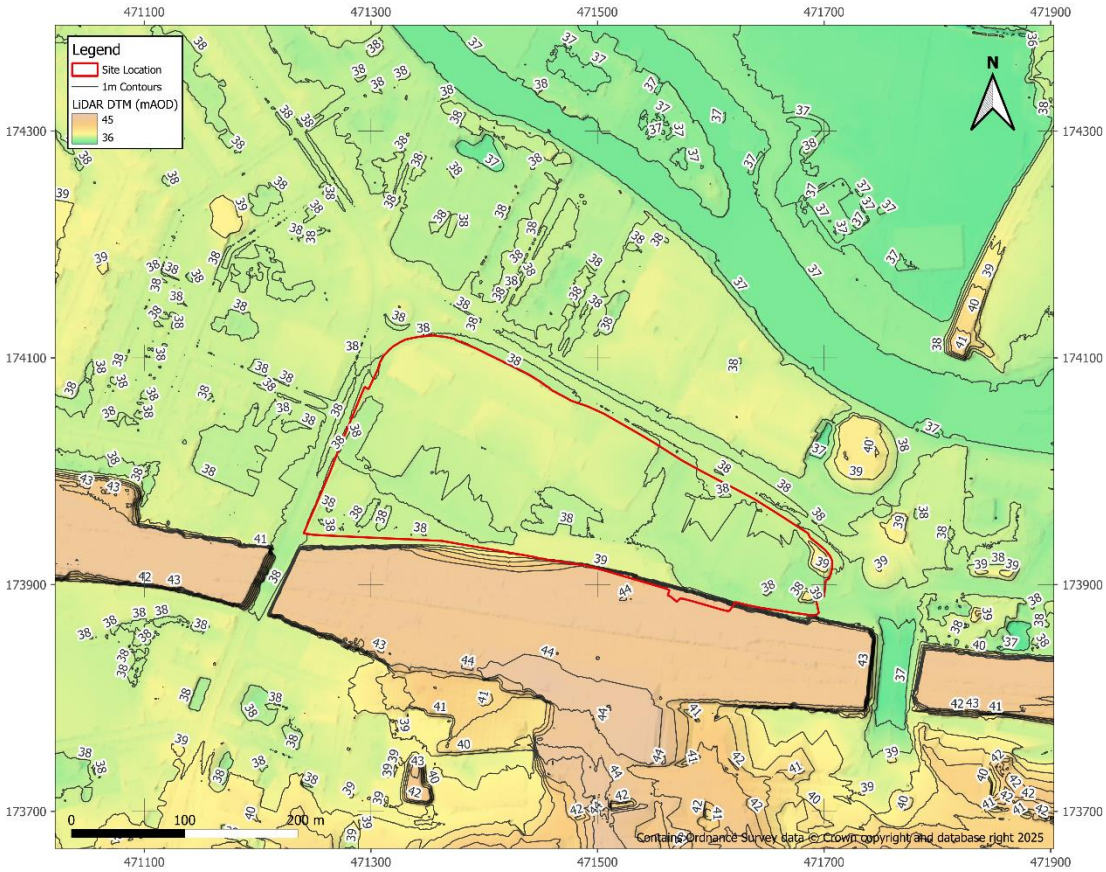

Figure 2 – Topography

3 Flood Risk

3.1 Historical Flooding

The EA has no records of historical flooding at this site.

3.2 Fluvial Flood Risk

In the existing Flood Map for Planning (FMfP), 90% of the site is located within Flood Zone 2, and 4% of the site located in Flood Zone 3a. Viewing the model results for the 3.3% AEP event, none of the site is located in Flood Zone 3b. All flooding at this site is associated with the River Thames, see Figure 3.

The EA climate change fluvial outputs for Flood Zone 2 and 3 have also been assessed. The proportion of the site located in Flood Zone 2 and 3a increases to 99% and 78% respectively, see Figure 4. Fluvial flood risk is considered to be moderate and is assessed in more detail in section 4.

3.3 Flood Defence Infrastructure

There is no formal flood defence infrastructure in the vicinity of the site. The site is not located within an area associated with a reduction in risk of flooding from rivers and sea due to defences.

3.4 Surface Water Flood Risk

The EA's surface water flood map shows parts of the site at surface water flood risk. In total, 7% of the site is inundated in the 3.3% AEP event, 13% is inundated in the 1.0% AEP event and 47% is inundated in the 0.1% AEP event, see Figure 5. When accounting for the effects of climate change, these proportions increase to 11%, 16%, and 52% respectively, see Figure 6.

Overall, the risk of surface water flooding is considered to be moderate given the low proportion of the site at high risk (3.3% AEP).

3.5 Groundwater Flooding

The site is underlain by a bedrock of chalk in the form of the Seaford Chalk formation. It is expected to permit high amounts of infiltration. Superficial deposits of Alluvium and Silt are also present at this site, these are also expected to be freely draining. The underlying soils are acid loamy soils which are also expected to be freely draining.

Based on the data available the water table at the site could be mobile, translating to a moderate risk of groundwater flooding. More data is required at the planning stage to confirm this.

3.6 Reservoir Flood Risk

The FMfP shows that the entire site is at risk from reservoir flooding during the wet day scenario, however the site is not at risk during the dry day scenario, see Figure 7. Whilst the site is shown to be at risk, it should be noted that reservoir failure is a rare event with a very low probability of occurrence. Current reservoir regulations aims to make sure that all reservoirs are properly maintained and monitored to detect and repair any problem.

3.7 Flood Warning Service

The site is located within the River Thames at Reading and Caversham EA Flood Warning Area.

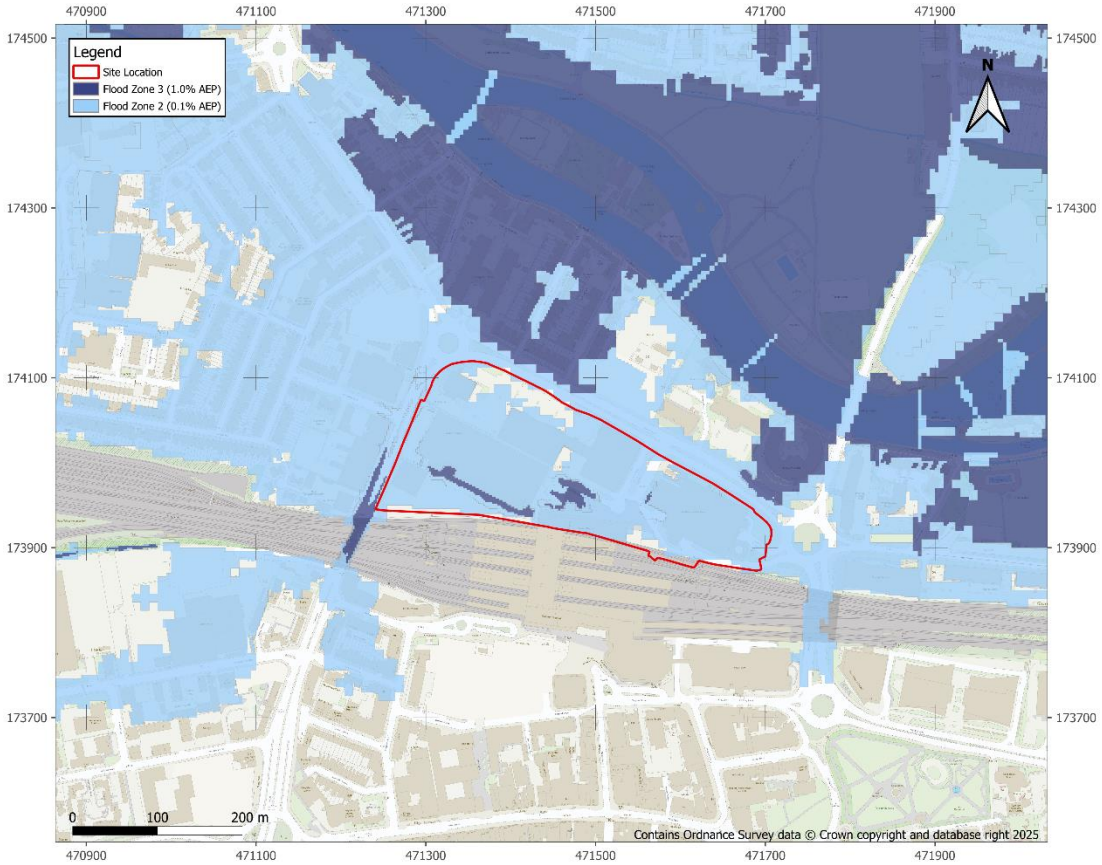

Figure 3 - Fluvial Flood Map

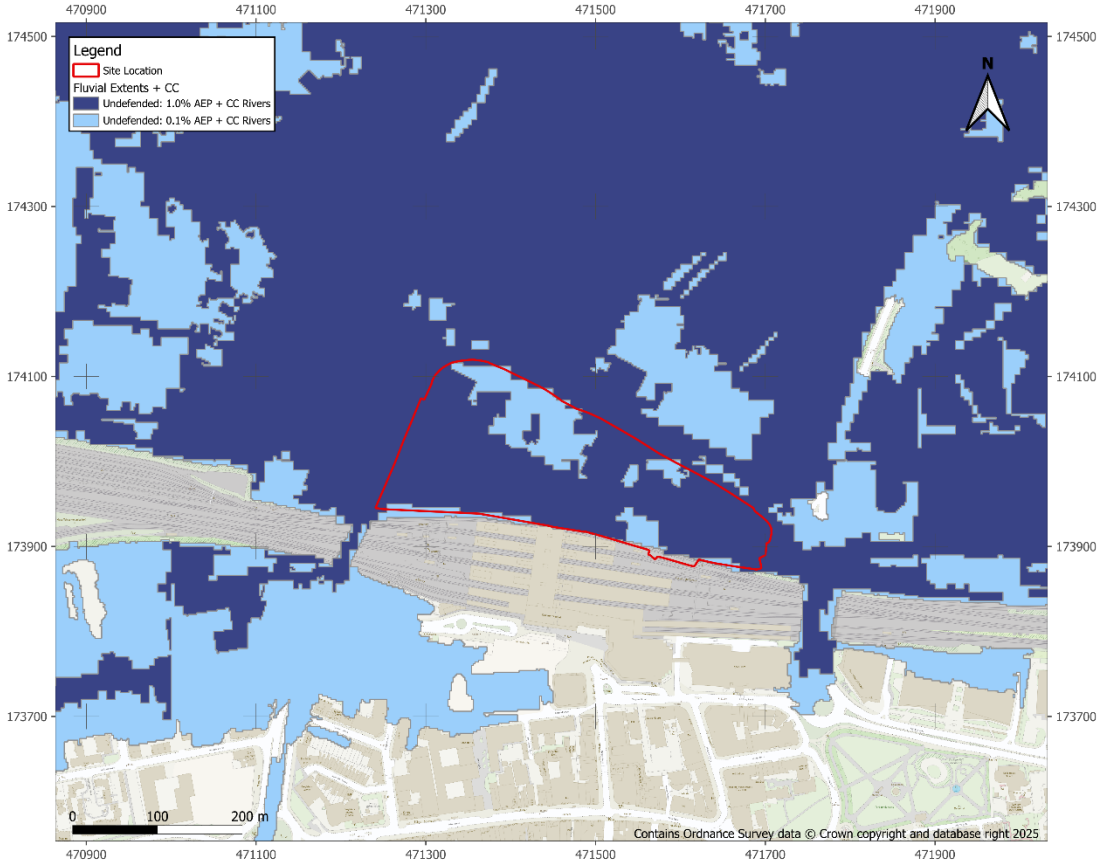

Figure 4 – Fluvial Climate Change Flood Map

Figure 5 – Surface Water Flood Map

Figure 6 -Surface Water Climate Change Flood Map

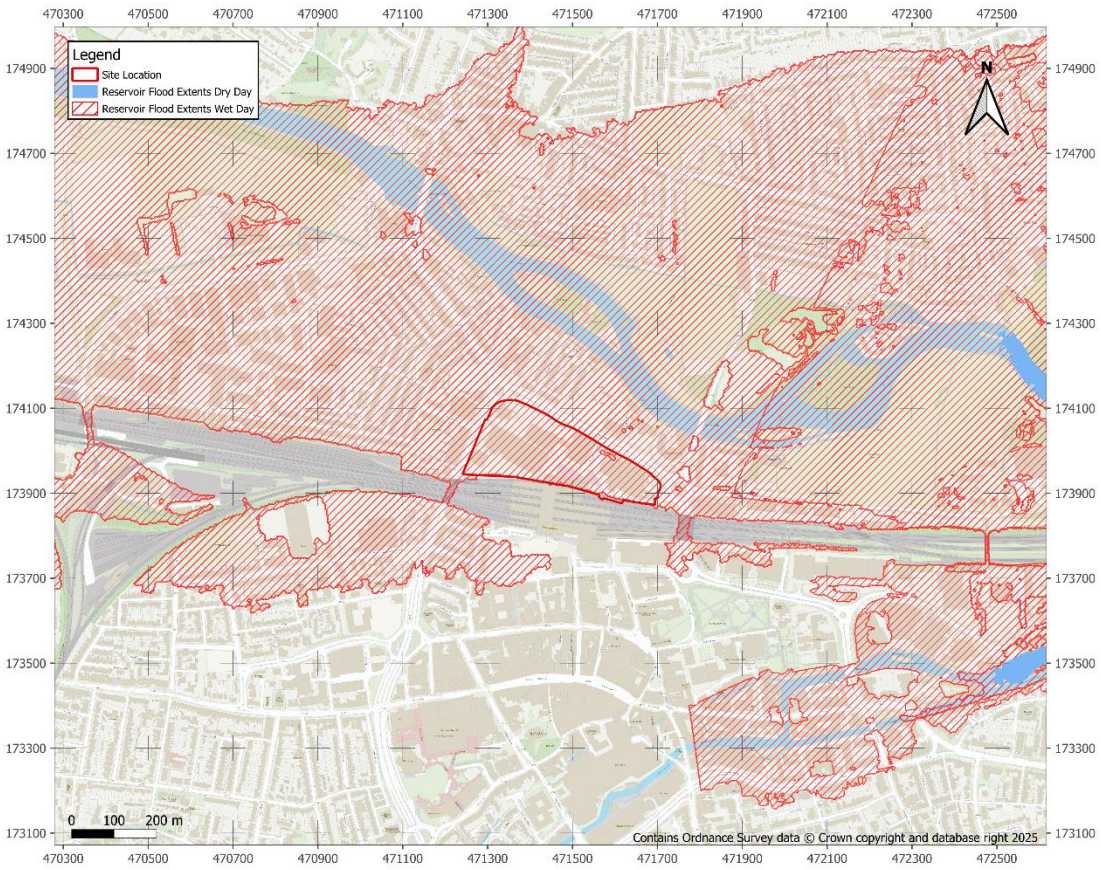

Figure 7 - Reservoir Failure Flood Map

4 Detailed Review of Primary Flood Risk

4.1 Primary Flood Risk

The primary flood risk mechanism at the site is fluvial in origin. The flood risk is quantitively assessed in more detail below.

4.2 Flood Risk Metrics

The River Thames model (Pangbourne to Sonning) (2021) which informs the latest FMfP was assessed to attain further detail on fluvial flooding.

For the 100-yr plus central climate change (31%) design event, the maximum flood level at the site is 38.3 m AOD, slightly higher than the average ground level for the site. The hazard map for this event (see Figure 8) shows that most of the site has a *low* hazard rating however there are areas of *danger for most* in the south and west of the site, indicating higher flood depths and velocities. Table 1 shows the flood risk metrics associated with the design event.

Table 1- Flood Risk Metrics

	Design Event 1.0% AEP (+31%)
Percentage Inundated (%)	73%
Average Flood Depth (m)	0.35 m (Max- 0.78 m)
Average Velocity (m/s)	0.1 m/s (Max – 0.71 m/s)
Speed of Onset (hrs)	191hr

4.3 Access and egress

Given the size of the site there are multiple access points for both vehicles and pedestrians. These include via Bagnall Way to the east, Vastern Road to the north, and Caversham Road to the west. Pedestrians may also access the site via Reading train station to the south.

During an extreme flood event, the safest route for pedestrians would be to cross the rail line via Reading station to reach the area of lower flood risk to the south. Vehicles should leave the site to the east or west onto Vastern Road and Caversham Road respectively. Site users should then follow the respective road south to cross beneath the rail line towards the lower risk areas of Reading. Figure 9 shows the respective vehicle routes dependent on which area of the site users are located.

Parts of this route are inundated by Flood Zone 2 (0.1% AEP) and during the design event. Flood Hazard for the 0.1% AEP event indicates *danger for most*. Therefore, providing adequate flood warning to site users will be vital. In general, the River Thames in this location is slow responding and the site is located in a flood warning area so this should be possible. It is important to also note that parts of the route are also at surface water flood risk, this risk is covered in more detail in the other site-specific considerations section. A site-specific FRA should consider in more detail the nature of the flood risk to determine how quickly it occurs and the degree of hazard.

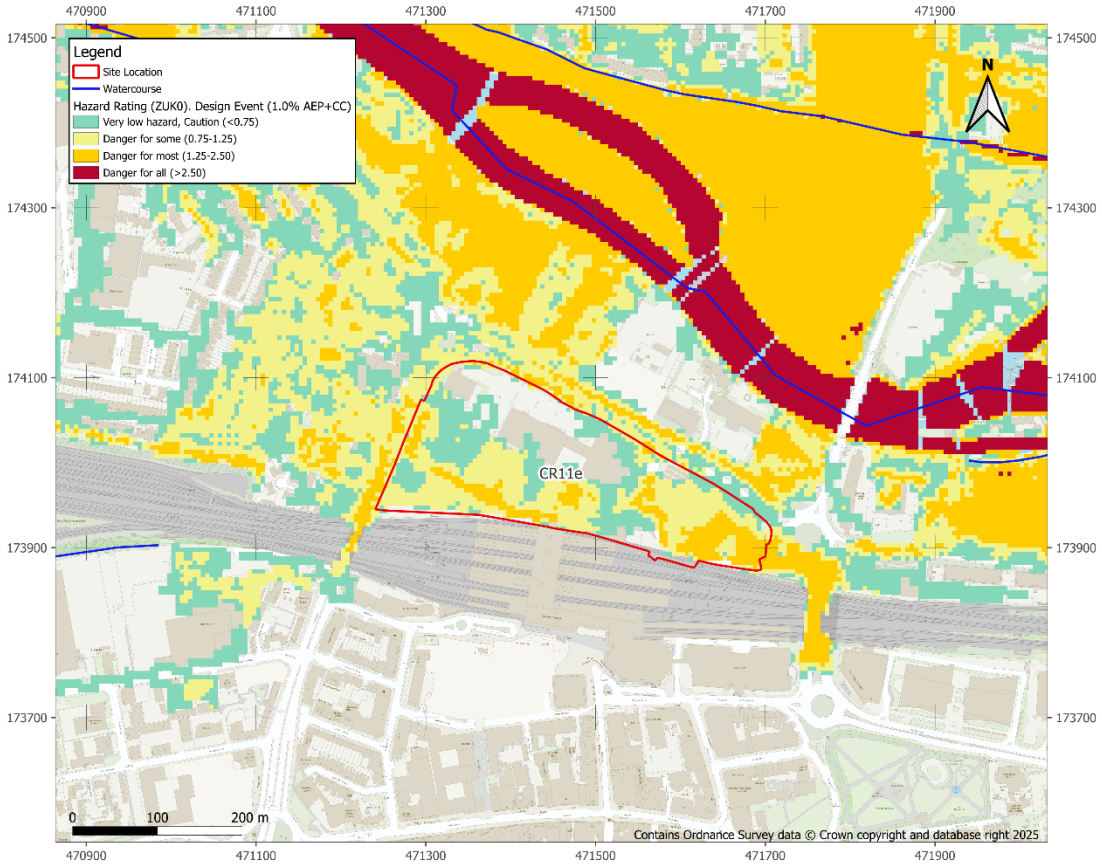

Figure 8 – Flood Hazard Map for the Design Event

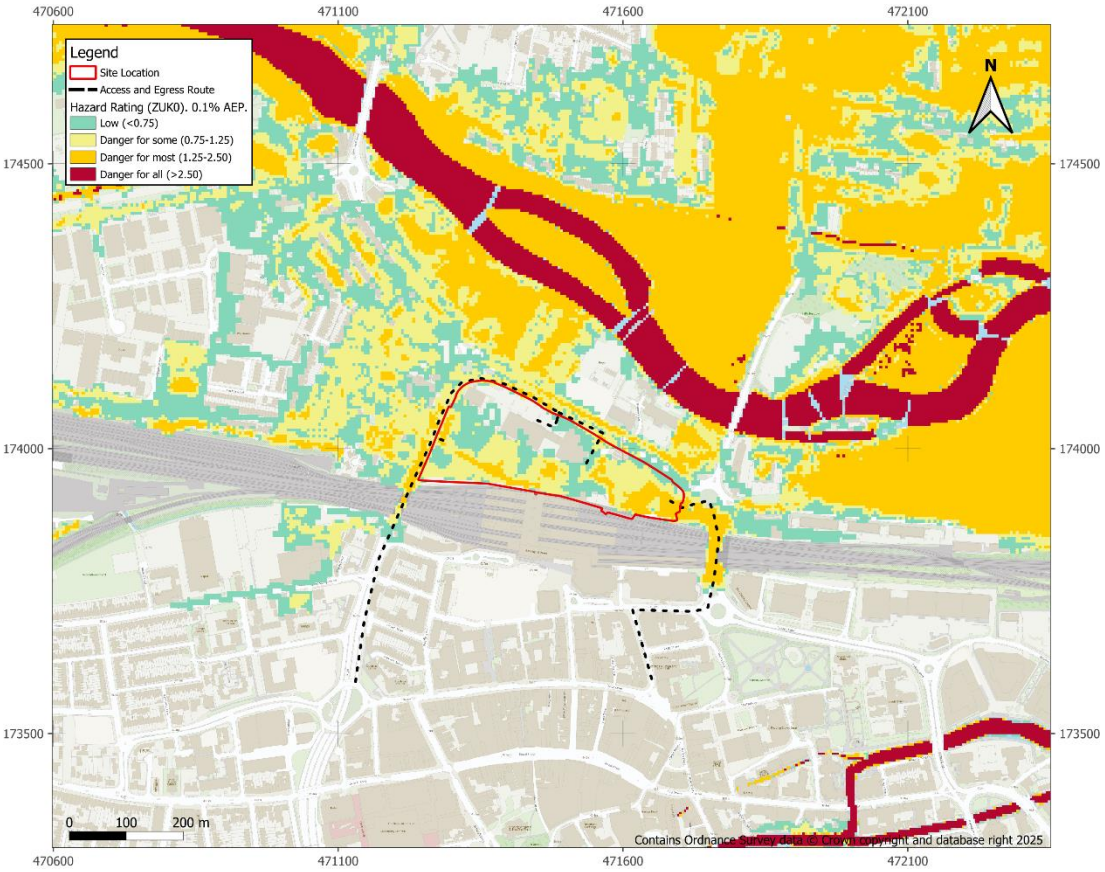

Figure 9 – Access/Egress Routes

5 Development Viability and FRA recommendations

5.1 Development Categorisation

Overall, a new mixed-use development at the site should be possible, however there are some barriers. The proposed development will consist of both housing (more vulnerable) and employment (less vulnerable) infrastructure. The latter is permissible within Flood Zones 2 and 3a. More vulnerable infrastructure is permissible in Flood Zone 2 but must pass an Exception Test if located in Flood Zone 3a as specified in the latest NPPF. Neither development categorisations are permissible in Flood Zone a3b.

Given that Flood Zone 3a only covers a small proportion of the site, it should be possible to locate the majority of *More Vulnerable Development* outside of its extent. However, given site levels some infrastructure may need to be raised above the design flood level. If this is the case, the impacts of the raising will need to be assessed to ensure that the development will be *safe for its lifetime, without increasing flood risk elsewhere*. This will need to consider the current land use on site and how this affects baseline flood risk.

5.2 Scale of Development

The total site area is currently 6.71 ha; allocated for a combination of residential, employment and commercial development. Given the size of the site, it is assumed that the residential development onsite will either be high density housing or utilise multistorey flats. Only 10% of the site is located within Flood Zone 1, therefore the majority of the development will be located within Flood Zone 2. Development should avoid the areas of Flood Zone 3 where possible to reduce its impact on flood risk in third party areas and negate the need for compensatory storage which will compromise the amount of land available for development.

5.3 Sequential Approach

It is important that a sequential approach is implemented at the site, prioritising more vulnerable residential development outside of the 1% AEP plus an appropriate allowance for climate change flood extent (the design flood extent) where possible. Less vulnerable employment development is also preferred in these zones however can be located in Flood Zone 3a (without the need for the Exception Test) if more space is required for residential uses as long as it is demonstrated that the development does not increase flood risk elsewhere and is designed to be appropriately resistant and resilient to flooding. Pluvial flood risk should also be used to inform the development layout with more vulnerable infrastructure located outside of high-risk areas.

A sequential approach to access should also be considered, in ensuring that any residential areas are not only at the lowest flood risk but also with available safe access.

5.4 Other Site-Specific Considerations

Approximately 50% of the site is at low risk of surface water flooding. Therefore, a site-specific FRA should consider in more detail the nature of the surface water flood risk to determine how quickly it occurs and the degree of hazard on site. The drainage strategy for the proposed development should be suitably designed to manage additional runoff arising from the development and ensure that surface water flood risk at the site and to third party land is not increased.

In assessing and demonstrating the viability of any drainage solution for the site, a site-specific FRA should follow the non-statutory technical standards for SuDS and any relevant Local Authority Local Plan policies. The geology at the site is freely draining. However, the water table is likely mobile, therefore the significant use of infiltration SuDS solutions may be challenging. It is recommended that a geotechnical investigation is undertaken at this

site to obtain further information relating to infiltration rates, this will confirm whether infiltration could be viable in some areas. Attenuated discharge to a watercourse or a sewer will also need to be considered as part of a site-specific FRA.

If it is necessary to locate new infrastructure in Flood Zone 3a it may compromise flood plain storage. In turn, hydraulic modelling may need to be undertaken to assess 3rd party impacts and compensatory storage requirements. Storage and modelling requirements should be confirmed with the EA for a site-specific FRA.