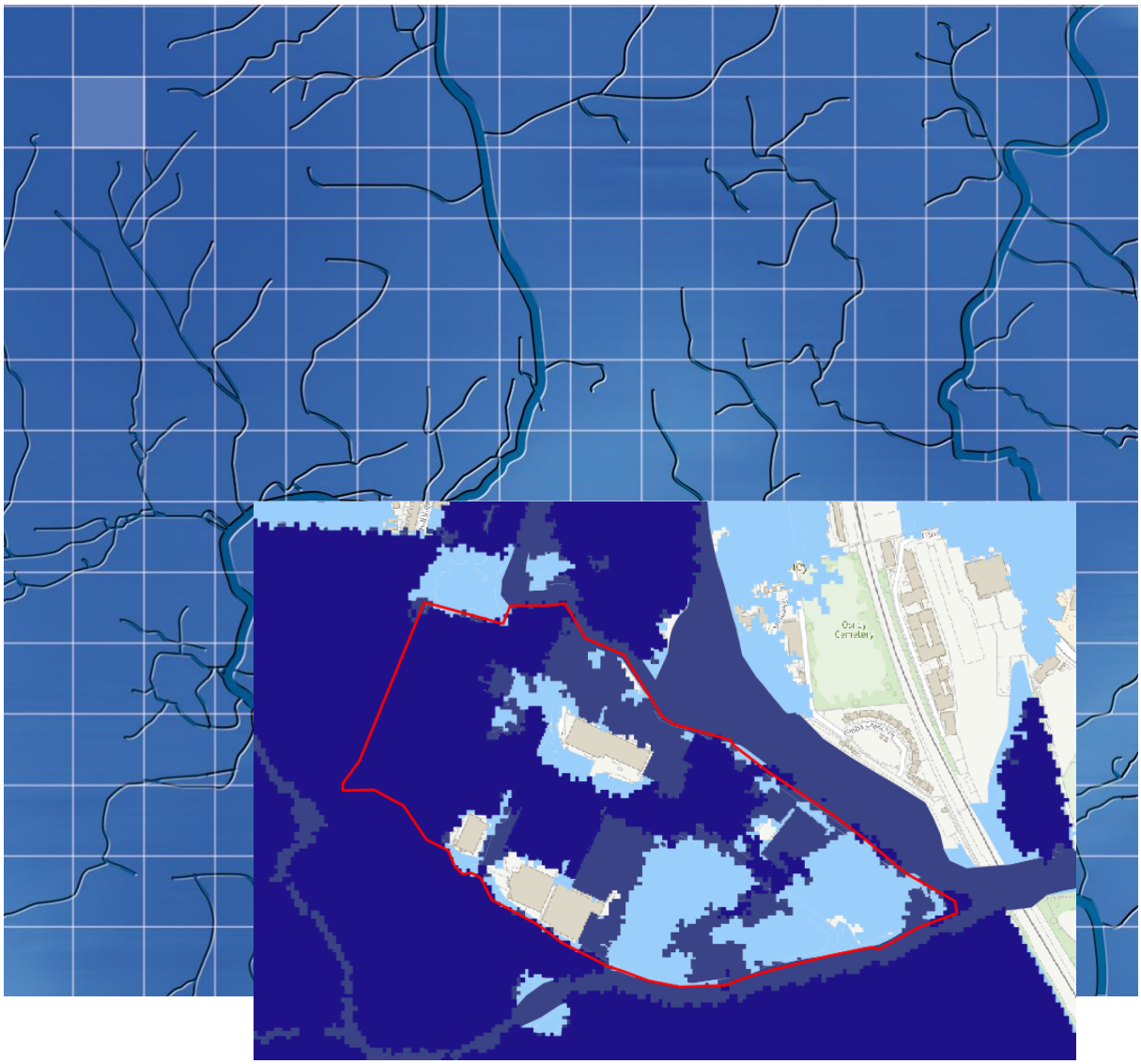
Oxford City Council

October 2025

Osney Mead (586)

Level 2 Strategic Flood Risk Assessment



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Osney Mead (586) Level 2 Strategic Flood Risk Assessment

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WHS10237

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1.0	09/10/2025	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.

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Osney Mead (586) Level 2 SFRA
Flood Risk Overview

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

Flood Risk

The site is at high risk from fluvial flooding.

The River Thames (2018) 1.0% AEP +26% CC design event indicates depths of over 0.5 m in many areas across the site. Approximately 39% of the site is located within Flood Zone 3b. As the access and egress route to the site is also located within Flood Zone 3b, significant barriers to development are present at the site.

The risk from pluvial flooding is considered to be moderate as it is predominantly limited to the existing road network.

The risk of flooding from other sources of flooding is considered to be moderate as the whole site is at risk from reservoir failure.

The overall confidence in the assessment is high. This is because detailed hydraulic modelling has been used to inform the assessment of the primary flood risk.

Conclusions and Recommendations

The development proposed is mixed residential. Residential development is categorised as more vulnerable development whilst retail, community, and commercial development is categorised as less vulnerable development. Neither category of development is permissible within Flood Zone 3b.

As 39% of the site area and the main access/egress route are located in Flood Zone 3b, significant barriers to development are present. Development may need to be set at a floor level to provide an appropriate freeboard above the flood level for the 100-year (+26% climate change) design event, estimated at 57.1 m AOD. A large amount of the site is sited below this level, so ground raising may be significant. The current development at the site displaces approximately 10,200 m^3 of water during the 1.0% AEP +26% CC design event. Therefore, the proposed development should not exceed this and may look to reduce the volume of flood waters displaced to reduce flood risk to third parties.

Contents

1 Introduction

1.1 Background

Wallingford HydroSolutions Ltd has been commissioned by Oxford City Council (OCC) to undertake a Level 2 Strategic Flood Risk Assessment (SFRA) at Osney Mead (reference: 586) 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

Osney Mead (586) is a 17.8 ha site located in the west of Oxford, see Figure 1. Current land use at the site is commercial and industrial.

The site is proposed for a mixed-use development including retail, community, and commercial uses alongside 247 residential dwellings.

2.2 Topography

Based on 1m LiDAR data, the site is shown to be relatively flat with localised areas of raised ground and topographic depressions, see Figure 2. The ground levels within the site boundary range from 54.3 to 58.3 m AOD. The average ground level is approximately 56.7 m AOD.

2.3 Nearby Watercourses

The site is surrounded by several watercourses including the River Thames to the north and east, Osney Stream to the north, and Bulstake Stream to the south and west, see Figure 1.

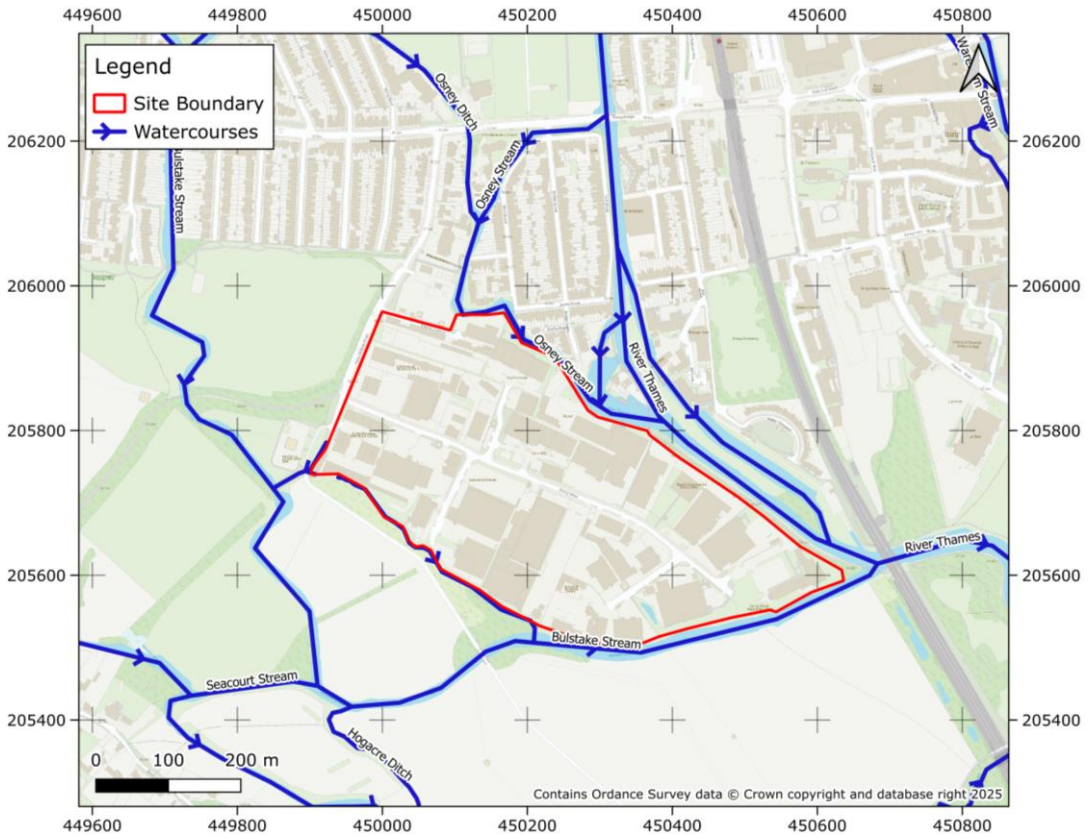

Figure 1 - Site Location

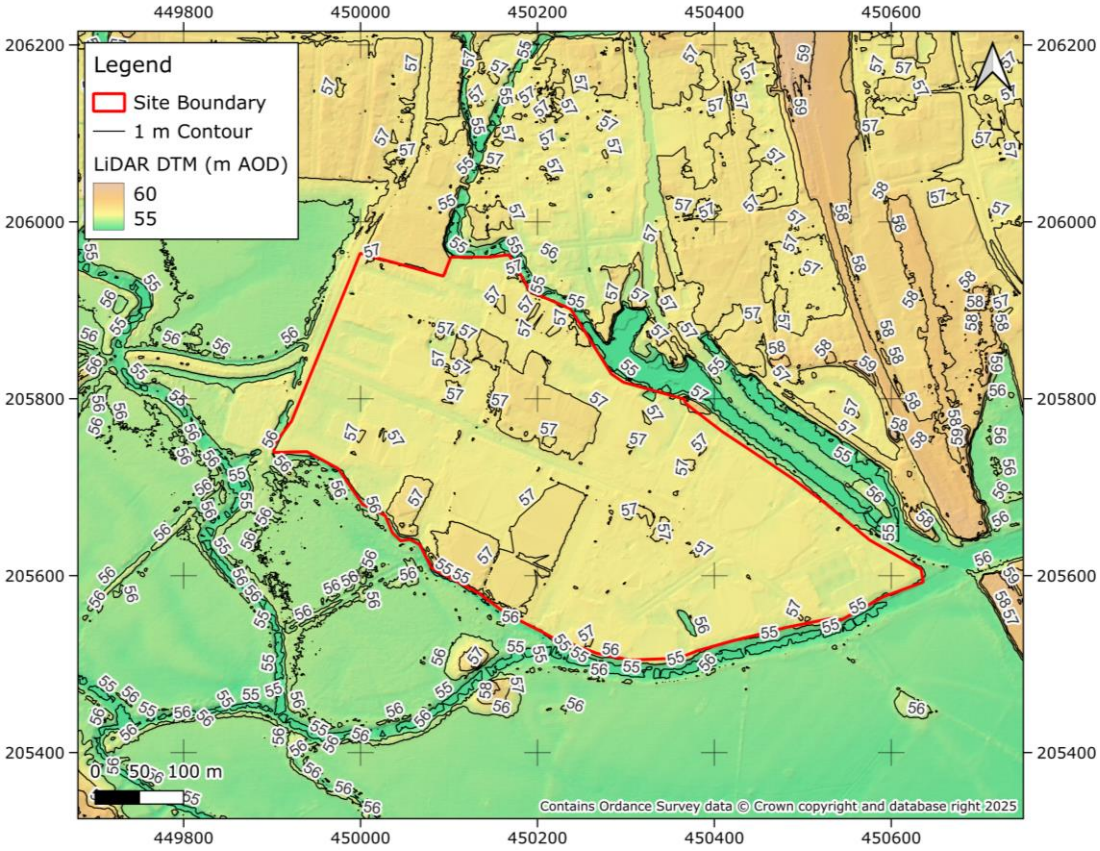

Figure 2 – Topography

3 Flood Risk

3.1 Historical Flooding

The EA has multiple records of historical flooding within the site boundary. The majority of these events inundated a small areas of the site, however the March 1947 and January 2003 events inundated significant portions of the site area. Figure 3 shows the maximum recorded historic flood extent. This is mainly attributed to the March 1947 event.

3.2 Fluvial Flood Risk

In the existing Flood Map for Planning (FMfP), 92% of the site is located within Flood Zone 2 (0.1% AEP), 64% is located within Flood Zone 3a (1.0% AEP), see Figure 4. These Flood Zones consider the undefended scenario whereas Flood Zone 3b (3.3% AEP) considers the defended scenario. This extent shows 39% of the site to be located within Flood Zone 3b. Though the undefended 3.3% AEP River Thames (2018) modelled extent is available and similar, the EA defended 3.3% AEP extent is greater and so is used in this assessment as a conservative measure.

The EA climate change fluvial outputs have also been assessed, with 98% of the site located within the 0.1% AEP extent, and 86% located within the 1.0% AEP extent, see Figure 5. The defended 3.3% AEP climate change extent inundates 74% of the site.

Fluvial flood risk is considered to be high and is assessed in more detail in section 4.

3.3 Flood Defence Infrastructure

There are no engineered flood defences along the watercourses close to the site boundary, however flood defences present along the River Thames, Osney Ditch, and Bulstake Stream approximately 200-400 m upstream of the site may have a minor impact on levels at the site.

3.4 Surface Water Flood Risk

The EA's surface water flood maps shows 4% of the site to be inundated during a 3.3% AEP event, 11% is inundated during a 1.0% AEP event, and 21% is inundated during a 0.1% AEP event, see Figure 6.

When considering the effects of climate change, the proportion of the site at risk for each event increases to 10%, 15%, and 25% respectively, see Figure 7.

Overall, the surface water flood risk to the site is moderate being predominantly limited to the existing road network within the site.

3.5 Groundwater Flooding

The site is underlain by a bedrock of mudstone in the form of the Oxford Clay and West Walton formation. It is expected to permit low amounts of infiltration. Superficial deposits of alluvium, sand, and gravel are also present at the site. The underlying soils are loamy and clayey floodplain soils with naturally high groundwater.

Based on the data available there is a moderate risk of groundwater flooding, however, due to the proximity of the site to the River Thames, groundwater flooding is likely to be heavily correlated with river levels and fluvial flooding.

3.6 Reservoir Flood Risk

The FMfP shows the whole site is inundated during the wet day scenario and the west of the site is inundated during the dry day scenario, see Figure 8. This risk can be attributed to a number of reservoirs located upstream of the site, though Farmoor Reservoir is the most notable.

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 aim to make sure that all reservoirs are properly maintained and monitored to detect and repair any problem. If required, the local planning authority (LPA) can consult the local resilience forum for emergency planning advice in relation to reservoir failure.

3.7 Flood Warning Service

The site is located within the River Thames and tributaries in the Binsey, Osney and Osney Island areas in Oxford EA Flood Warning Area.

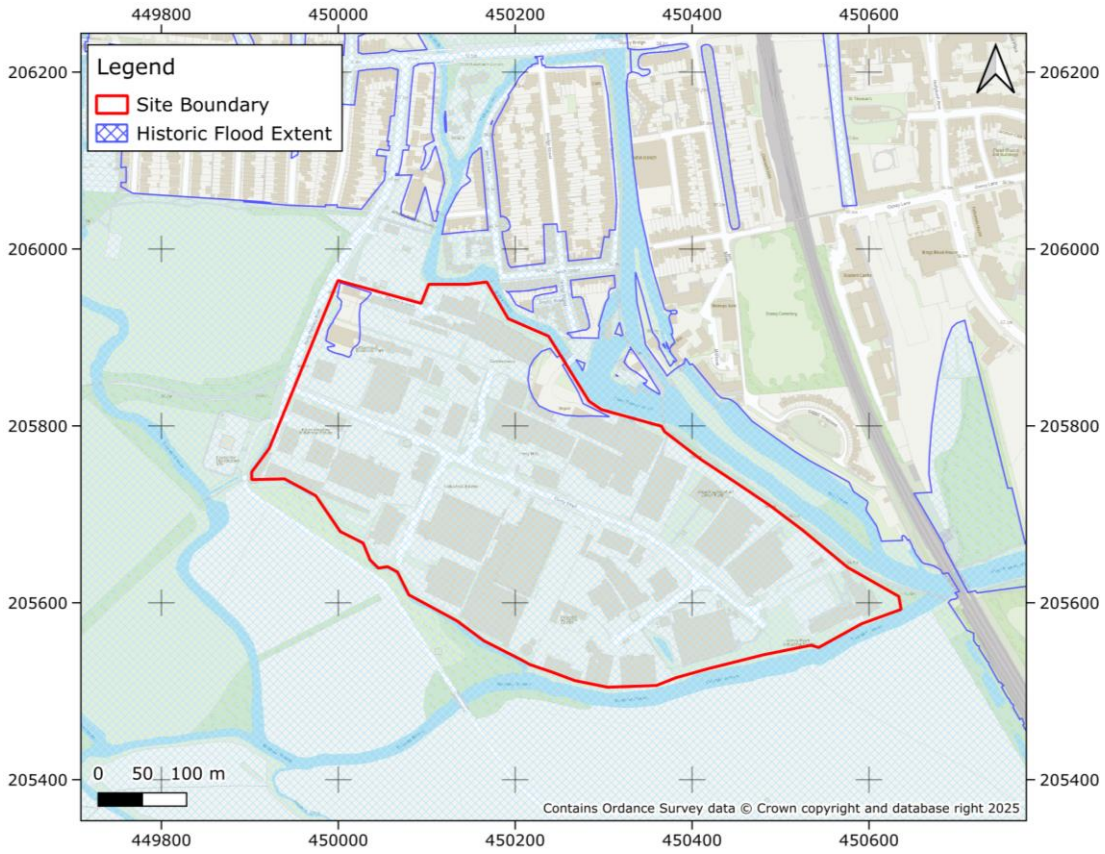

Figure 3 - Recorded Flood Outlines

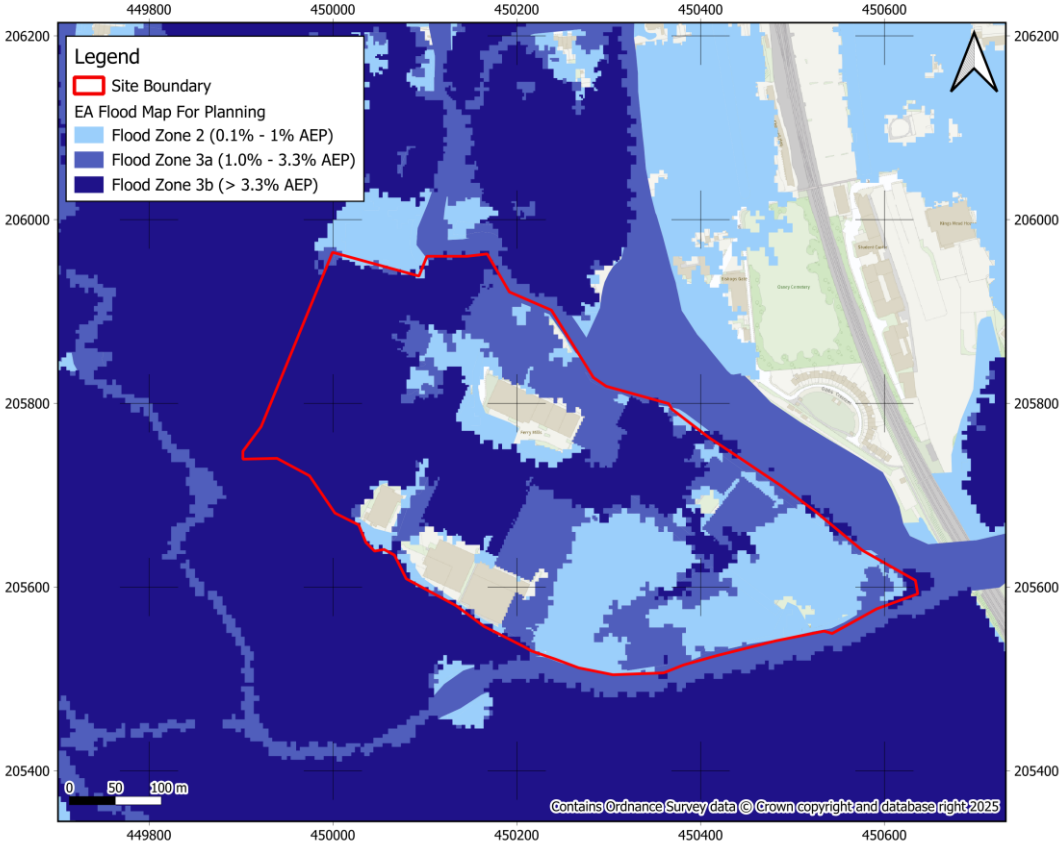

Figure 4 - Fluvial Flood Map

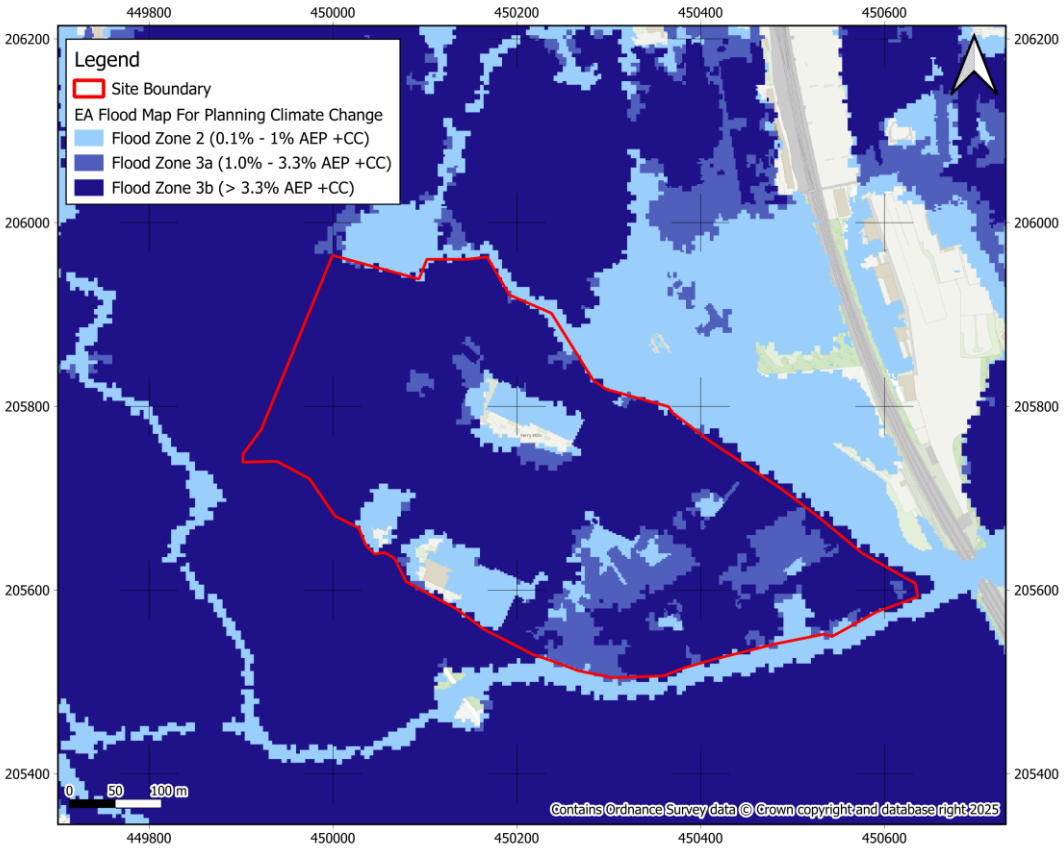

Figure 5 – Fluvial Climate Change Flood Map

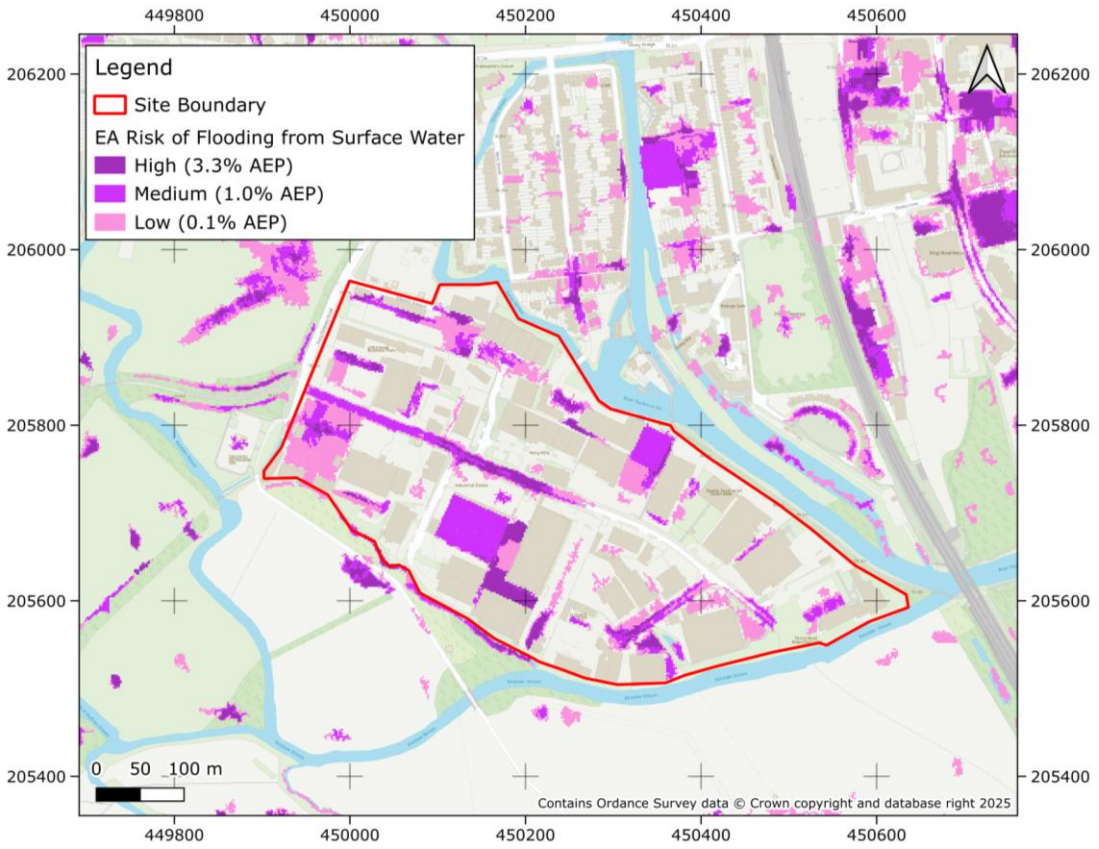

Figure 6 – Surface Water Flood Map

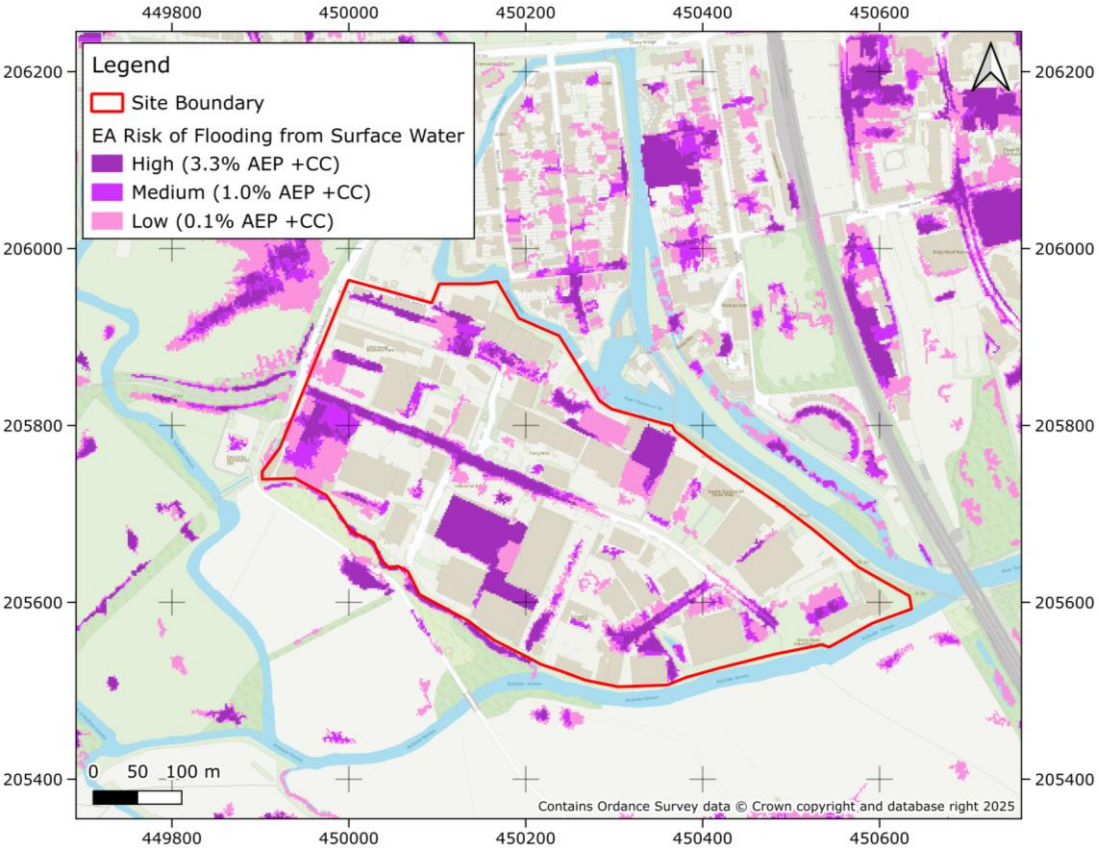

Figure 7 -Surface Water Climate Change Flood Map

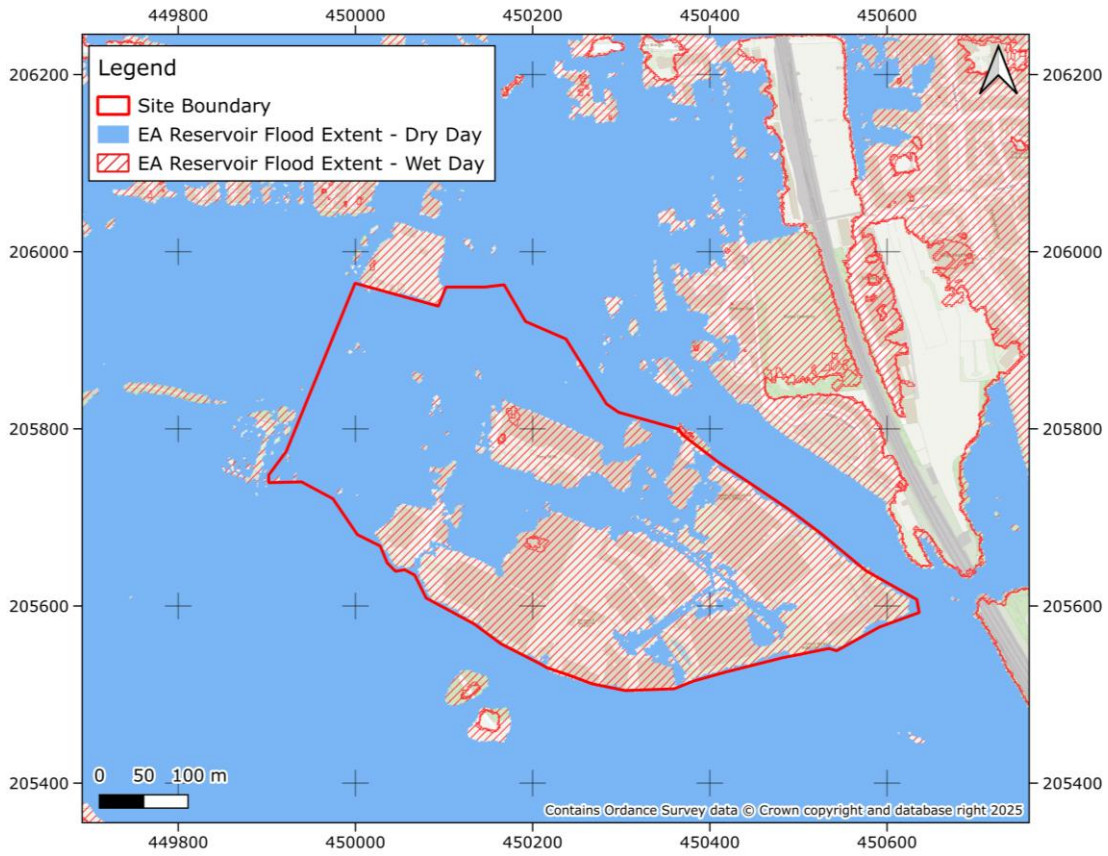

Figure 8 - Reservoir Failure Flood Map

4 Detailed Review of Primary Flood Risk

4.1 Primary Flood Risk

Fluvial flooding is the primary flood risk mechanism at the site and is assessed in more detail below. Areas of the site are also at risk from surface water flooding and so an assessment of this has also detailed below.

4.2 Flood Risk Metrics

The River Thames Model (2018) was re-run as part of the previous SFRA for Oxford City in 2023. This was to obtain results applying the latest climate change allowances.

Depth data for the 100-yr plus central (26%) climate change design event is first assessed to attain further detail on fluvial flooding. The modelled scenario considers the presence of flood defences unlike the FMfP data, although the impact at this site is minimal.

The depth data in Figure 9 indicates that inundation during this event is widespread, with the greatest risk in the west of the site. The maximum flood depth within the site is approximately 1.5 m, however this is likely associated with existing surface waterbodies within the site and along its boundary. Outside of these waterbodies, the maximum flood depth is approximately 1.0 m, located in the southwest of the site bordering a tributary of the Bulstake Stream. Flood depths in the west of the site are predominantly between 0.3 and 0.6 m. In the east of the site flood depths are generally lower between 0.05 and 0.3 m. The design flood level for the 1.0% AEP +26% CC event is 57.1 m AOD, above the average ground level at the site based on LIDAR (56.7 m AOD).

Also of note is that, the existing roads across the site also experience significant flooding. Osney Mead is the main access road within the site and is associated with flood depths in excess of 0.5 m. Furthermore, the main access road to the site, Ferry Hinksey Road, is entirely inundated during the design event with depths of approximately 0.4 - 0.5 m where it junctions with Osney Mead. Areas of no inundation within the site are isolated to higher ground and are surrounded by inundated land.

As part of this site lies in Flood Zone 3b, the River Thames Model (2018) depth data for the 100-yr plus higher central (41%) climate change design event (re-run in 2023) was also assessed to attain further detail on fluvial flooding. Once more, the modelled scenario considers the presence and condition of flood defences unlike the FMfP data.

Figure 10 indicates an increase in inundation, particularly within the east of the site, compared with Figure 9. During the higher central climate change scenario, only four isolated areas of the site remain outside of the inundation, located within the centre and southwest of the site. These are associated with isolated areas of higher land. Flood depths within the site remain similar to the central climate change scenario, with a maximum flood depth of 1.6 m within existing waterbodies and a maximum depth of approximately 1.0 m outside of these waterbodies. Across the site, the average flood depth is approximately 0.3 m although this varies spatially, with higher flood depths in the west of the site than the east.

The Risk of Flooding from Surface Water (RoFSW) depth data for the 100-yr plus climate change design event was also assessed to attain further detail on surface water flooding.

During this event, inundation predominantly occurs along the Osney Mead road and in car parks/yard areas of several warehouses across the site, see Figure 11. The maximum inundation depth is approximately 0.2 m, though the majority of the inundated areas have depths less than 0.2 m. Flooding during the design pluvial event is significantly less widespread than during the fluvial event.

It should be noted that the climate change allowances used in RoFSW are based on the 2050's epoch (2041-2069) and reflect the median estimate of rainfall increases. If the

development has a lifetime beyond this time period, a site-specific FRA should consider the climate change impacts for the 2080's epoch (2075-2125).

4.3 Access and egress

The main access point to the site is via Ferry Hinksey Road along the western site boundary. Figure 12 shows the best identified access and egress route to the site during the 1.0% AEP +26% CC design event, following the route with the lowest hazard. The route travels north along Ferry Hinksey Road before turning right onto Botley road to continue travel east. At the junction close to the Royal Oxford Hotel, site users can travel along either Hythe Bridge Street or Park End Street to continue travelling east, however the route along Park End Street is associated with the lowest hazard rating. Crossing the Castle Mill Stream, site users can continue east and north towards the flood free areas of central Oxford.

Though this route travels through the smallest area of inundated land, the extent of flooding in this area of Oxford means that the majority of the route is inundated to some extent. Four areas along the route are indicated as being hazardous for most. These are located along Ferry Hinksey Road and Botley Road. The maximum flood depth and velocity (approximately 2.1 m and 1.0 m/s respectively) both occur along the Botley Road.

Therefore, early flood warning will be vital to ensure that the access route can be utilised before it is inundated by floodwaters. The River Thames catchment is dominated by chalk which has relatively slow river response times to storm events, being groundwater rather than surface water dominated. This increases the time taken for inundation and for adequate warnings and preparation in an extreme flood event. As the site is located within an EA Flood Warning Area, an evacuation plan for the site should be developed and all residents and businesses at the site should sign up for the flood warnings/alerts.

Once the development layout is known, a site-specific FRA should consider onsite routes across the site and any infrastructure required to reach the proposed access route. The proposed route should also be reassessed in a site-specific FRA when all access points to the site are known, to ensure the route with the lowest hazard remains the same.

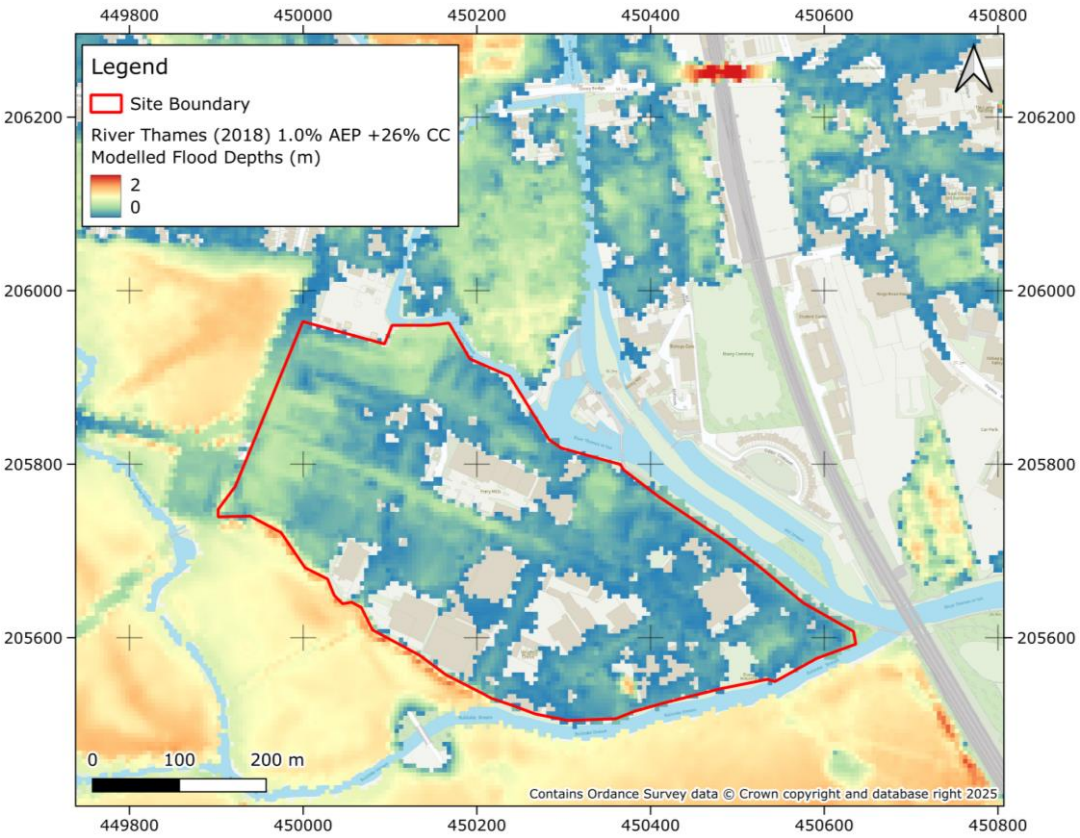

Figure 9 – River Thames (2018) 1.0% AEP +26% CC Modelled Flood Depths (m)

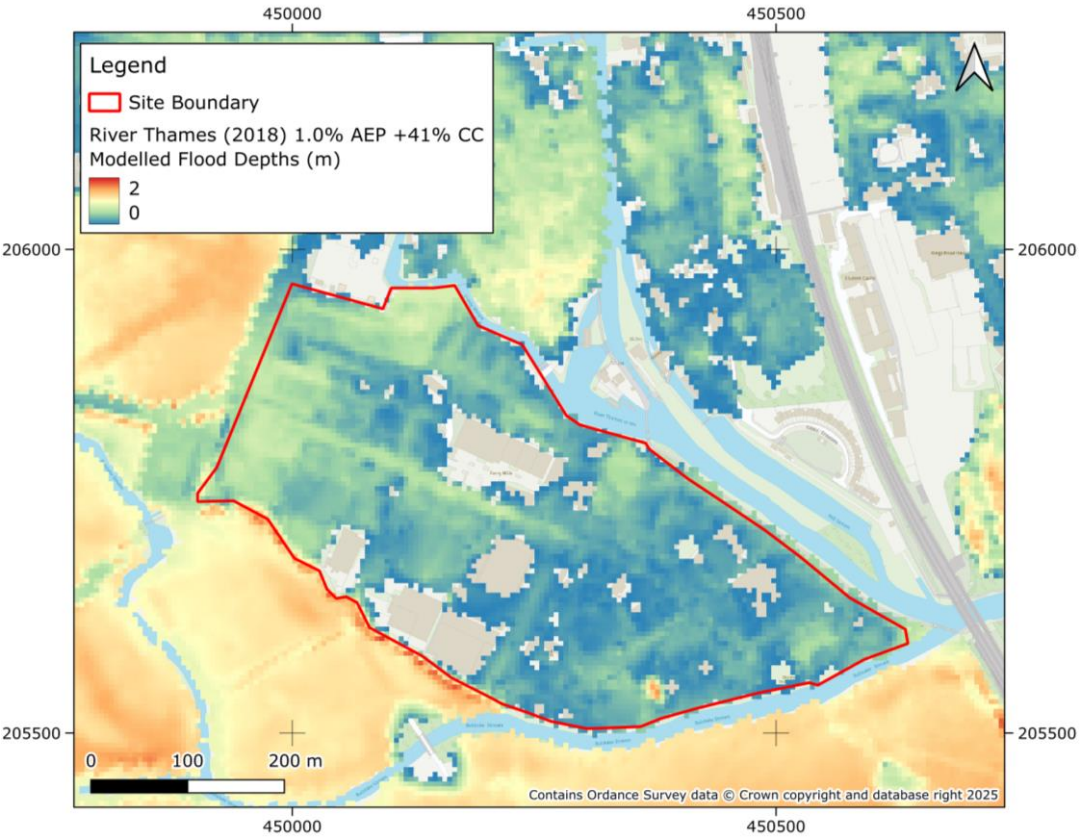

Figure 10 - River Thames (2018) 1.0% AEP +41% CC Modelled Flood Depths (m)

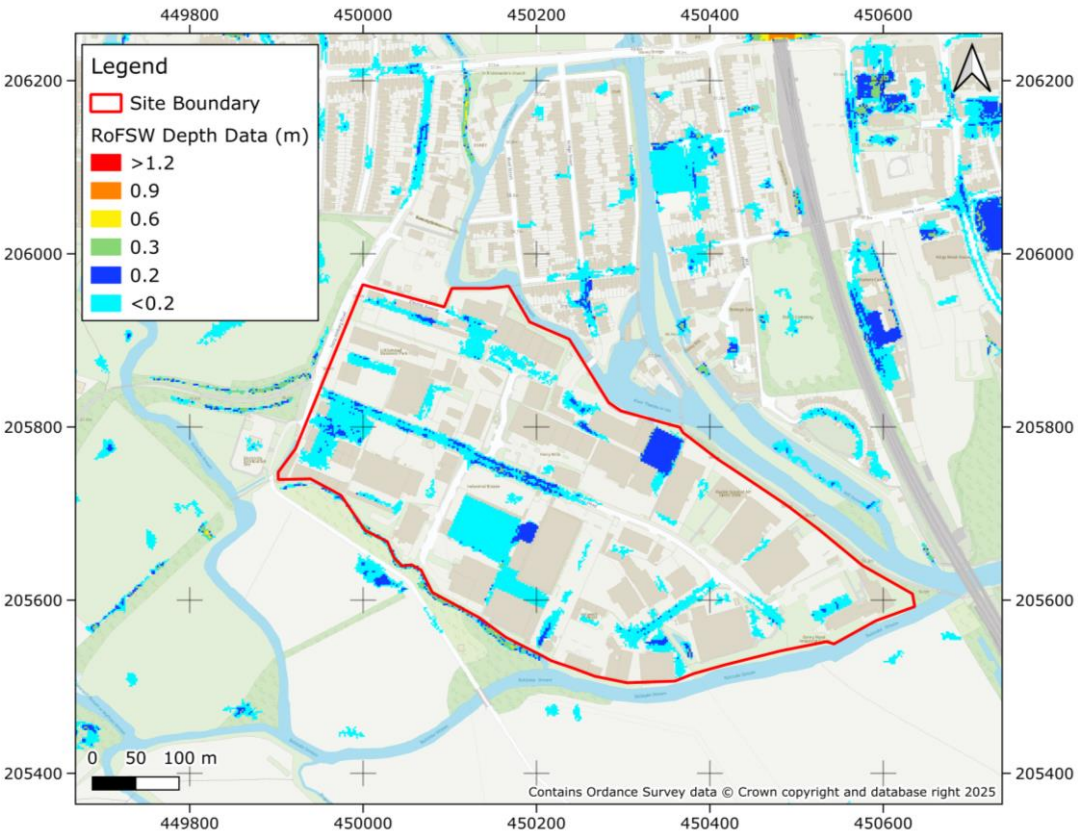

Figure 11 - Risk of Flooding from Surface Water 1.0% AEP +CC Depth Data (m)

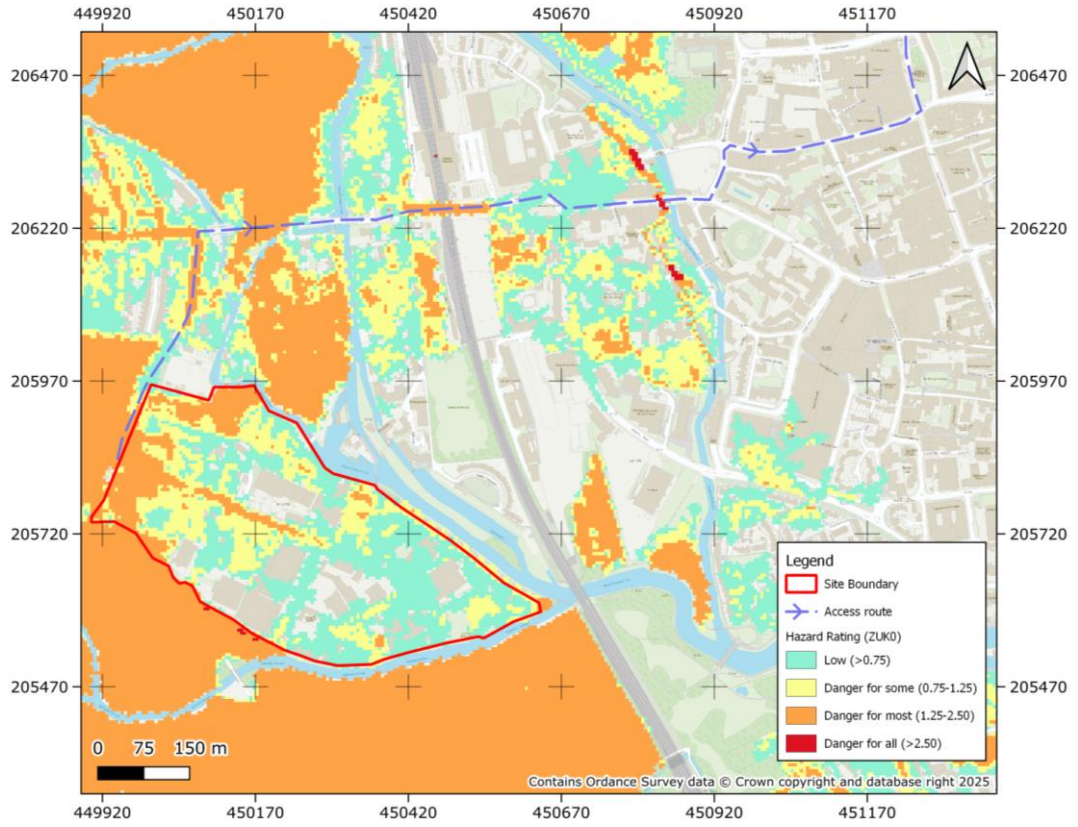

Figure 12 – Access/Egress Routes showing Flood Hazard (ZUK0) for the 1.0% AEP +26% CC Event

5 Development Viability and FRA recommendations

5.1 Development Categorisation

The development proposed is mixed residential with residential categorised as more vulnerable development, and retail, community, and commercial categorised as less vulnerable development. A sequential approach to development is required for both development categories, with development first prioritised within areas of Flood Zone 1 prior to consideration in higher flood risk zones. More vulnerable development is permissible within Flood Zone 2 but must pass an exception test to be deemed permissible within Flood Zone 3a. Less Vulnerable Development is permissible within Flood Zone 2 and 3a. Neither development type is permissible within Flood Zone 3b.

Given that Flood Zone 3b inundates 39% of the site and is expected to inundate 74% of the site when considering climate change, development at the site faces significant barriers. As the main access and egress route is also located within Flood Zone 3b, this also poses a barrier to development.

5.2 Scale of Development

Due to the extent of Flood Zone 3b within the site and along the access route, the scale of development at the site should be proportional to the amount of land located outside of this zone. Only open space and/or water compatible development should be incorporated into Flood Zone 3b, provided it does not impact flood risk elsewhere.

Any development located within the design flood extent may need to be set at a floor level to provide an appropriate freeboard above the flood level for the 100-year (+26% climate change) design event, estimated at 57.1 m AOD. A large amount of the site is sited below this level, so ground raising may be significant. As compensatory storage will be required to offset any ground raising, this site may only provide opportunities for small scale developments. However, it is important to highlight that development is already present at the site. This development is estimated to displace 10,200 m^3 of water during the 1.0% AEP +26% CC design event. The proposed development should not exceed this and may be minded to incorporate open space or water compatible development to reduce this volume.

5.3 Sequential Approach

It is important that a sequential approach is implemented at the site and when allocating sites for development. Priority for development should be given to areas within Flood Zone 1 wherever possible, followed by Flood Zone 2 and then Flood Zone 3a. As stated, no development aside from open space or water compatible development should be located in Flood Zone 3b. Furthermore, a sequential approach should consider the impacts of climate change on flood zone extents and take into account all sources of flooding.

5.4 Other Site-Specific Considerations

Development will need to be set at a floor level to provide an appropriate freeboard (typically 300mm minimum) above the flood level for the defended 1% annual exceedance probability (plus central climate change allowance) design event. If ground raising is implemented within the design flood extents, modelling may need to be undertaken to assess 3rd party impacts and compensatory storage requirements. A site-specific FRA should confirm any modelling requirements with the EA to assess 3rd party impacts, including the need for breach analysis to further assess the protection provided by the flood defences in the vicinity of the site and confirm the finished floor levels (FFLs).

Areas of significant flood risk are present along the main access route to the site. Given there is no advance flood warning provision for the site, the potential for evacuation before a more extreme fluvial or pluvial flood, considering the effects of climate change for the

lifetime of the development, needs to be considered by a site-specific FRA with advice to sought from the emergency services and Oxford City Council's emergency planner.

A site-specific FRA should also 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. It should be noted that the climate change allowances used in the pluvial design event scenario are based on the 2050's epoch (2041-2069) and reflect the median estimate of rainfall increases. If the development has a lifetime beyond this time period, the site-specific FRA should consider the climate change impacts for the 2080's epoch (2075-2125).

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 national standards for SuDS and any relevant Local Authority Local Plan policies. The geology at the site has low permeability and this combined with soils which have naturally high groundwater, means the effectiveness of infiltration SuDS solutions may be limited. 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. Any activity near to the River Thames at this site may require Flood Risk Activity Permits, due to its designation as a main river.

Due to the site's location within both the dry and wet day reservoir failure inundation extents, any development in this area could affect the reservoirs risk designation, design category and how it is operated with potential cost implications for developers.