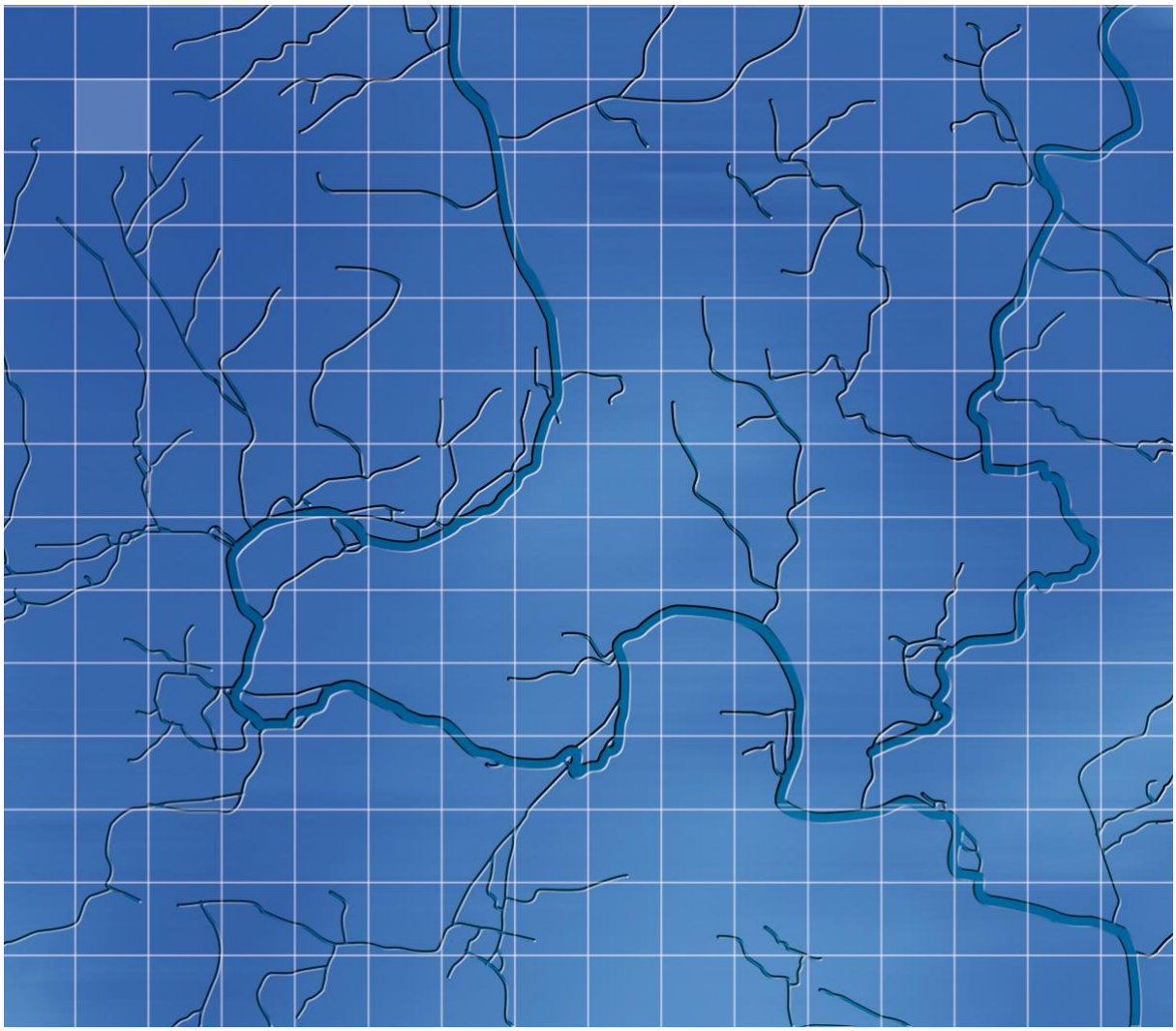
Oxford City Council

October 2025

Canalside Land, Jericho (011)

Level 2 Strategic Flood Risk Assessment



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Canalside Land, Jericho (011) Level 2 Strategic Flood Risk Assessment

Document issue details

WHS10237

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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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Canalside Land, Jericho (011) Level 2 SFRA
Flood Risk Overview

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

Flood Risk

The EA Flood Map for Planning shows 73.3% of the site is located within Flood Zone 2 (0.1% AEP), and 12.8% is located within Flood Zone 3a (1.0% AEP).

The River Thames Model (2018, re-run in 2023) 1.0% AEP + 26% CC design event extent covers 58.6% of the site area. Depths in the areas of inundation are generally less than 0.2 m, however in some areas exceed 0.3m. The design flood level at the site is 57.5 m AOD. Overall fluvial flood risk is considered to be high.

Pluvial flooding affects the centre of the site and is considered to be moderate.

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

The overall confidence in the assessment is moderate as although a detailed hydraulic model has been used to inform the assessment of fluvial flood risk, EA national mapping has been used to assess pluvial flood risk.

Conclusions and Recommendations

A sequential approach to the siting of the development should be used, with development prioritised first within Flood Zone 1 prior to consideration of any siting within Flood Zone 2 or 3a.

The proposed development at the site is a housing led, mixed-use development. Residential areas are classed as More Vulnerable Development, which is permissible in Flood Zone 2, but needs to pass the Exception Test to justify development in Flood Zone 3a. Less vulnerable uses are permissible in Flood Zone 2 and 3a without the need to pass an exception test. Both types of development are not permissible in Flood Zone 3b.

Given that Flood Zone 3b inundates a small proportion of the site (11.4%), it should be possible to locate infrastructure outside of its extent. However, the site faces significant barriers given that a large proportion of the site falls within the design flood extent (1.0% AEP + 26% Climate Change event). More vulnerable development located in its extent will need to be raised above the design flood level and compensatory storage may need to be provided to offset any 3rd party flood risk impacts.

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 Canalside Land, Jericho (reference: 011) 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

Canalside Land, Jericho (011) is a 0.50 ha site located adjacent to the Oxford Canal, to the west of the Jericho area, see Figure 1. The site, known as Jericho Wharf, is currently home to a derelict boatyard and storage units. The majority of the site area is impermeable hardstanding.

Proposed development at the site consists of a housing led, mixed-use development comprising 18 dwellings.

2.2 Topography

Based on 1m LiDAR data, the site is flat, see Figure 2. The ground levels within the site boundary range from 56.9 to 58.2 m AOD. The average ground level is approximately 57.7 m AOD. Levels are generally lower in an area in the centre of the site along the western boundary.

2.3 Nearby Watercourses

The Oxford Canal runs adjacent to the length of the site's western boundary, see Figure 1. Castle Mill Stream which is a backwater of the River Thames runs parallel immediately to the west of the canal. Castle Mill Stream bifurcates from the River Thames approximately 700m to the northwest of the site and rejoins it approximately 1.2km south of the site. At its closest point, the River Thames is located approximately 200m to the west.

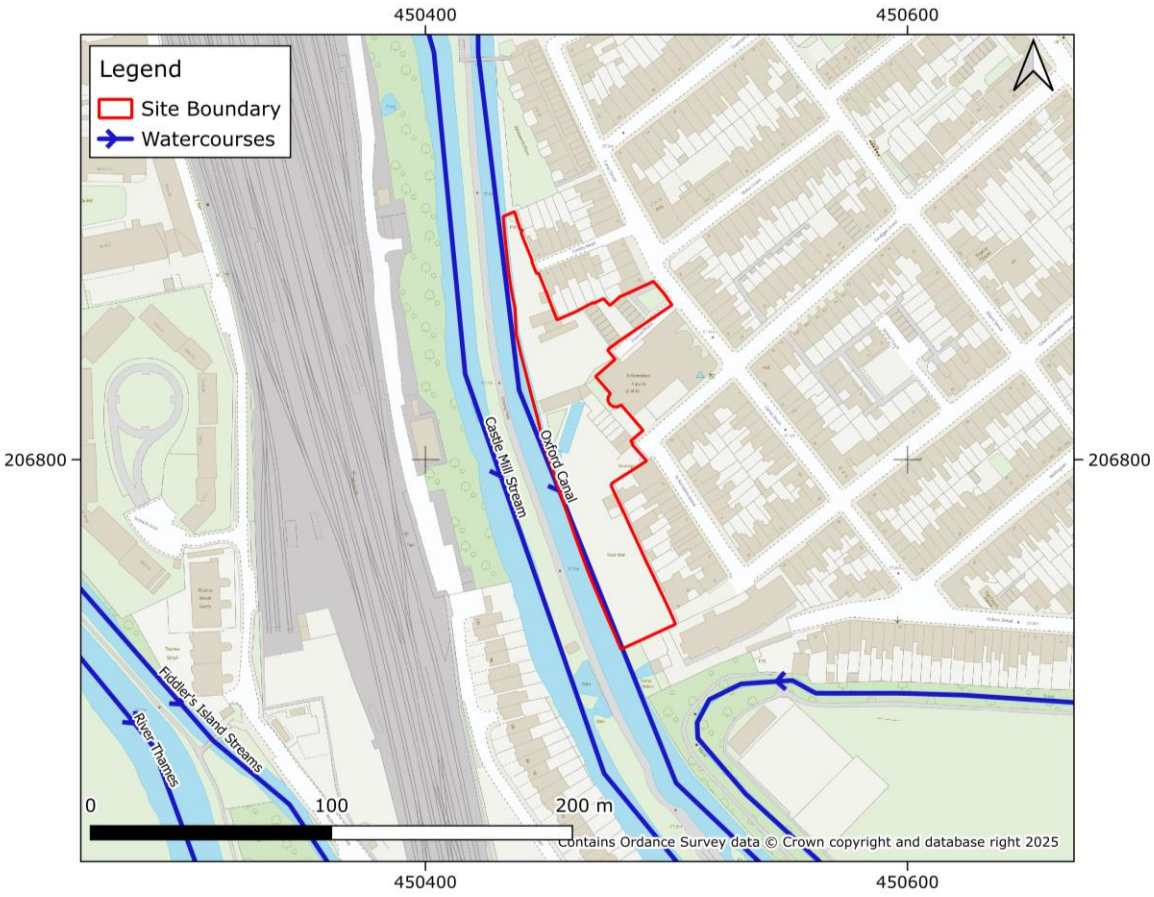

Figure 1 - Site Location

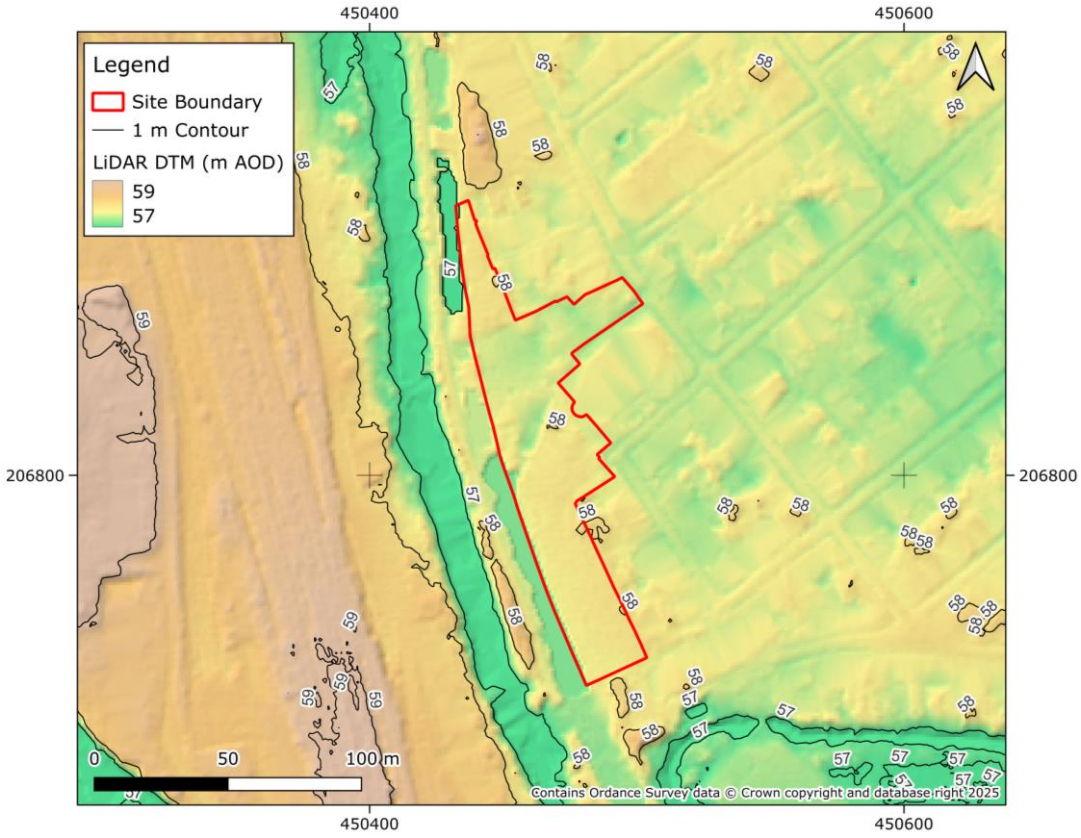

Figure 2 - Topography

3 Flood Risk

3.1 Historical Flooding

The EA has two records of historical flooding at the site. The most recent occurred in the winter of 2014, with an event of a similar magnitude occurring in the winter of 2000. During these events, flooding was constrained to the areas of lower topography in the centre of the site and along its western boundary, see Figure 3.

3.2 Fluvial Flood Risk

In the existing Flood Map for Planning (FMfP), 73.3% of the site is located within Flood Zone 2 (0.1% AEP), and 12.8% is located within Flood Zone 3a (1% AEP). Viewing the River Thames 2018 model results for the undefended 3.3% AEP event, 12.4% of the site is located within Flood Zone 3b. At this location the FMfP is based on a combination of modelled extents and the maximum historical extent. The areas at risk are generally located in the west of the site adjacent to the Oxford Canal, see Figure 4.

The FMfP climate change outputs have also been assessed, all of the site is within Flood Zone 2 (0.1% AEP) and 58.6% of the site inundated by Flood Zone 3 (1.0% AEP), see Figure 5. The River Thames (2018) undefended 3.3% AEP +26% Climate Change extent equivalent to Flood Zone 3b with climate change, indicates approximately 31.1% of the site is expected to be inundated.

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

3.3 Flood Defence Infrastructure

Embankments are present along Castle Mill Stream approximately 20m west of the site boundary. A small area to the west of St Barnabas' Church in the centre of the site is within an area associated with a reduction in risk from flooding due to flood defences. The site is not located within a flood storage area.

3.4 Surface Water Flood Risk

The EA's surface water flood maps show 2.1% of the site to be inundated during a 3.3% AEP % event, 9.7% to be inundated during a 1.0% AEP event, and 23.2% to be inundated during a 0.1% AEP event, see Figure 6. The area at risk during the 3.3% event is due to surface water pooling within a depression in the topography. During the 1.0% and 0.1% AEP event, a greater area is at risk due to a surface water flow route entering the site area from the residential areas to the east of the site.

When considering the effects of climate change, the proportion of the site at risk for the 3.3%, 1.0% and 0.1% AEP events increases to 7.7%, 13.1%, and 30.0% respectively, see Figure 7.

Overall, the surface water flood risk to the site is moderate and is assessed in more detail in Section 4.

3.5 Groundwater Flooding

The site is underlain by a bedrock of clay and mudstone in the form of the Oxford Clay Formation and West Falton Formation. It is expected to permit low amounts of infiltration. Superficial deposits of alluvium are also present at this site; these are expected to have moderate permeabilities. The underlying soils are loamy and clayey floodplain soils with naturally high groundwater.

Based on the data available there is considered to be a moderate risk of groundwater flooding given the potentially high-water table at the site. However, more data is required at the planning stage to confirm this.

3.6 Reservoir Flood Risk

The FMfP shows that the majority of the site is at risk from reservoir flooding during the wet day scenario only, see Figure 8. 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 not located directly within an EA Flood Warning Area. The nearest Flood Warning Area (R.Thames and tributaries in the Binsey, Osney and Osney Island) is located approximately 150m to the west of the site.

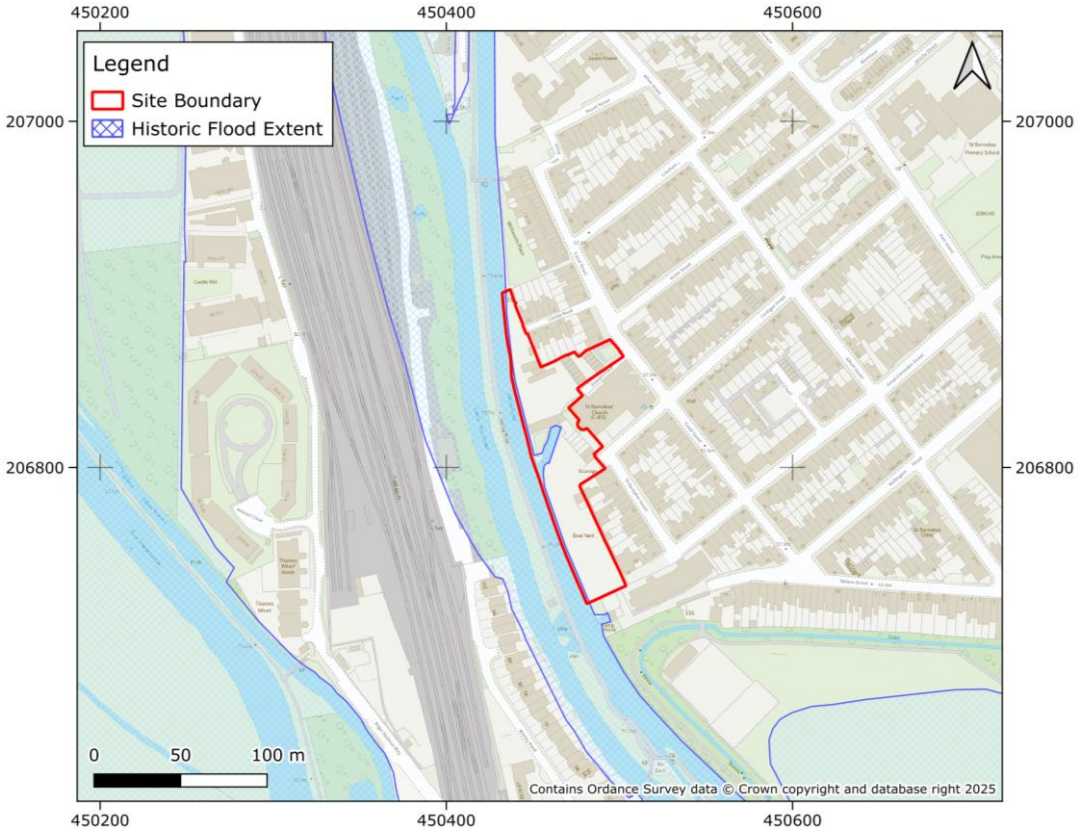

Figure 3 - Recorded Flood Outlines

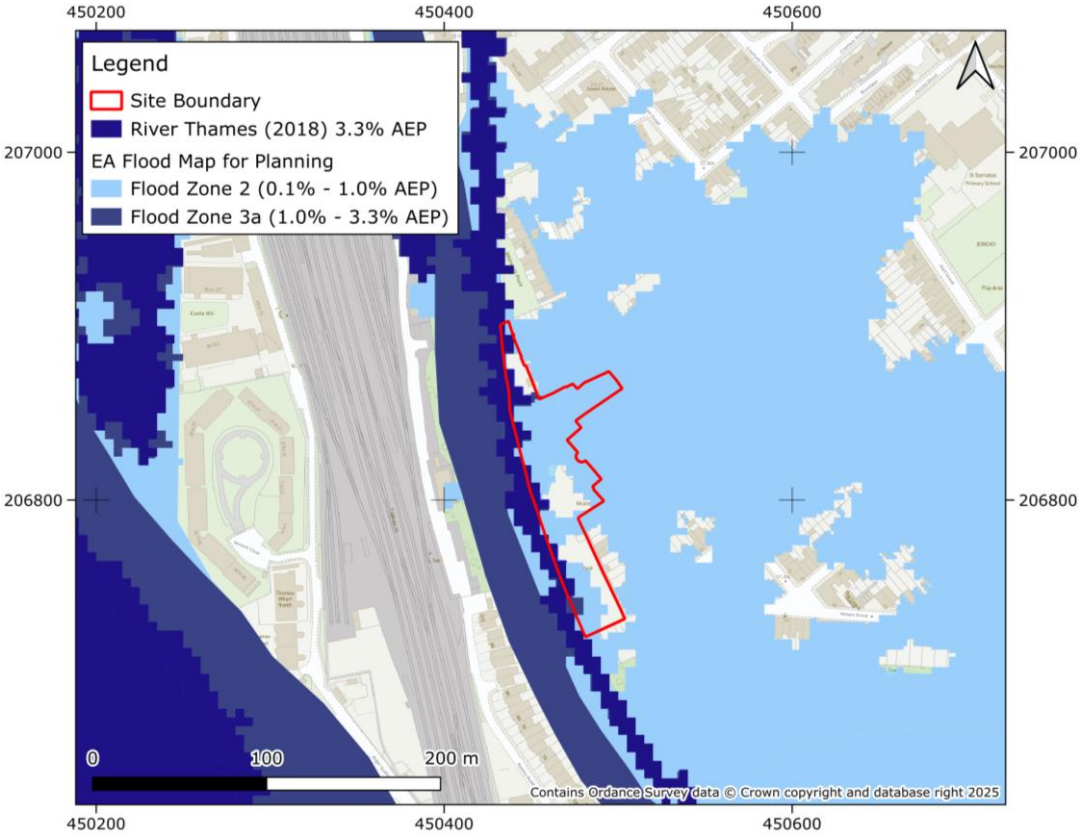

Figure 4 - Fluvial Flood Map

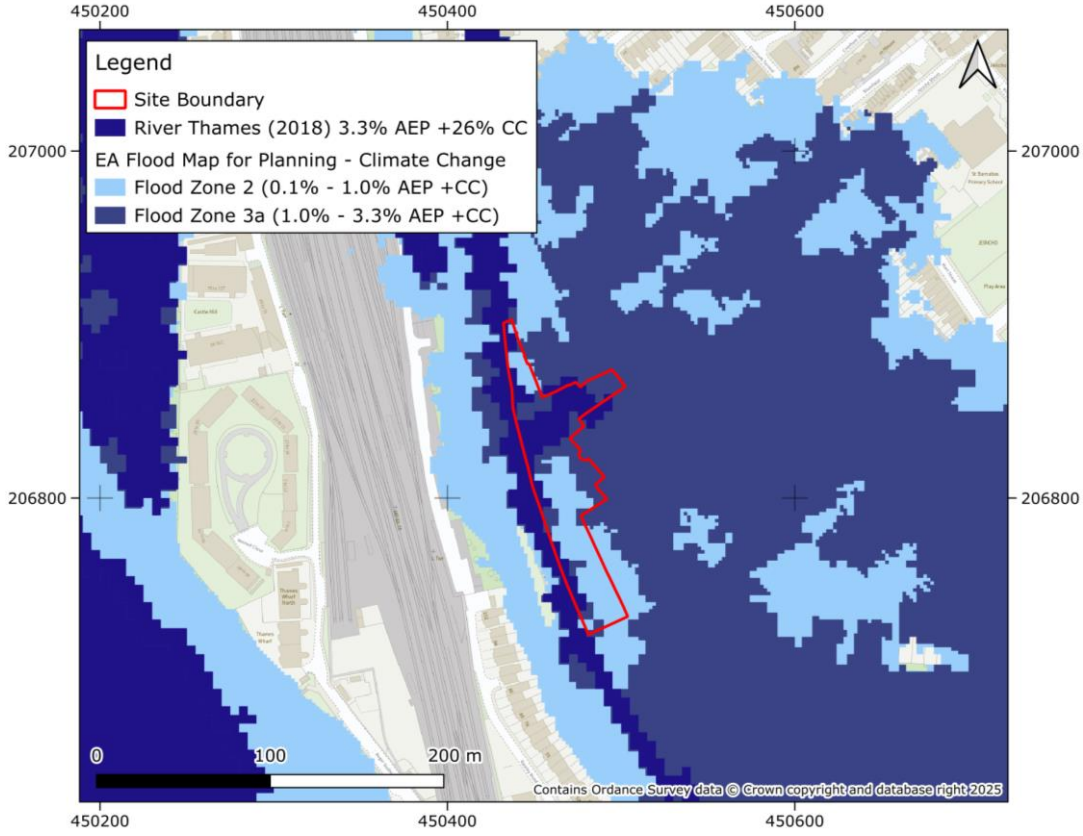

Figure 5 – Fluvial Climate Change Flood Map

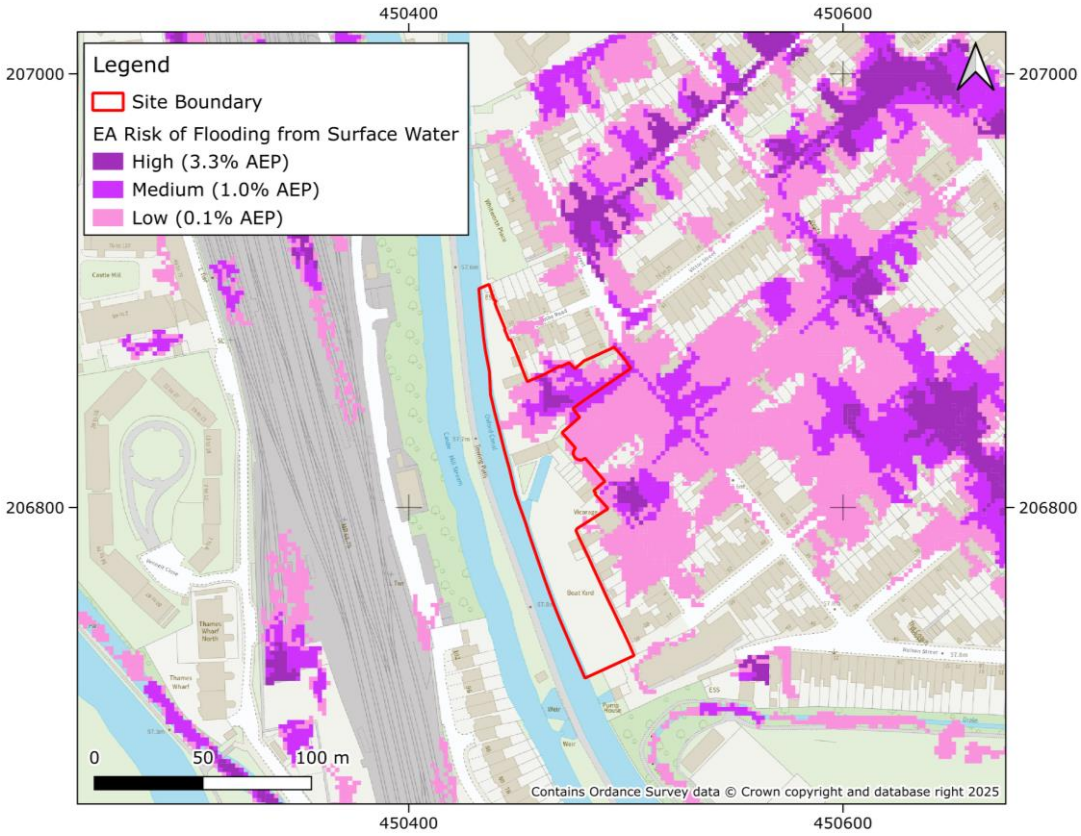

Figure 6 – Surface Water Flood Map

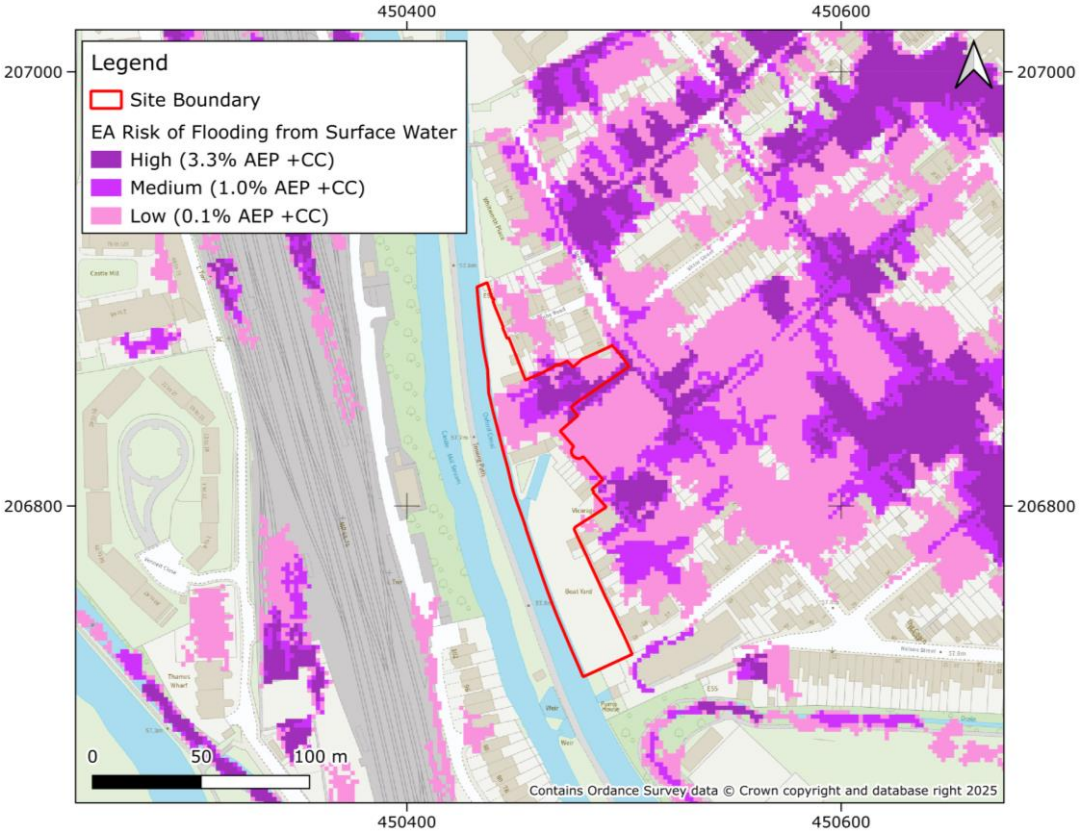

Figure 7 -Surface Water Climate Change Flood Map

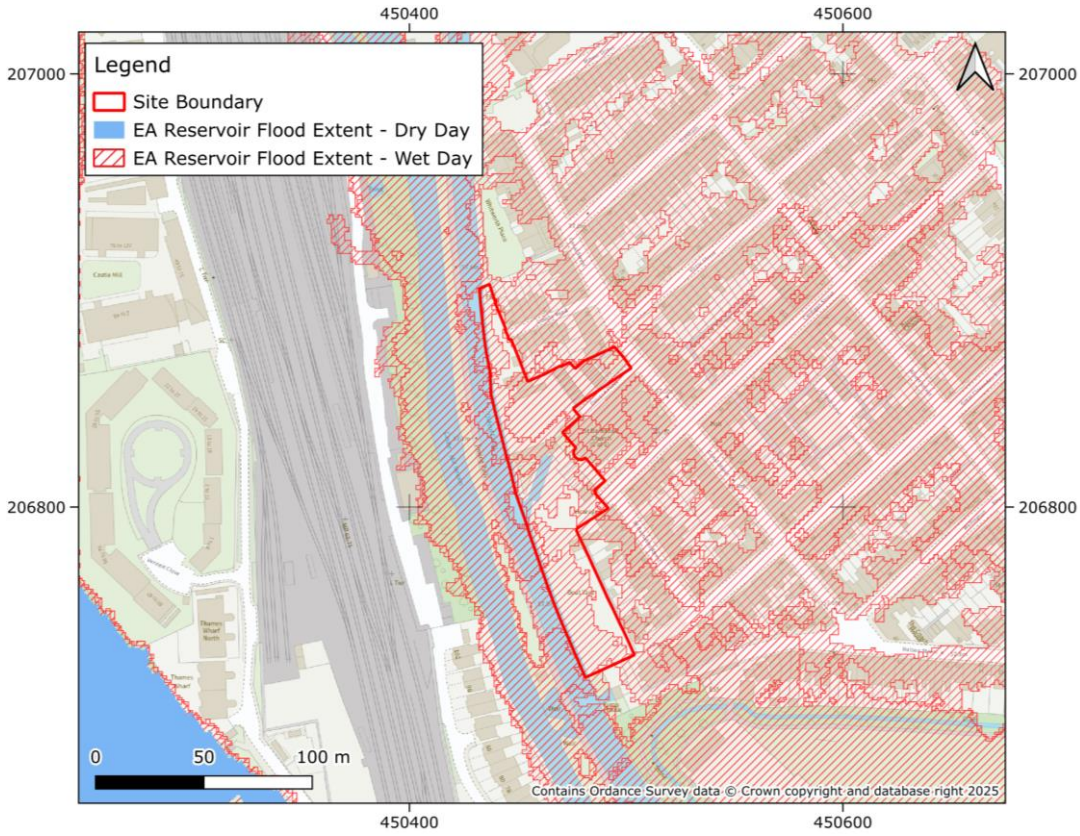

Figure 8 - Reservoir Failure Flood Map

4 Detailed Review of Primary Flood Risk

4.1 Primary Flood Risk

The primary flood risk at the site is fluvial. However, as there is a significant risk from pluvial flooding in the centre of the site, the flood risk generated by both mechanisms is quantitively assessed in more detail 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 mapping for the design event (see Figure 9) shows flooding in the west and north of the site, with a further flow route through the centre of the site where ground levels are lowest. In total 58.6% of the site is inundated during the design event. The maximum flood depth within the site is 0.34 m, located close to Dawson Place at the eastern extent of the site. Flood depths along the western boundary of the site, closest to the Oxford Canal, are also generally between 0.1 and 0.3 m. The design flood level for the 1.0% AEP +26% CC event is 57.68 m AOD, just below the average ground level at the site based on LIDAR (57.7 m AOD).

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 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.

The depth mapping across the site for this event (see Figure 10) shows an increase in flood extents with 78.3% of the site inundated. Flooding remains most severe across the northern half of the site. Flood depths across the site generally depths are below 0.2 m, however along the site's western boundary they tend to be above 0.2m and close to 0.4 m in the north of the site. The maximum flood depth within the site is 0.41m, again located close to Dawson Place at the eastern extent of the site. The design flood level within the site for the 1.0% AEP +41% CC design event is 57.75 m AOD, slightly higher than the average ground level on site based on LIDAR (57.7 m AOD).

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 is limited to pre-existing residential properties along Dawson Place, and an area to west of these properties, see Figure 11. The area is at risk due to surface water runoff from Canal Street and residential areas in Jericho to the east of the site. The depth mapping indicates that inundation depths are generally less than 0.2 m, with some areas reaching up to 0.3 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

Current access to the site is assumed to be via St Barnabas Street, Dawson Place, and Combe Road along the east of the site boundary. Due to the risk of flooding to the centre

and south of Jericho during the 1.0% AEP +26% CC design event, the best route of access and egress is via Combe Road at the north of the site, see Figure 12.

The best identified route of egress leaves the site via Combe Road before turning left to travel north along Canal Street. Continuing north along Canal Street, which becomes Mount Street as it turns east, site users are able to turn either left or right at its junction with Allam Street in order to continue travel northeast towards Walton Street and further flood free areas of Oxford.

This route travels through the smallest area of inundated land, isolated to a length of 50m along Combe Road. In this section a maximum depth and velocity of 0.12 m and 0.01 m/s is reached. The hazard rating along Combe Road is *Low*.

Despite the low hazard along the route early flood warning will be vital site to ensure that the access route can be utilised before floodwater inundates it especially given the site's proximity to the Oxford Canal. The River Thames catchment which the site falls within is dominated by chalk, it 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.

It should be noted that the site is not currently located within an EA Flood Warning Area. However, other areas of Oxford are located within flood warning areas and so Flood Warnings from these should be considered when assessing the need for evacuation from the site.

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.

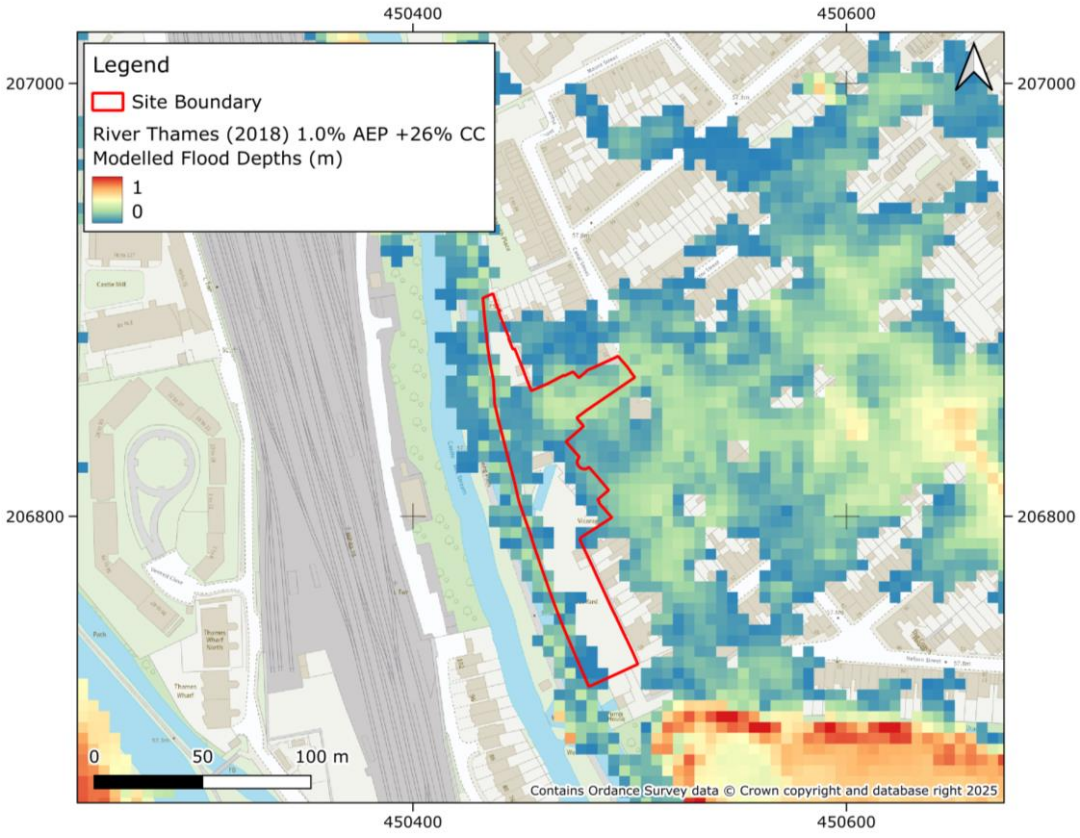

Figure 9 - River Thames (2018) 1.0% AEP +26% CC Modelled Flood Depths (m)

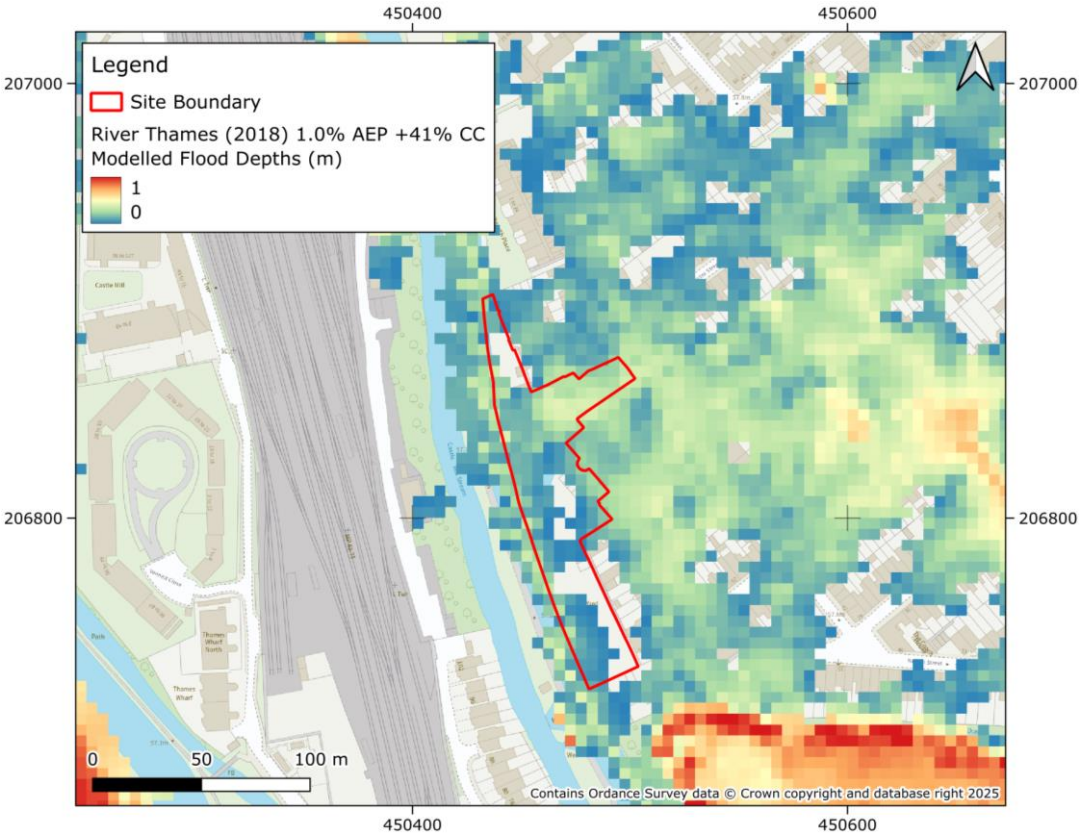

Figure 10 – River Thames (2018) 1.0% AEP +41% CC Modelled Flood Depths (m)

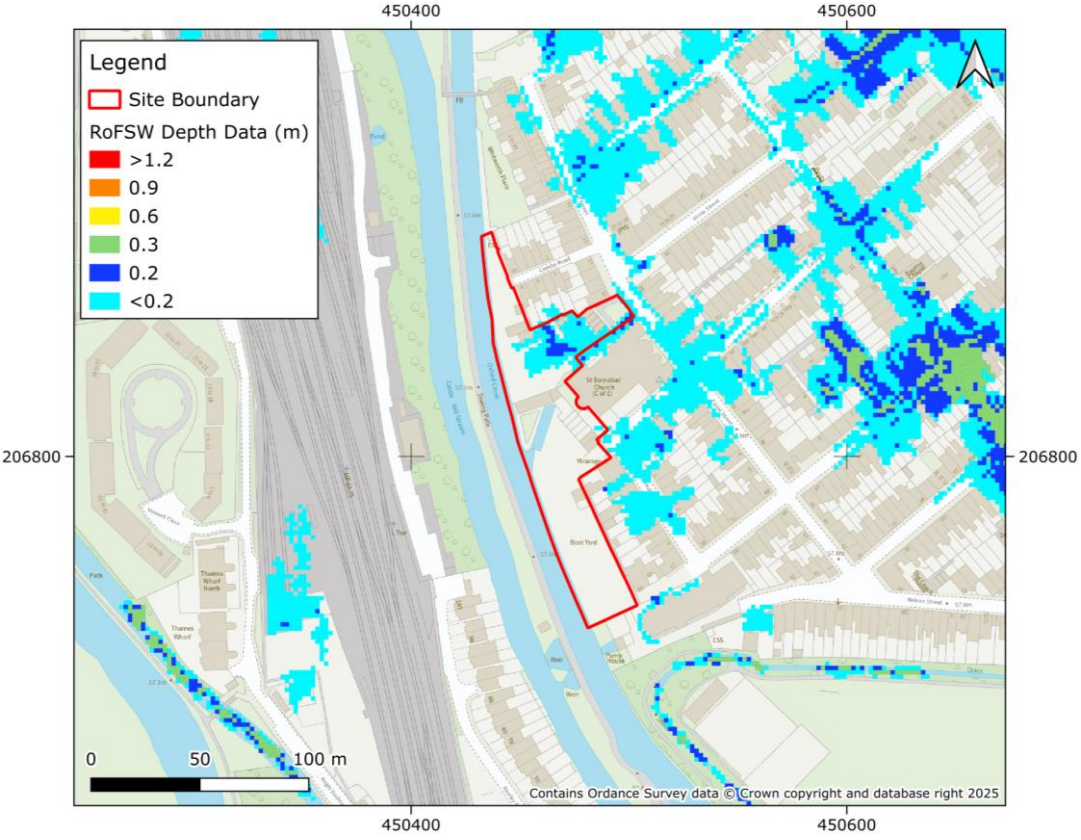

Figure 11 - RoFSW Depth Data for 1.0% AEP + Climate Change Event

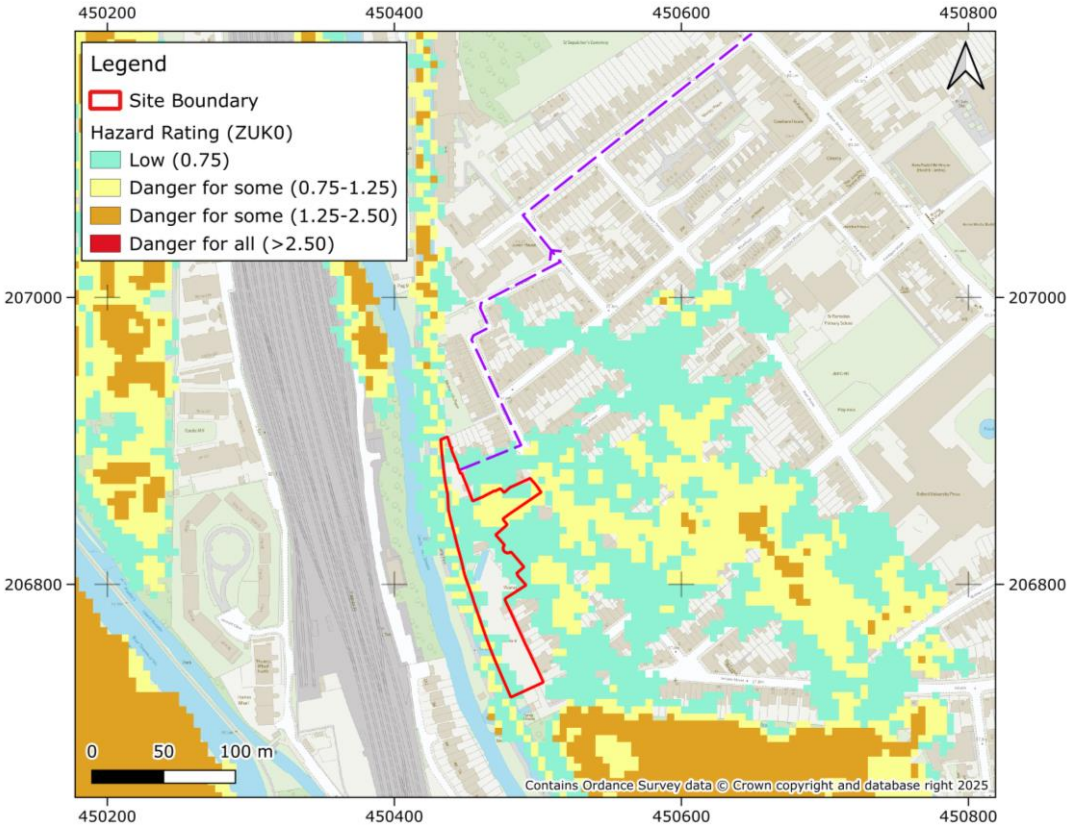

Figure 12 – Access/Egress Routes showing Flood Hazard (ZUK0) for the 1.0% AEP +26% CC Event

5 Development Viability and FRA recommendations

5.1 Development Categorisation

A sequential approach to the siting of the development should be used, with development prioritised first within Flood Zone 1 prior to consideration of any siting within Flood Zone 2 or 3a.

The proposed development at the site is a housing led, mixed-use development. Residential areas are classed as More Vulnerable Development, which is permissible in Flood Zone 2, but needs to pass the Exception Test to justify development in Flood Zone 3a. Less vulnerable uses are permissible in Flood Zone 2 and 3a without the need to pass an exception test. Both types of development are not permissible in Flood Zone 3b.

Given that Flood Zone 3b inundates a small proportion of the site (11.4%), it should be possible to locate infrastructure outside of its extent. However, the site faces significant barriers given that a large proportion of the site falls within the design flood extent (1.0% AEP + 26% Climate Change event). More vulnerable development located in its extent will need to be raised above the design flood level and compensatory storage may need to be provided to offset any 3rd party flood risk impacts.

5.2 Scale of Development

The total site area is currently 0.5 ha; allocated for residential redevelopment. At the site, 18 residential dwellings are proposed. If assuming medium density housing (60 dwellings per hectare) 18 dwellings would require 0.3 ha.

To reduce the impact on floodplain storage, building footprints and infrastructure should be sited outside of the modelled design flood extent wherever possible. This should in turn reduce the need for compensatory storage which could compromise the land available for development which is already limited.

A site-specific FRA would need to assess in more detail the requirements for compensatory storage.

5.3 Sequential Approach

It is important that a sequential approach is implemented at the site, prioritising development in Flood Zone 1 wherever possible, followed by Flood Zone 2 and then Flood Zone 3a. As already stated, no development should be located in Flood Zone 3b. If required more vulnerable housing development should be prioritised in lower flood risk areas with less vulnerable infrastructure (i.e. employment land, car parks and open spaces) located in higher flood risk areas if required. This is on the assumption that it does not increase flood risk elsewhere when considering the design flood event (57.68 m AOD) and is designed to be appropriately resistant and resilient to flooding.

Note, surface water flood risk is also present in smaller areas across the centre and east of the site. Therefore, it should be used alongside the FMfP to inform the development layout and steer development outside of high-risk areas, if possible.

5.4 Site-Specific Considerations

Development will need to be set at a floor level to provide an appropriate freeboard (typically 300mm minimum) above the design flood level of 57.68 m AOD for the defended 1.0% AEP (plus central climate change allowance) design event. If ground raising is implemented within the design flood extents, modelling will 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 to 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 flood risk surround the site to the east, with no completely flood free egress options. A route with low hazard has been identified during the design event. However given there is no advance flood warning provision for the site, a site-specific FRA should consider the evacuation requirements before the design event and a more extreme fluvial or pluvial event taking account of the site layout and advice to sought from the emergency services, including Oxford City Council's emergency planner.

A site-specific FRA should also consider the nature of the surface water flood risk in more detail 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. It is noted that the existing site is comprised of hard standing so there is potential for the site to offer a significant betterment on existing rates. 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 discharge would likely be into the canal and would need appropriate permissions from the Canal and River Trust.

Due to some parts of the site being in the wet day reservoir failure inundation extent, any development in this area could affect the reservoirs risk designation, design category and how it is operated with potential cost implications for developers. However, it is noted that the quantum of development is very small in comparison to the existing development in Oxford already lying within the reservoir flood extents so any change in designation is assumed to be unlikely.