



300 Brook Drive, Green Park

Flood Risk Assessment

On behalf of **Green Park (Reading) No.1 LLP c/o Mapletree**

maple^{tree}

Project Ref: 332611112 | Rev: A | Date: October 2024

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Executive Summary

This Flood Risk Assessment (FRA) has been prepared by Stantec UK Ltd to accompany a full planning application for external refurbishment works to the office building at 300 Brook Drive Green Park Reading, plus erection of a new End of Journey facility, terracing, cycle storage and associated landscaping works. In accordance with the fundamental objectives of the National Planning Policy Framework (NPPF), the FRA demonstrates that:

- (i) The development is safe;
- (ii) The development does not increase flood risk; and,
- (iii) The development does not detrimentally affect third parties.

The Environment Agency (EA) data confirms that the site is located mainly within Flood Zone 2 , defined as follows:

**Flood Zone 2 'Medium Probability' between a 1 in 1000 and 1 in 100 (0.1% - 1%)
Annual Probability of flooding from rivers and between a 1 in 1000 and 1 in 200
(0.1% - 0.5%) Annual Probability of flooding from the sea.**

The Flood Zone classification ignores the presence of defences, and in this location is based on the historic flooding records for the area. As such, this ignores the reduction in risk associated with the Green Park Flood Management Strategy which includes interlinked areas of floodplain storage and a flood relief channel, of which Longwater Lake is a part, to enable the Green Park development in the 1980s. More critically, it ignores the changes in topography across the Green Park area that would have a significant effect on the areas at risk of flooding.

Outputs have been extracted from the EA River Kennet Model 2018, which confirms that flooding is limited to the north-west and northern edges of the site, for events up to and including the extreme 1 in 1000 annual probability event and the 1 in 100 annual probability +25% allowance for climate change flood.

The proposed refurbishment works, and End of Journey facility building are a 'Less Vulnerable' land use, consistent with the existing site use, which is considered appropriate within Flood Zone 2 subject to passing the flood risk Sequential Test. Since the works are improvements to the existing 300 Brook Drive facility, it is clear they cannot be located elsewhere, and the Sequential Test is not applicable.

The potential climate change impacts over the lifetime of the development have been fully assessed, with the site requiring consideration of a peak river flow climate change allowance of +21% ('Central' allowance, 2115 Kennet and tributaries Management Catchment). In the absence of modelling of this scenario, the available +25% scenario is used to provide a conservative proxy.

The flood risk mitigation strategy for the development consists of the following elements:

- The proposed End of Journey facility be located on land at approximately 40m AOD, consistent with the existing building. As such it will be approximately 900mm above the modelled 1 in 100 annual probability +25% allowance for climate change fluvial level and therefore exceed standard freeboard requirements;
- Continuous safe and dry access from the site is provided at the 1 in 100 annual probability +25% climate change flood level via Brook Drive.
- Surface water runoff impacts from the works are mitigated through a range of SuDS measures, including permeable materials used for new footpaths, incorporation of a sedum

room on the new End of Journey facility (which will provide an improvement from the existing impermeable cladded structure being replaced), and rain garden in the main lawn area.

In summary, the FRA demonstrates that the proposed development is safe and in accordance with the requirements of national and local planning policy.

Summary of Key FRA Data

Aspect of flood risk	Applicable Guidance/ Source of Data	Summary	Section of FRA
Site Location	n/a	300 Brook Drive, Green Park, Reading, RG2 6UH	3.1
Existing Ground Levels	Topographic Survey by	Sits mainly at a level of between 39.5m AOD and 40.0m.	3.2
Primary source of flood risk	n/a	Fluvial - Longwater Lake and Foudry Brook link channel	4
Presence of flood defences	n/a	Site located within the Green Park Flood Management Strategy	3.5
Proposed Development	Proposals by Stride Treglown/ Place Design	Refurbishment of the existing office building and the addition of an 'End Of Journey' facility	6.1
Planning Aspects			
Flood Risk Vulnerability	Planning Practice Guidance (PPG) 'Flood Risk and Coastal Change'	'Less Vulnerable' (no change)	6.2
Flood Zone		Flood Zone 2 'Medium Probability' (based on historic flood map).	4.1
Sequential Test		Sequential Test not applicable – works are refurbishment and enhancement of existing building	6.3
Exception Test		Exception test not required.	6.3
Applicable Climate Change Allowances	EA climate change allowances guidance	Kennet and Tributaries Management Catchment +21% (Central)	5.1
Reference Flood Levels			
Present Day	EA River Kennet model 2018	1 in 30 annual probability = 38.69mAOD 1 in 100 annual probability = 38.90m AOD 1 in 1000 annual probability = 39.23m AOD	4.3
Climate Change		1 in 100 annual probability +25%= 39.10 m AOD	5.1
Proposed Mitigation Measures			
Ground Floor Levels	EA and SFRA	Existing building threshold level = 40.0m AOD (900mm freeboard above climate change flood level). End of Journey facility proposed to be at same approximate elevation.	7.1
Floodplain Storage	EA and SFRA	Proposals are outside the 1 in 100 annual probability +25% climate change floodplain and will have no impact on floodplain storage	7.2
Flood Flow Routes	SFRA	Site located outside flood flow routes	7
Safe Access	SFRA	Continuous safe access at 1 in 100 annual probability +25% climate change event and the extreme 1 in 1000 annual probability event.	7.3
Surface Water Drainage	EA and SFRA	No changes proposed to existing building. SuDS measures including permeable paving materials, rain garden and a sedum roof will be incorporated to demonstrate nil detriment.	7.4

Abbreviations

ABI	-	Association of British Insurers
AP	-	Annual Probability
BGS	-	British Geological Survey
CDM	-	Construction (Design and Management)
CIRIA	-	Construction Industry Research and Information Association
DDA	-	Disability Discrimination Act
DEFRA	-	Department for Environment, Food and Rural Affairs
EA	-	Environment Agency
FMS	-	Flood Management Scheme
FRA	-	Flood Risk Assessment
FRAP	-	Flood Risk Activity Permit
FRMP	-	Flood Risk Management Plan
GIS	-	Geographic Information System
LLFA	-	Lead Local Flood Authority
M. AOD	-	Metres Above Ordnance Datum (Newlyn)
NPPF	-	National Planning Policy Framework
PFRA	-	Preliminary Flood Risk Assessment
PPG	-	Planning Practice Guidance
RBC	-	Reading Borough Council
RoSWF	-	Risk of Surface Water Flooding
SuDS	-	Sustainable Drainage Systems
SFRA	-	Strategic Flood Risk Assessment

1 Introduction

1.1 Scope of Report

- 1.1.1 Stantec UK Ltd. has been commissioned by Green Park (Reading) No. 1 LLP (care of Mapletree) to prepare a Flood Risk Assessment (FRA) for proposed refurbishment works at 300 Brook Drive, in Green Park, Reading.
- 1.1.2 The report is based on the available flood risk information for the site as detailed in **Section 1.4** and prepared in accordance with the planning policy requirements set out in **Section 2**.

1.2 Existing Site and Proposed Development

- 1.2.1 The existing site is currently a vacant office building and is bounded by Brook Drive to the south-east. The site is approximately 1.57ha in area and is located within Green Park Business Park.
- 1.2.2 The site lies within the administrative boundary of Reading Borough Council (RBC).
- 1.2.3 The proposal is for *'External refurbishment works to an existing office building (Use Class E) including alterations to the main entrance space, elevations, installation of PV panels and electric vehicle charging points, relocation of plant equipment, erection of a new end of journey/ changing facility, cycle storage and associated landscaping works'* – see further details in **Section 6**.

1.3 Report Structure

- **Section 2: Policy Context** – This section sets out the various national and local policies and guidance that relate to this site.
- **Section 3: Site Setting** – This section provides an overview of the site location, the hydrological context and local features that could impact on flood risk.
- **Section 4: Assessment of Flood Risk** – This section sets out the available base data on flood risk from stakeholders and identifies the flood risk to the existing site.
- **Section 5: Climate Change Impacts** – This section summarises the EA climate change allowances guidance and sets out the flood risk to the site arising from climate change.
- **Section 6: Proposed Development and Sequential Test** – This section outlines the proposed development, and outlines the context of the Sequential Test and, if applicable, the Exception Test.
- **Section 7: Flood Mitigation Strategy** – This section sets out any measures proposed to be incorporated into the development to mitigate flood risk.
- **Section 8: Residual Risk** – This section summarises how residual risk has been addressed within the proposed development.
- **Section 9: Conclusions** – This section summarises the finding of the report.

1.4 Sources of Information

1.4.1 The FRA has been prepared based on the following sources of information:

- **Environment Agency (EA) published 'Open Data' datasets** (see [Appendix A](#));
- **EA Product 4 data** (Product 5/6/7 data in July 2023) including outputs from the **EA Kennet (Tyle Mill to Thames Confluence) hydraulic model (2018)** (see [Appendix D](#));
- **Topographic survey** of the site (Drawing reference 102475 - 1) undertaken by Midland Survey LTD in September 2023 (see [Appendix B](#));
- **Development proposals** by Stride Treglown and Place Design (see [Appendix C](#));
- **The Reading Borough Council (RBC) Preliminary Flood Risk Assessment (PFRA)**, June 2011 and Addendum 2017;
- **The Reading Borough Council (RBC) Level 1 Strategic Flood Risk Assessment (SFRA)**, June 2017.

1.5 Caveats and Exclusions

- 1.5.1 This FRA has been prepared in accordance with the NPPF, the associated PPG and local planning policy. The approach for flood mitigation and proposals for the surface water management strategy are based on the requirements of the EA and Reading Borough Council (RBC) in its role as Lead Local Flood Authority (LLFA). The conclusions are based on data available at the time of the study and on the subsequent assessment that has been undertaken in relation to the development proposals as outlined in [Section 1.2](#).
- 1.5.2 Activities during the construction phase may have an impact on the existing and future flood risk. Thus, an assessment of the risks and appropriate mitigation measures should be identified and managed by the contractor.
- 1.5.3 The Construction (Design and Management) Regulations (CDM Regulations) will apply to any future development of this site which involves "construction" work, as defined by the CDM Regulations. As such it is the responsibility of the proposed developer (ultimate client) to fulfil its duties under the CDM Regulations.
- 1.5.4 It should be noted that the insurance market applies its own tests to properties in terms of determining premiums and the insurability of properties for flood risk. Those undertaking development in areas which may be at risk of flooding are advised to contact their insurers or the Association of British Insurers (ABI) to seek further guidance prior to commencing development. Stantec does not warrant that the advice in this report will guarantee the availability of flood insurance either now or in the future.

2 Planning Policy Context

2.1 National Policy and Guidance

National Planning Policy Framework (NPPF) and Planning Practice Guidance (PPG)

- 2.1.1 National policy in relation to flood risk is contained within the **National Planning Policy Framework (NPPF)**, updated December 2023, issued by the Department for Levelling Up, Housing and Communities, with reference to Section 14 'Meeting the challenge of climate change, flooding and coastal change'.
- 2.1.2 The latest version of the associated **Planning Practice Guidance (PPG)** 'Flood Risk and Coastal Change' section was updated August 2022.
- 2.1.3 The NPPF and PPG demonstrate a flood risk management approach for the lifespan of the proposed development considering the effects of climate change. The document sets the framework to minimise vulnerability, provide resilience to the impacts of climate change, and to fully consider the potential impacts of climate change for the lifetime of the development within the mitigation measures.
- 2.1.4 The guidance on the application of climate change allowances in FRAs is linked via the PPG and was most recently updated in August 2022. The guidance provides contingency allowances for the potential increases in peak river flow, peak rainfall intensity and sea level rise which are considered accordingly subject to the site conditions – discussed further in **Section 5**.
- 2.1.5 The NPPF sets out the requirement for the Sequential Test and Exception Test in paragraphs 168 and 169 respectively – see below.

“168. The aim of the sequential test is to steer new development to areas with the lowest risk of flooding from any source. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding).”

169. If it is not possible for development to be located in areas with a lower risk of flooding (taking into account wider sustainable development objectives), the exception test may have to be applied. The need for the exception test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification set out in Annex 3”

- 2.1.6 These Tests are to be applied where appropriate, depending on the proposed development flood risk 'vulnerability,' the Flood Zone in which it is located and the risk of flooding from other sources. This is detailed further in **Section 6**.
- 2.1.7 The NPPF and PPG place emphasis on the need to fully consider – and design for – the impacts of climate change as set out in the 'Flood risk assessments: climate change allowances' planning guidance accessible at the following link:

<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

- 2.1.8 This guidance provides contingency allowances for potential increases due to climate change in peak river flow, sea level rise and rainfall intensity. These allowances are key for designing appropriate mitigation into the development to consider the flood risks over the lifetime of the development (peak river flow and/or sea level rise), and for the management of surface water over the site (peak rainfall intensity). The relevant allowances for consideration and the impacts to the development are discussed further in **Section 5**.

2.2 Local Policy and Guidance

Reading Borough Local Plan

- 2.2.1 Local planning policy contained within the 'Reading Borough Local Plan,' adopted November 2019, with specific reference to Policy EN18 'Flooding and Sustainable Drainage Systems', which states:

Policy EN18: Flooding and Sustainable Drainage Systems

Development will be directed to areas at lowest risk of flooding in the first instance, following the Sequential and Exceptions Test set out in the NPPF, and taking into account the effects of climate change. It will consider flooding from all sources, including fluvial, surface water, groundwater, and sewer flooding. Where development in areas at risk of flooding is necessary, it will not reduce the capacity of the flood plain to store floodwater, impede the flow of floodwater or in any way increase the risks to life and property arising from flooding. Wherever possible, development should be designed to reduce flood risk, both on- and off-site.

All major developments must incorporate sustainable drainage systems (SuDS) as appropriate and in line with the Government's Technical Standards. Smaller schemes are encouraged to incorporate SuDS, where possible. Runoff rates should aim to reflect greenfield conditions and, in any case, must be no greater than the existing conditions of the site. Schemes should ensure that the movement of water through vertical infiltration as well as horizontal run-off does not worsen contamination effects. Wherever possible, SuDS provision should maximise ecological benefits, link into the existing Green Network, incorporate tree planting and landscaping and avoid damage to existing significant trees, including through changes to the site hydrology. All new developments in areas of flood risk should give priority to SuDS.

All developments will demonstrate how they have been designed to incorporate measures to adapt to climate change. The following measures shall be incorporated into development...

- *...All development shall minimise the impact of surface water runoff from the development in the design of the drainage system, and where possible incorporate mitigation and resilience measures for any increases in river flooding levels as a result of*

Strategic Flood Risk Assessment

- 2.2.2 The Reading Borough Council (RBC) Strategic Flood Risk Assessment (SFRA) Level 1 was released in 2017 and forms part of the Local Plan evidence base, to inform future spatial planning and to assist in developing planning policies to address flood risk. Moreover, the document provides an overall understanding of the flood risk within the study area considering all potential sources and provides recommendations for safe access for developments in the Borough.
- 2.2.3 It is essential therefore, that the Council are in a position to make informed decisions, providing a careful balance between the risk of flooding and other unrelated planning constraints that may place pressure upon 'at risk' areas.

- 2.2.4 A Level 2 SFRA was also released in December 2017 that considers flood risk for allocated sites.

Preliminary Flood Risk Assessment

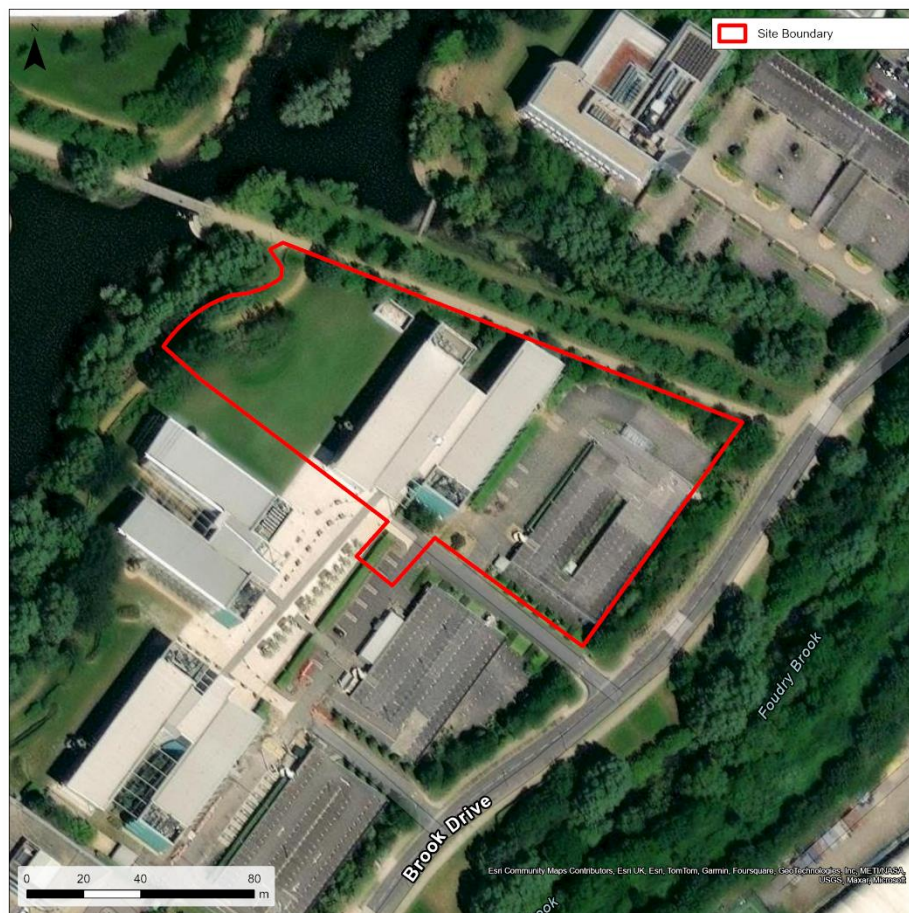
- 2.2.5 The RBC is defined as the Lead Local Flood Authority (LLFA) under the Flood and Water Management Act 2010. The first element of the Flood Risk Regulations (2009) is for LLFAs to produce a Preliminary Flood Risk Assessment (PFRA) providing a high-level overview of flood risk from all sources within a local area, including consideration of surface water, groundwater and ordinary (minor) watercourses. The RBC PFRA, released in 2011, and Addendum released in 2017, have been reviewed to ascertain any details of historic flooding at the site as part of this study.

3 Site Setting

3.1 Site Description

- 3.1.1 The site is located at 300 Brook Drive, in Green Park, Reading (postcode RG2 6UH, site centre OS grid reference 470,300m E, 169,900m N); see **Figure 3-1**. The site is 1.57 hectares and is located with the Green Park Business Park to the south of the centre of Reading. The has vehicular access from the south-eastern boundary via Brook Drive.
- 3.1.2 The site is currently a vacant office building and is surrounded by Brook Drive to the east and Longwater Avenue to the north west. A public footpath and cycleways runs along the site's north-eastern to north-western boundary.
- 3.1.3 Within the boundary there is a carpark on the east side of the office building and a landscaped area to the west, which falls gently to the banks of the Longwater Lake beyond the site boundary.

Figure 3-1: Site Location Plan

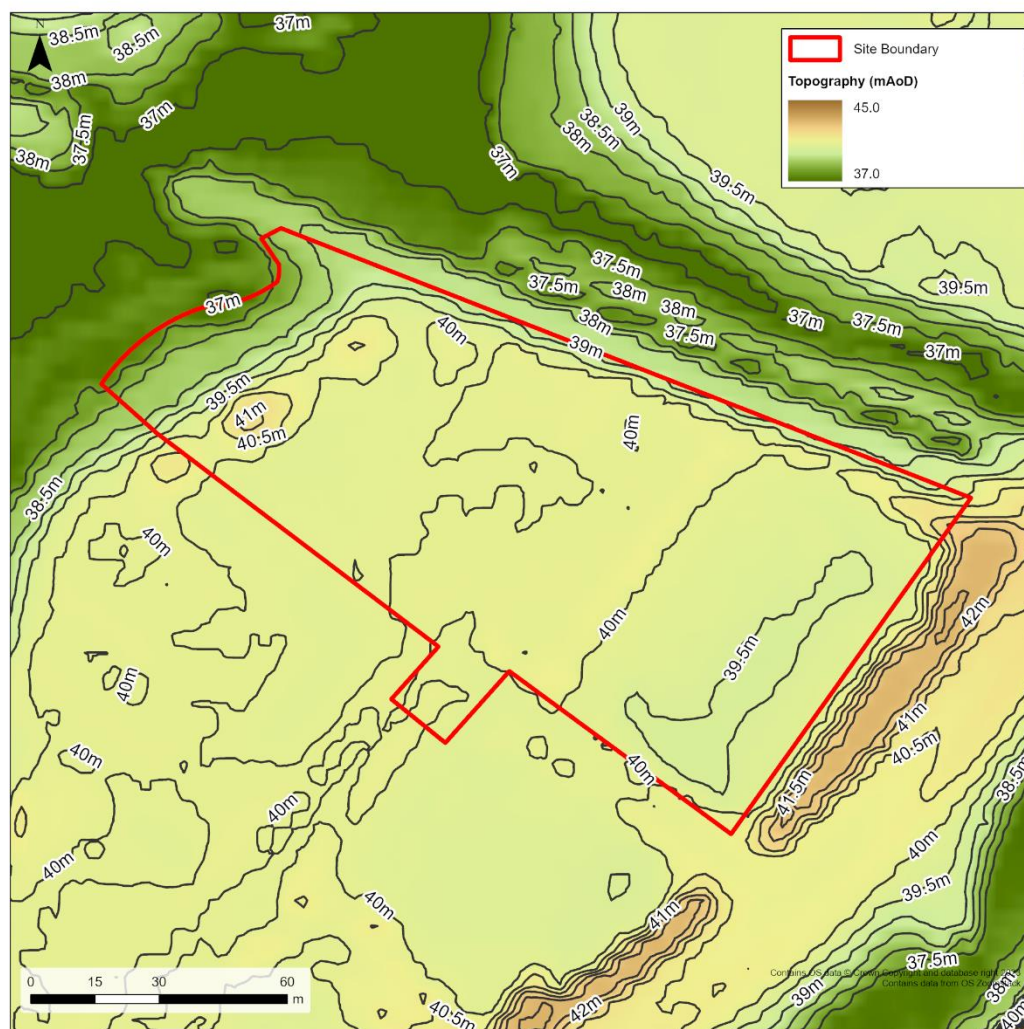


3.2 Topography

- 3.2.1 The topographic survey in **Appendix B** by Midland Surveys Ltd shows that the site is mainly at a level of between 39.5m AOD and 40.0m AOD.

- 3.2.2 EA LIDAR survey data, as shown **Appendix A**, shows that the site lies at a similar elevation to other surrounding areas around Longwater. Slightly beyond the site boundary the land falls to the north-east and north-west towards the Longwater Lake and Foudry Brook Link Channel, respectively.

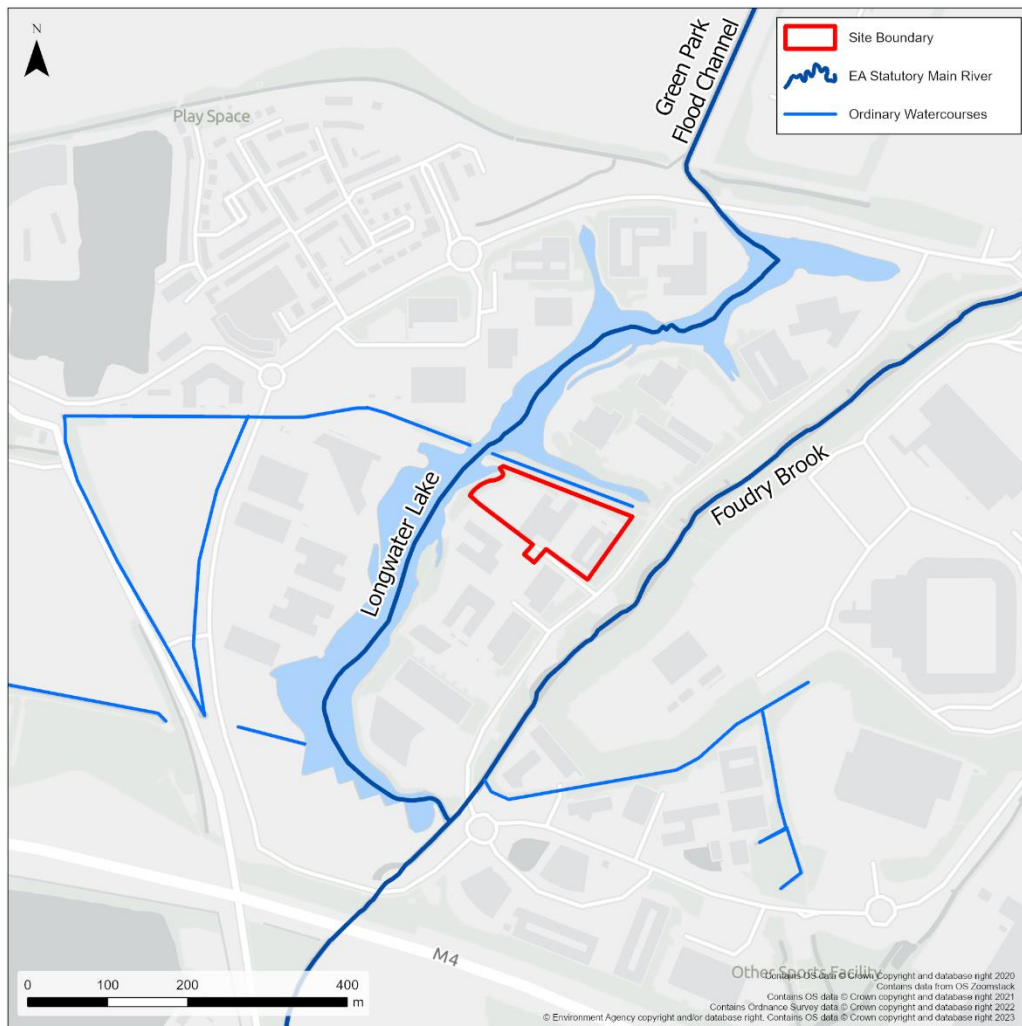
Figure 3-2: Site LIDAR Topographic Data



3.3 Hydrological Setting

- 3.3.1 The **Foudry Brook**, a 'main river' and tributary of the River Kennet, drains a predominantly clay catchment to the south of Reading. It flows north and passes under the M4 Motorway 200m to the east of the site, then continues north alongside Brook Drive, along the east side of Green Park.
- 3.3.2 A flood relief channel – also 'main river' – diverges from the Foudry Brook (approximately 350m from the site) and flows north through Longwater (the central lake feature in Green Park and immediately north-west of the site) and north to eventually outfall into the River Kennet – see **Section 3.5**.
- 3.3.3 A small 'ordinary watercourse' land drainage channel is shown on the EA surface water mapping to the immediate north of the site. Information from the Green Park Management Strategy – see **Section 3.5** – indicates this channel provides wider connectivity between the different areas of designated floodplain storage across the Green Park area (as well as providing a flood storage function itself).

Figure 3-3: Hydrological Features



3.4 Geology and Hydrogeology

3.4.1 The British Geological Survey (BGS) online viewer suggest that the site lies on:

- Superficial Deposits of Beenham Grange Gravel (sand and gravel)
- Bedrock geology of Lambeth Group (clay, silt and sand)

3.4.2 The 1:50,000 scale geological sheet of the area confirms these findings.

3.4.3 From consideration of the geomorphological and topographical setting of the site, it is expected that groundwater level will be consistent with the typical river level at approximately 36.5m AOD, however locally higher water levels may be present following periods of prolonged rainfall and elevated river levels.

3.4.4 The site does not lie within an EA Groundwater Source Protection Zone; however, it does lie within a 'Drinking Water Safeguard Zone' for surface water.

3.4.5 The site lies on a Secondary A designated bedrock aquifer defined as '*aquifers that comprise permeable layers that can support local water supplies and may form an important source of*

base flow to rivers’ and within an area of Groundwater Vulnerability designated ‘Medium - High.’

3.5 Flood Defences

Green Park Flood Management Scheme

- 3.5.1 In order to facilitate the development of all the Green Park phases and alleviate an existing flooding problem in South Reading, a ‘Flood Management Scheme’ (FMS) was devised in the 1980s with the Rivers Division of the then Thames Water Authority (as predecessors of the EA) and the applicable local authorities.
- 3.5.2 The basis of this agreement is detailed within the ‘Foudry Brook – Flood Storage Proposals’ by Lewin, Fryer and Partners dated September 1985. This document, together with an earlier Peter Brett Associates (PBA – now Stantec) report ‘Foudry Brook – Proposed New Channel M4 to River Kennet’ (June 1984), demonstrates the original rationale of development and floodplain management as well as confirming the geographical extents for which the Flood Management Scheme mitigates the effects of development.
- 3.5.3 The Flood Management Scheme, which has been implemented during the first two phases of Green Park, removed a previous bottleneck caused by the raised landfill sites spanning the floodplain to the north of Green Park, on the Foudry Brook catchment, by constructing a new flood relief channel to the River Kennet, of which Longwater Lake (Flood Relief Channel) is part of.
- 3.5.4 The scheme was agreed with the Thames Water Authority and comprised the following elements:
- A flood channel taking flood flows from the Foudry Brook, via a fixed crest flow control weir and passing them to a new connection into the River Kennet at Fobney.
 - Provision of 16ha of land reserved for dedicated flood storage within the development to agreed criteria in respect of area and level; and
 - Building platforms to be raised out of the (1 in 200 annual probability) floodplain to accommodate the Green Park development.
- 3.5.5 The scheme is designed to reduce the flood risk associated with the Foudry Brook whilst at the same time allowing further land raising to facilitate the entire Green Park development.
- 3.5.6 As a consequence of the scheme completion so far, and in accordance with the aspirations of Thames Water Authority and RBC at the time, flood levels in this area of south Reading have been lowered providing relief to properties with historic flooding problems. During the intervening years since the construction of the Longwater Flood Relief Channel, a period of temporary betterment over that designed for has been experienced. This is because, effectively, the flood compensation for the wider scheme ground raising was constructed in advance.

4 Assessment of Flood Risk

The assessment of flood risk has been undertaken based on the sources of information listed in [Section 1.4](#).

4.1 EA Opendata Flood Maps

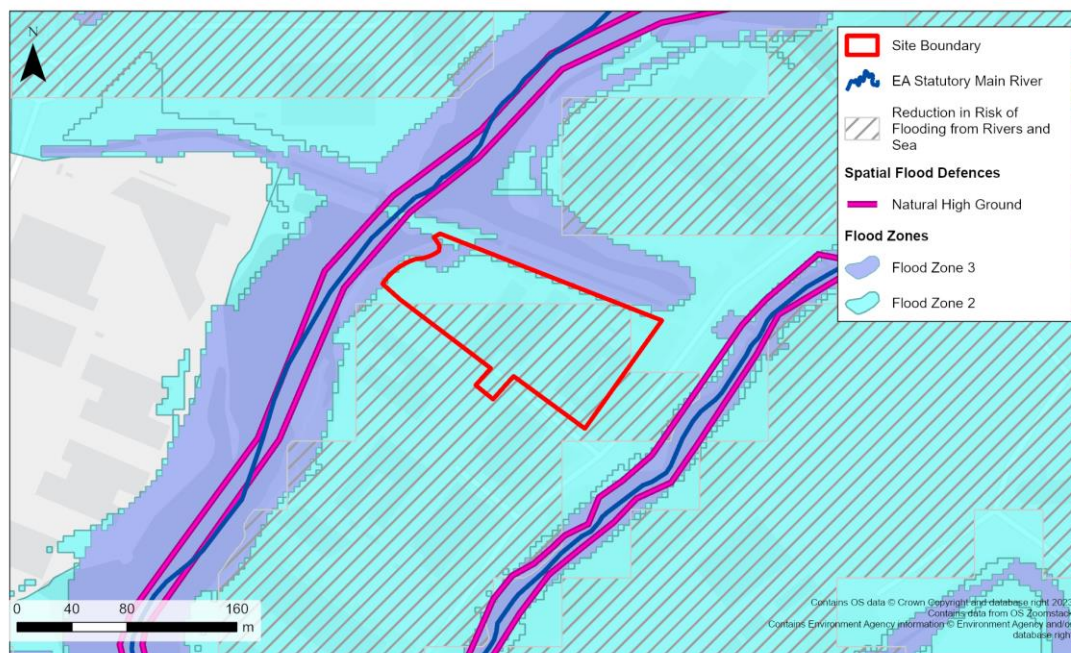
- 4.1.1 The following maps have been taken from the Stantec GIS flood maps report in [Appendix A](#) based on the EA Opendata datasets available online and reproduced with OS mapping under licence to Stantec.

Flood Zone Map

- 4.1.2 The first phase in identifying whether a site is potentially at risk of flooding is to consult the .GOV.UK 'Flood Map for Planning' website. This provides an initial indication of the extent of the Flood Zones, which is refined through the use of more detailed site-specific level survey and modelled flood levels. The Flood Zones are defined in Table 1 of the Planning Practice Guidance (PPG) 'Flood Risk and Coastal Change' section as follows:

- **Flood Zone 1 'Low Probability'** – Land at less than 1 in 1000 (0.1%) annual probability of river or sea flooding;
- **Flood Zone 2 'Medium Probability'** – Land between 1 in 100 (1%) and 1 in 1000 (0.1%) annual probability of river flooding, or between 1 in 200 (0.5%) and 1 in 1000 (0.1%) annual probability of sea flooding;
- **Flood Zone 3 'High Probability'** – Land at 1 in 100 (1%) or greater annual probability of river flooding, or 1 in 200 (0.5%) or greater annual probability of sea flooding;

Figure 4-1: EA Flood Zone Map



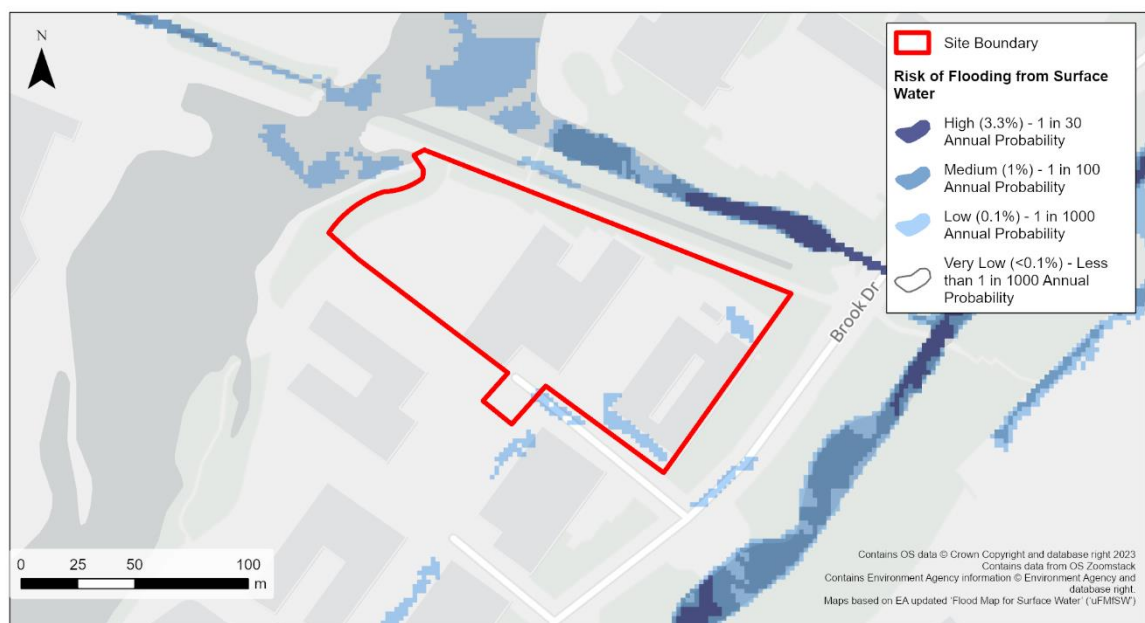
- 4.1.3 The EA Flood Zone map indicates that the majority of the site lying within **Flood Zone 2 'Medium Probability'**. With some of the north western and north boundary lying within **Flood Zone 3 'High Probability'**,

- 4.1.4 It is understood that the Flood Zone 2 extent in this area is based on the 'worst historic' flooding records and, as such, covers an extensive area due to the historically low-lying nature of the area. However, there has been significant development and ground remodelling across this area and as such this Flood Zone extent does not represent the actual flood risk to the site or wider area - see hydraulic model output data in [Section 4.3](#)
- 4.1.5 The hatching designation over parts of the site indicate the area benefits from a reduction in flood risk due to local flood alleviation/flood defence measures. It is assumed this relates to the wider flood alleviation measures provided as part of the Green Park Flood Management Strategy, of which Longwater Lake - and the adjacent ordinary watercourse – are a part (see [Section 3.5](#)).
- 4.1.6 The Flood Zone map does not consider the presence of any flood defences in the area and does not differentiate between Flood Zone 3a 'High Probability' and Flood Zone 3b 'Functional Floodplain' (this is designated within the SFRA – see [Section 4.2](#)).

Flood Risk from Surface Water

- 4.1.7 The EA 'Risk of Flooding from Surface Water' map shows where areas could be potentially susceptible to surface water flooding in an extreme rainfall event. The latest mapping assesses flooding resulting from severe rainfall events based on the following three scenarios:
- 'High' Risk: 1 in 30 (3.3%) or greater AP rainfall event;
 - 'Medium' Risk: Between a 1 in 100 (1%) and 1 in 30 (3.3%) AP rainfall event;
 - 'Low' Risk: Between 1 in 1000 (0.1%) and 1 in 100 (1%) AP rainfall event;
 - 'Very Low' Risk: Lower than 1 in 1000 (0.1%) AP rainfall event.
- 4.1.8 The EA mapping shows that the majority site is predicted to be at a 'Very Low' risk of surface water flooding; see [Figure 4-2](#), although there are some small pockets of areas in the site which are shown to be at 'Low' risk.

Figure 4-2: EA Risk of Flooding from Surface Water Map



- 4.1.9 It should be noted that the surface water maps are generated using a generic methodology on a national scale, whereby rainfall is routed over a ground surface model. The analysis does not take account of any specific local information on below-ground drainage infrastructure and infiltration, although an adjustment is included in urban areas to account for the impact of sewerage and a standard infiltration allowance based on soil type. Consequently, the mapping provides a guide to potentially vulnerable areas based on the general topography of an area.

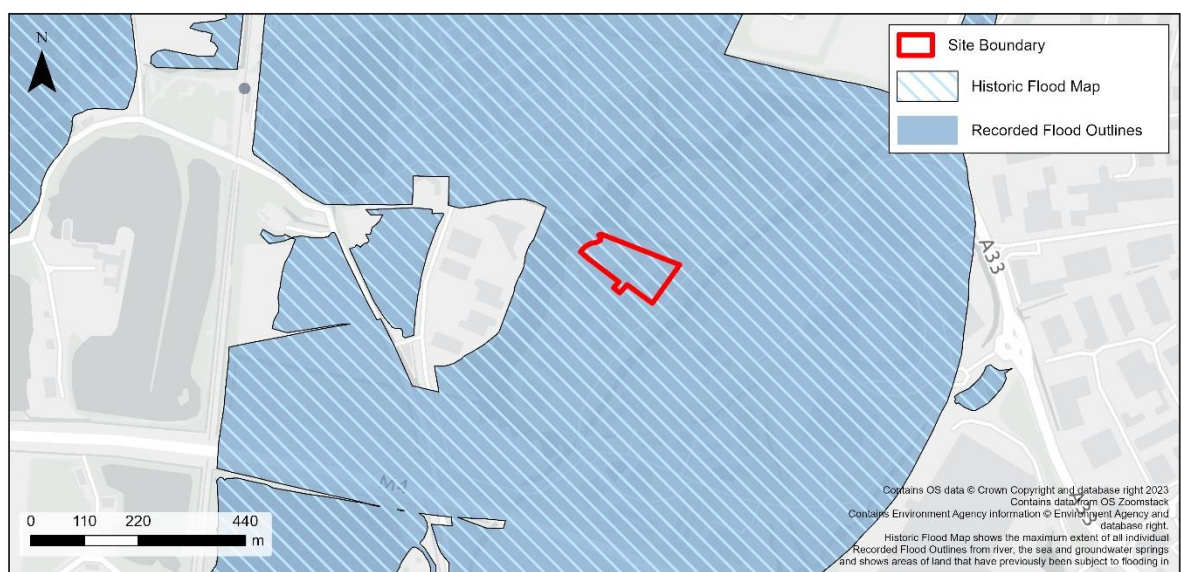
Flood Risk from Reservoirs Map

- 4.1.10 The EA provides maps showing the risk of flooding in the event of a reservoir failure. The reservoir breach extents are captured in the baseline flood maps have been taken from the Stantec GIS flood maps in **Appendix A**
- 4.1.11 The EA reservoir maps show two flooding scenarios, a 'dry-day' and a 'wet-day.' The 'dry-day' scenario predicts the flooding that would occur if the dam or reservoir failed when rivers are at normal levels. The 'wet day' scenario predicts how much worse the flooding might be if a river is already experiencing an extreme natural flood.
- 4.1.12 The mapping confirms the site is not at risk of reservoir breach during a 'dry-day' or a 'wet-day' scenario.
- 4.1.13 It should be emphasised that the risk of flooding from a reservoir breach is very small. The EA is the enforcement authority for the Reservoirs Act (1975) and there is a mandatory requirement for all large, raised reservoirs (where greater than 25,000m³ of water is stored above natural ground level) to be inspected and supervised by reservoir panel engineers. The reservoir owner has a duty of care under the Health and Safety at Work Act 1974 to ensure others are not placed at risk from their assets or actions. Whilst the consequences of a reservoir breach could be severe, the probability of such an occurrence is therefore considered to be very low.

Historic Flood Map

- 4.1.14 The EA 'Historic Flood Map' is a dataset showing the maximum extent of all individual recorded flood outlines from river, the sea and groundwater and shows areas of land that have previously been subject to flooding.

Figure 4-3: EA Historic Flood Map



- 4.1.15 This map indicates that recorded floods have affected the entirety of the site, however as discussed in **Section 3.3** there have been significant changes in topography over the wider area since the 1980s, and the management of fluvial flood events in the area as a result of the Green Park Management Strategy, which limits the relevance of historic records of flooding to the area.

4.2 Strategic Flood Risk Assessment

- 4.2.1 The current RBC Strategic Flood Risk Assessment (SFRA) Level 1 and Level 2 reports were prepared by PBA in 2017 and provide advice to RBC on flood risk issues within the Borough. This document has been reviewed and key information of relevance to the site has been extracted.

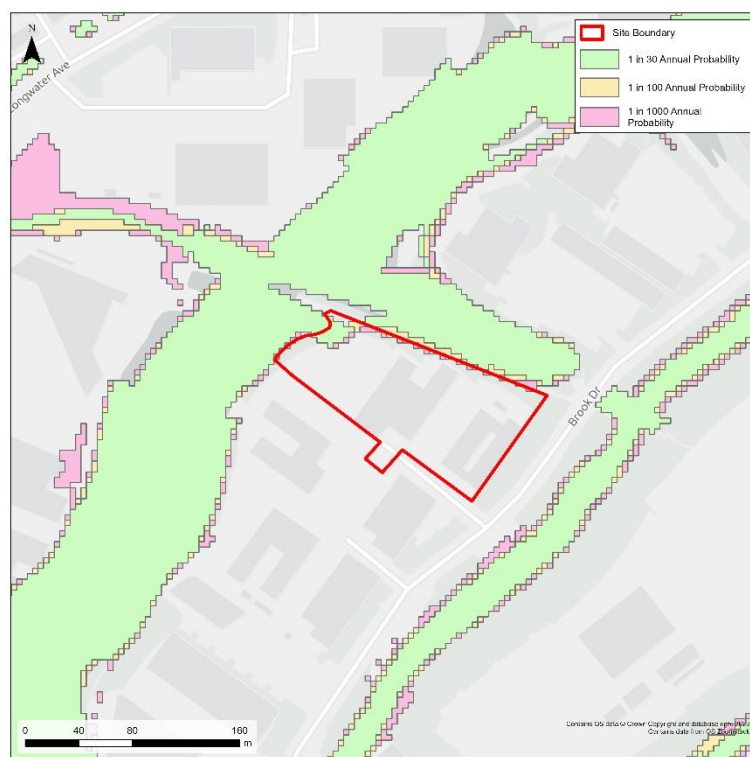
- **Historic Flooding:** Map F1 provides the EA historic floodplain map, consistent with the data discussed in **Section 3.1**. Maps F2_S1 and F1-S2 show historic flooding records affecting the north of Reading for 5 recorded flood events. These show that the site has largely been unaffected since the implementation of the Green Park flood management scheme. The area did flood up till 1992 with the car park being affected in the 1992 floods (F2-S2), However since there has been no further flooding documented on the site;
- **Flood Zone:** Map F4_S shows the Flood Zone maps across the area, indicating the site is in Flood Zone 2. However, the Flood Zones are due to be updated to take account of more recent EA River Thames and River Kennet modelling and therefore modelled flooding may be more up to date than the presented Flood Zone information;
- **Modelled Flood Extents:** SFRA map series reference F5_S provides modelled present day and climate change flood extents through the Borough. As mentioned above, this mapping has subsequently been updated to take account of the new EA River Thames and River Kennet modelling and therefore this map is superseded by the information discussed in **Section 4.3**;
- **Surface Water:** SFRA map series reference F6_S provides the surface water flood risk through the Borough. These outputs are consistent with the surface water flood maps discussed in **Section 4.1**;
- **Reservoir Breach:** SFRA Map F7 shows the flood risk associated with reservoir breach in the area (the only reservoir affecting the Borough being Whiteknights Lake at Reading University). The mapping confirms that any flooding as a result of a breach is limited to land to the south-east of Reading and the site is unaffected;
- **Groundwater:** SFRA Map F8 provides a high-level overview of areas susceptible to groundwater flooding, taken from a national dataset and based on underlying geological conditions across 1km grid squares. The site is shown in an area at 'Greater than 75%' susceptibility. However due to the changes in flow arrangements and changes in topography resulting from the Green Park Flood Management Strategy this is expected to be significantly lower;
- **Sewers:** Map F9 provides a summary of Thames Water sewer flooding incidents by postcode, indicating the site postcode area of the site has 1-5 recorded sewer flooding incidents from both internal and external sources.

- 4.2.2 It is noted that the August 2022 update to the PPG 'Flood Risk and Coastal Change' section includes an amended definition for Flood Zone 3b as the 1 in 30 (3.3%) annual probability flood, instead of the 1 in 20 (5%) annual probability flood. Since a 1 in 30 annual probability event has been run by the EA as part of their modelling exercise (see **Section 4.3**) the 1 in 30 annual probability event has been taken as Flood Zone 3b for this assessment, based on the latest guidance.

4.3 EA River Kennet 'Tyle Mill to Thames Confluence' Model 2018

- 4.3.1 The EA has provided modelled flood data from the 'Lower Kennet' 2018 flood model. This model is considered to be the best available information for assessing flood risk to the site, and Stantec have obtained the Product 5/6/7 data (i.e. the hydraulic model and outputs) and interrogated this to extract site-specific data.
- 4.3.2 **Figure 4-4** shows the modelled flood extents, which indicate almost all of the site is outside all present-day flood events, up to and including the extreme 1 in 1000 annual probability event, with very minor amounts of flooding along the northern boundaries of the site (associated with Longwater Lake and the Foudry Brook link channel respectively).

Figure 4-4: EA Modelled Flood Extents – Thames 2018 Model – Present Day



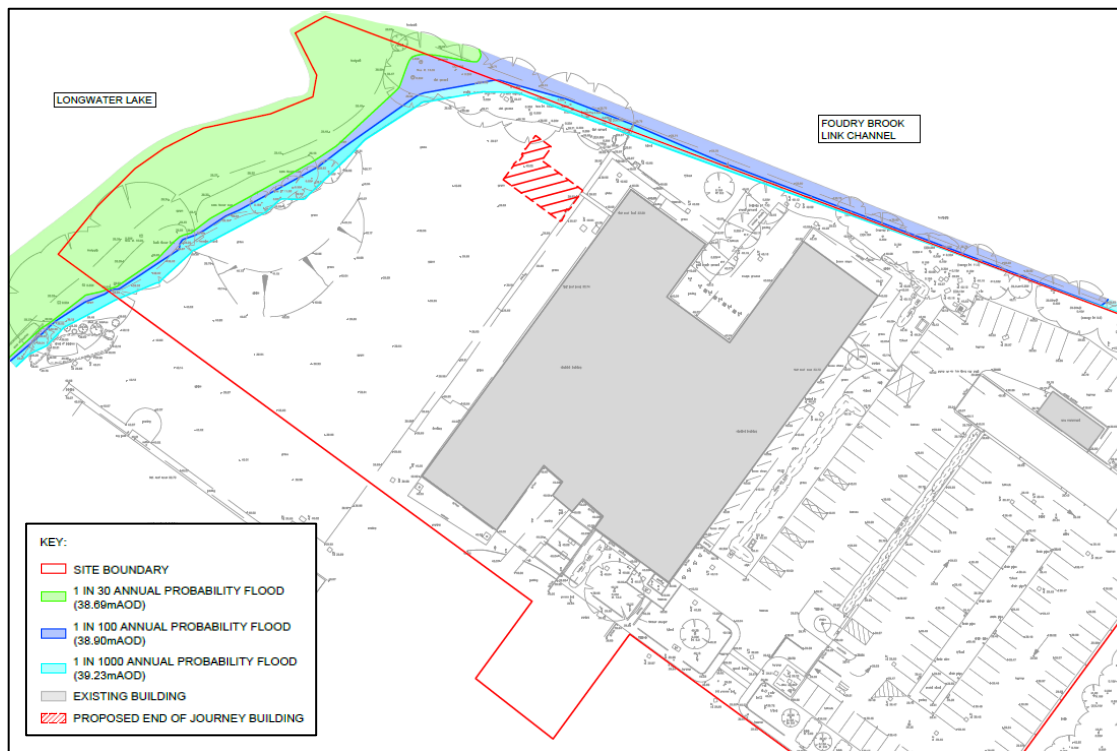
- 4.3.3 The modelled flood levels across the site from node reference 'GREE1_1420.1' located in the centre of Longwater Lake are summarised in **Table 4-1**:

Table 4-1: EA Modelled Flood Levels – Present Day

Flood Event (Annual Probability)	Modelled Flood Level, m AOD
1 in 5 (20%)	38.38
1 in 20 (5%)	38.64
1 in 30 (3.33%)	38.69
1 in 100 (1%)	38.90
1 in 1000 (0.1%)	39.23

4.3.4 **Figure 3.5** provides an extract of **Stantec drawing 332611112-200-0001** (see **Appendix D** for full drawing), the detailed flood extent for the modelled present day flood events and generated using these extracted flood levels and the topographic survey by Maltby Surveys.

Figure 4-5: Modelled Flood Extents (extract of Stantec drawing 332611112-200-0001)



4.3.5 The topographic survey in **Appendix B** indicates that the site is mainly at a level of between 39.5m AOD and 40m AOD. Comparison with the modelled flood levels indicate the site :

- **1 in 30 annual probability event:** The existing building over the site is unaffected by flooding and the main site area is on ground above the flood level by typically 800mm or more (based on a typical elevation of 39.5m AOD to 40.0m AOD). The north western boundary experience shallow flooding but remains in the areas of vegetation.
- **1 in 100 annual probability event:** The main site area is on ground above the flood level by typically 600mm or more.
- **1 in 1000 annual probability event:** The main site area is on ground above the flood level by typically 270mm or more. The existing building, at 40.0m AOD, is above this flood level by 770mm. Flooding remains contained to the northern boundaries of the site

4.3.6 The potential impacts of climate change over the lifetime of the proposed development have been considered so that mitigation measures can be designed accordingly and are discussed in **Section 5**.

5 Climate Change Impacts

It is necessary to fully consider the potential impacts of climate change over the lifetime of new development. The applicable allowances to take into consideration are detailed in the 'Flood risk assessments: climate change allowances' planning guidance (see [Section 2.1](#)) and discussed in turn below.

5.1 Peak River Flow

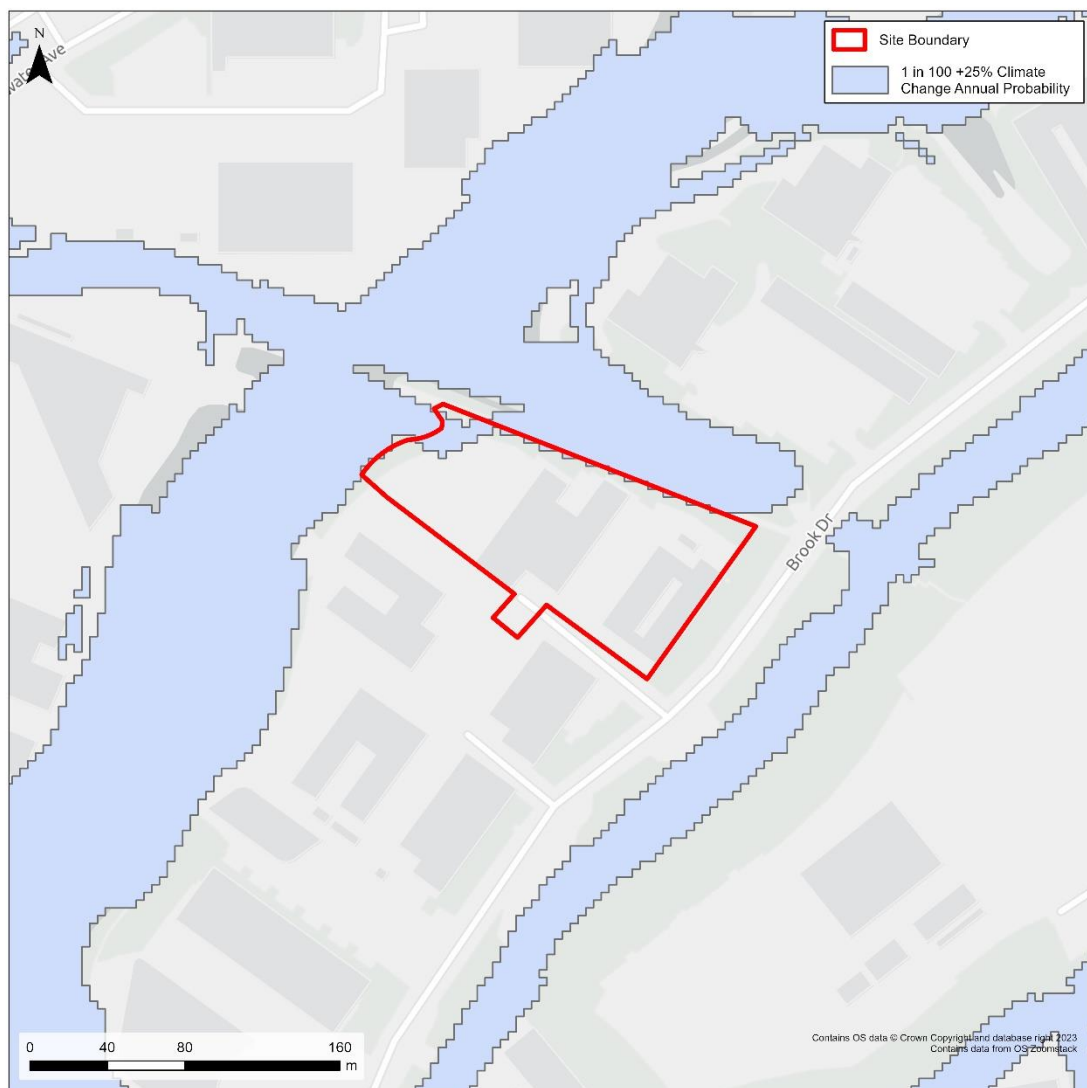
- 5.1.1 The peak river flow allowances provide a range of allowances based on percentile (i.e. the degree of certainty of an event occurring, based on the range of climate change scenarios assessed through scientific investigations). The applicable values for a site are dependent on the 'River Management Catchment' in which the site is located, which can be confirmed via the online mapping tool embedded within the guidance.
- 5.1.2 The peak river flow allowances provide a range of scenarios based on percentile (i.e., the degree of certainty of an event occurring, based on the range of climate change scenarios assessed through scientific investigations). The provided allowances are subject to the sub-catchments of river basin district (known as management catchments) and the vulnerability classification of the proposed use of the site.
- 5.1.3 The Central allowance is identified as the design standard for most forms of proposed development in all appropriate Flood Zones (the exception being 'Essential Infrastructure' which requires the 'Higher Central' value). The peak river flow allowances to be considered as part of the FRA are as detailed in [Table 5-1](#)

Table 5-1: Climate Change – Peak River Flow - Central Allowances

River Management Catchment	Central Climate Change Allowance - Epoch		
	2020s	2050s	2080s
Kennet and tributaries <i>Management Catchment</i>	+10%	+8%	+21%

- 5.1.4 As the 1 in 100 annual probability +21% climate change scenario has not been modelled, the equivalent modelled +25% climate change scenario provides a conservative proxy for the 'design event'.
- 5.1.5 [Figure 5-1](#) below shows the climate change flood extents from the 2018 model. These extents indicate the majority of the site is outside the 1 in 100 annual probability +25% climate change flood events, consistent with the present day scenarios. There is, again, localised flooding along the northern boundaries of the site associated with the adjacent watercourses.

Figure 5-1: EA Modelled Flood Extents –Kennet 2018 Model – Climate Change

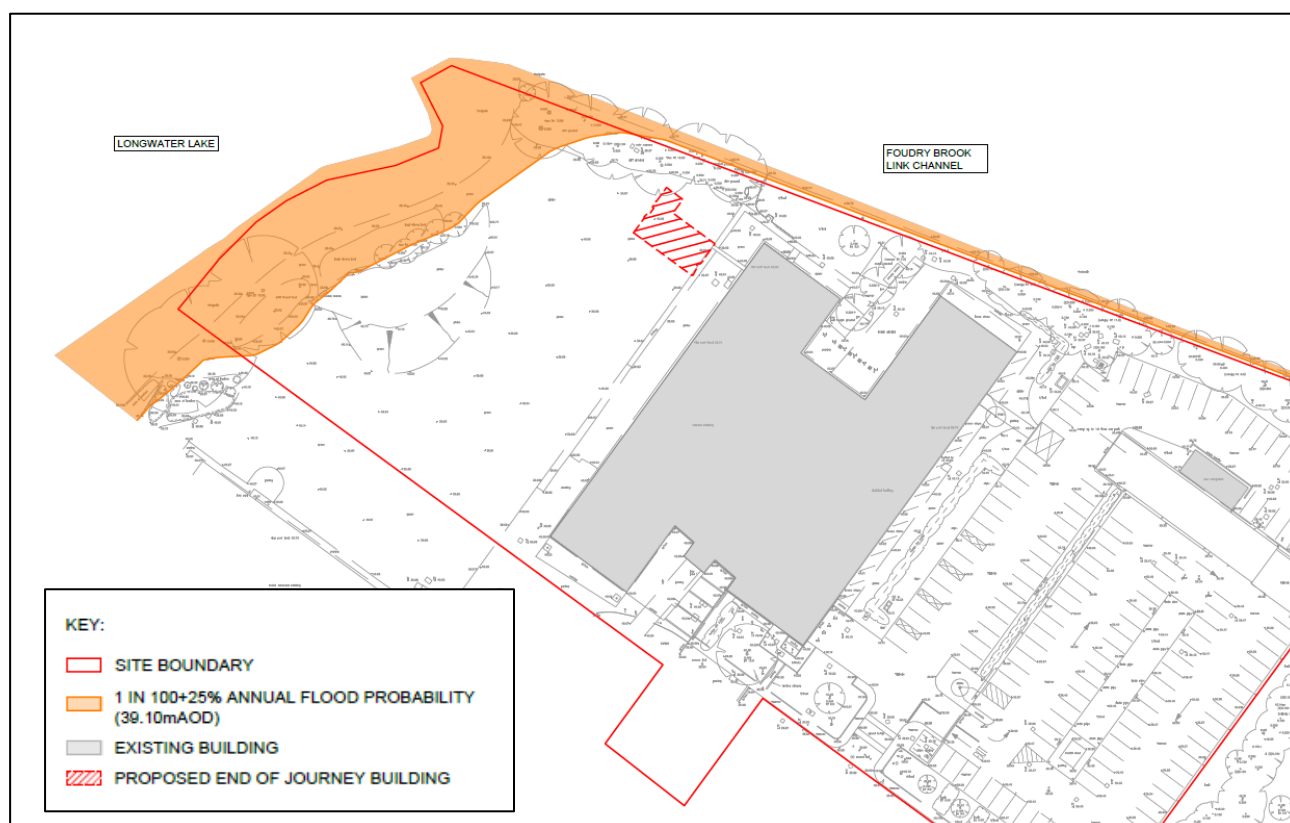


5.1.6 As shown in **Figure 5-2**, the extract of **Stantec drawing 332611112-200-0002** (see **Appendix D**) shows the extent of flooding in the climate change scenario based on these extracted flood level and the topographic survey by Maltby Surveys.

Table 5-2: EA Modelled Flood Levels – Climate Change

Flood Event (1 in 100 Annual Probability plus specified climate change allowance)	Modelled Flood Level m AOD
+25% climate change	39.10

Figure 5-2: Modelled Flood Extents (extract of Stantec drawing 332611112-200-0002)



5.1.7 **Figure 5-2** shows that the 1 in 100 annual probability +25% climate change event will not affect the main elements of the site.

5.2 Peak Rainfall

5.2.1 The potential increase in peak rainfall intensity needs to be considered in the surface water drainage strategy for new developments.

5.2.2 The EA climate change allowances guidance was updated in May 2022 to include a GIS based 'peak rainfall allowances' map showing the anticipated changes in rainfall intensity based on river management catchment. The anticipated changes in peak rainfall intensity in small catchments (less than 5km²), or urbanised drainage catchments are summarised in **Table 5-3**. For large rural drainage catchments, the peak river flow allowances are applied.

Table 5-3: Climate Change – Peak Rainfall Intensity Allowances

<i>Kennet and tributaries Management Catchment</i>	Total potential change anticipated (2070s epoch – i.e. 2061 to 2125)	
	<i>Central</i>	<i>Upper End</i>
<i>3.3% (1 in 30-year) rainfall</i>	<i>25%</i>	<i>35%</i>
<i>1% (1 in 100-year) rainfall</i>	<i>25%</i>	<i>40%</i>

6 Proposed Development

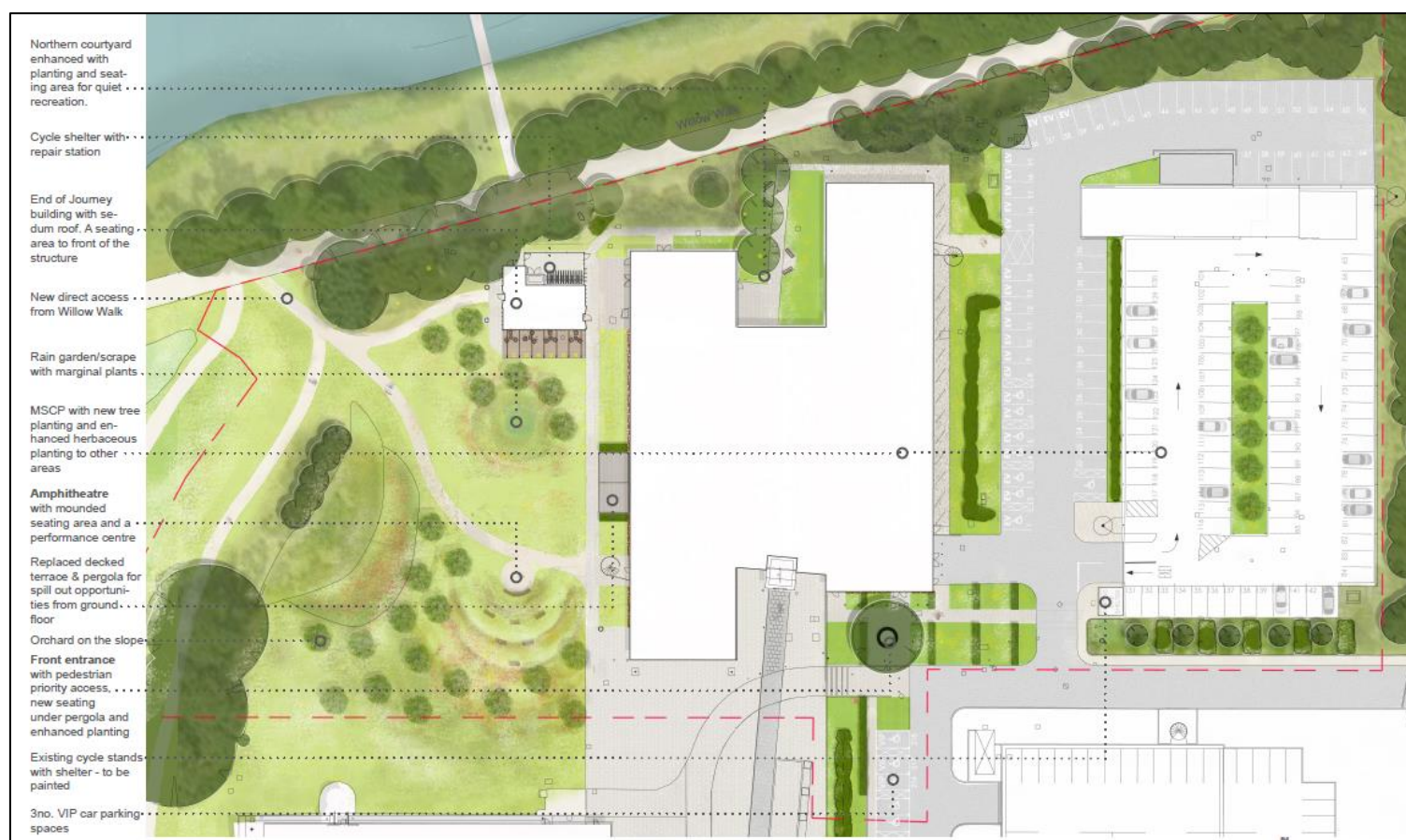
6.1 Description of Proposed Development

6.1.1 This FRA accompanies a planning application for:

'External refurbishment works to an existing office building (Use Class E) including alterations to the main entrance space, elevations, installation of PV panels and electric vehicle charging points, relocation of plant equipment, erection of a new end of journey/ changing facility, cycle storage and associated landscaping works'

6.1.2 Details of the landscape proposals by Place Design are included in **Appendix C**, while an extract of the landscape strategy, showing the End of Journey facility, is shown in **Figure 6-1**.

Figure 6-1: Extract of Place Design Site Masterplan



6.1.3 The proposed mitigation is based on a design life for the development of 100 years, and the climate change allowances discussed in **Section 5** are also based on this assumption.

6.2 Flood Risk Vulnerability

6.2.1 The NPPF Annex 3 confirms the '*Flood risk vulnerability classification*' of a site, depending upon the proposed usage. The proposed works to the existing office development is classed as '**Less vulnerable**' development.

- 6.2.2 This classification is subsequently applied to PPG 'Flood Risk and Coastal Change' Table 2 'Flood risk vulnerability and flood zone incompatibility' to determine whether:
- The proposed development is permitted or not for the Flood Zone in which it is located, and;
 - Whether an exception test is required for the proposed development.
- 6.2.3 The location of the proposed 'less vulnerable' development is in Flood Zone 2. Table 2 confirms that commercial development is permitted within Flood Zone 2. The current land use is commercial, so there is no change in vulnerability.
- 6.2.4 As noted in **Section 4.1**, the Flood Zones are based on a historic floodplain extent that is not representative across the Green Park area because of the significant changes in topography and river management in the area. Furthermore, the latest available EA modelling indicates the site lies outside all modelled flood extents, including the extreme 1 in 1000 annual probability floodplain.

6.3 NPPF Sequential Approach

- 6.3.1 The NPPF follows a sequential risk-based approach in determining the suitability of land for development in flood risk areas, with the intention of steering all new development to the lowest flood risk areas.
- 6.3.2 Irrespective of the above point regarding the flood risk to the area, the form of proposals is such that the Sequential Test is not applicable – the proposal is for refurbishment works to the existing office building, and new facilities to serve the building. As such, it is clearly inappropriate to undertake the Sequential Test to consider 'reasonably available alternative sites' at lower risk of flooding.
- 6.3.3 Therefore, it is considered that the Sequential Test is not applicable, and the Exception Test is not required.

7 Flood Mitigation Strategy

7.1 Building Design

- 7.1.1 Standard requirements for ground floor levels of new development are set out in BS8533:2017 'Assessing and Managing Flood Risk in New Development – Code of Practice.' This recommends floor levels are set a minimum of 300mm above the modelled 1 in 100 annual probability plus allowance for climate change flood level.
- 7.1.2 This is also consistent with the guidance from the EA and the recommendations in the Reading Borough Council (RBC) SFRA.
- 7.1.3 The topographic survey indicates the surrounding ground level/minimum threshold of the existing building is at an elevation of 40m AOD, and the End of Journey building facility will be located on similarly elevated ground.
- 7.1.4 As such, this is 900mm above the modelled 1 in 100 annual probability +25% climate change flood level, and 770mm above the 1 in 1000 annual probability flood level – significantly exceeding freeboard requirements.

7.2 Floodplain Storage

- 7.2.1 Any new development located in the vicinity of a watercourse should be constructed such that it does not detrimentally impact on flow routes or reduce the available floodplain storage over a site; either of which could potentially cause an increase in flood levels on-site or elsewhere. This is considered up to the benchmark of the 1 in 100 annual probability plus allowance for climate change fluvial flood level.
- 7.2.2 As all of the refurbishment and redevelopment works will remain outside the 1 in 100 annual probability +25% climate change event, there will be no impact on floodplain storage capacity or floor flow routes.

7.3 Safe Access

- 7.3.1 It is necessary to consider and incorporate safe access arrangements as part of the mitigation, to ensure the users/occupants of the development are safe in times of flooding.
- 7.3.2 The main site area and adjacent access route to the site to the east (Brook Drive) is outside all modelled flood extents.
- 7.3.3 Therefore, continuous safe access is available in all flooding scenarios including both 1 in 100 annual probability plus climate change and the 1 in 1000 annual probability event.

7.4 Surface Water Drainage Management

- 7.4.1 The NPPF recognises that flood risk and other environmental damage can be managed by minimising changes in the volume and rate of surface runoff from development sites and recommends that priority is given to the use of Sustainable Drainage Systems (SuDS) in new development, this being complementary to the control of development within the floodplain.
- 7.4.2 The key design criteria for aspects of the Surface Water Drainage System are detailed in the DEFRA 'Non statutory technical standards for sustainable drainage systems.'
- 7.4.3 As the intention of SuDS is to mimic the natural drainage regime of the undeveloped site, the NPPF PPG states the following (consistent with the Building Regulations H3 hierarchy):

...the aim should be to discharge surface water runoff as high up the following hierarchy of drainage options as reasonably practicable:

- ***into the ground (infiltration),***
- ***to a surface water body,***
- ***to a surface water sewer, highway drain or another drainage system,***

- 7.4.4 The works to the existing building are external refurbishments only and as such will not impact on the existing main building drainage arrangements, and there is a negligible impact on impermeable area resulting from the works.
- 7.4.5 New footpaths are proposed to be constructed using self-binding gravel that will allow runoff to permeate through the surface and therefore mimic the existing soft landscaping over the site.
- 7.4.6 The proposal for the new End of Journey facility will replace an existing cladded building sitting on an area of impermeable surfacing, and the new structure will incorporate a sedum roof that will serve to capture and retain some of the surface runoff before it drains to the adjacent watercourses.
- 7.4.7 A new pergola is proposed on the north side of the main building, but this is to be over existing impermeable surfacing and as such will not impact on the volume of runoff generated.
- 7.4.8 A small new area of slab paving is proposed in an area next to the End of Journey facility, but any detrimental impacts of this new impermeable surfacing will be more than offset by the more significant new SuDS improvement measures, with a new feature raingarden providing a capacity of over 30m³ within the main lawn area.
- 7.4.9 As such, the proposals demonstrate there is no detrimental impact to surface water runoff from the site.

8 Residual Risk

8.1.1 The PPG states the following in relation to residual risk:

“Residual risks are those remaining after applying the sequential approach to the location of development and taking mitigating actions. Examples of residual flood risk include:

- *the failure of flood management infrastructure such as a breach of a raised flood defence, blockage of a surface water conveyance system, overtopping of an upstream storage area, or failure of a pumped drainage system;*
- *failure of a reservoir, or;*
- *a severe flood event that exceeds a flood management design standard, such as a flood that overtops a raised flood defence, or an intense rainfall event which the drainage system cannot cope with.”*

8.1.2 It is difficult to completely guard against flooding since extreme events greater than the design standard event are always possible however, it is practicable to minimise the risk by allowing a substantial freeboard (safety margin) and by using suitable construction and management techniques.

8.1.3 The existing measures to minimise residual risks such as climate change and other uncertainties are outlined below:

- The building and End of Journey facility is located is on land outside the EA-modelled extreme 1 in 1000 annual probability floodplain, and the 1 in 100 annual probability +25% allowance for climate change floodplain, and above these reference flood levels by approximately 770mm and 900mm, respectively.
- Continuous safe access via Brook Drive is available in all flooding scenarios including the extreme 1 in 1000 annual probability event and the 1 in 100 annual probability +25% allowance for climate change event.

8.1.4 As such, the residual risk is considered to be acceptable for the lifetime of the development.

9 Conclusions

- 9.1.1 This Flood Risk Assessment (FRA) has been prepared by Stantec to accompany a planning application for works at 300 Brook Drive, Green Park, Reading RG2 6UH. The proposals are for:

‘External refurbishment works to an existing office building (Use Class E) including alterations to the main entrance space, elevations, installation of PV panels and electric vehicle charging points, relocation of plant equipment, erection of a new end of journey/ changing facility, cycle storage and associated landscaping works’

Flood Risk

- 9.1.2 The main source of flood risk for the site is fluvial from the Longwater Lake and the Foudry Brook link channel, located to the immediate north-west and north of the site, respectively.
- 9.1.3 The site is located mainly within Flood Zone 2 ‘Medium Probability’ (land between a 1 in 100 (1.0%) and 1 in 1000 (0.1%) of river flooding) based on the historic flood record used for this Flood Zone designation.
- 9.1.4 Data has been extracted from the EA River Kennet Model 2018, which indicates that flooding is limited to the north-west and northern edges of the site, for events up to and including the extreme 1 in 1000 annual probability event and the 1 in 100 annual probability +25% allowance for climate change flood. The existing building is on land over 700mm above the extreme 1 in 1000 annual probability flood level, and 900mm above the reference climate change flood level.
- 9.1.5 The site is at very low risk of flooding from all other sources.

Vulnerability and Sequential Test

- 9.1.6 The proposals are for the refurbishment of the existing office building and construction of an End of Journey facility, which are classified as ‘Less Vulnerable’ as defined in the National Planning Practice Framework (NPPF) Annex 3, consistent with the existing land use.
- 9.1.7 The form of proposals is such that the Sequential Test is not applicable – the proposal is for refurbishment works to the existing office building, and new facilities to serve the building. As such, it is clearly inappropriate to undertake the Sequential Test to consider ‘reasonably available alternative sites’ at lower risk of flooding. Therefore, it is considered that the Sequential Test is not applicable, and the Exception Test is not required.

Mitigation Strategy

- 9.1.8 The existing building threshold level is at approximately 40.0m AOD and the proposed ‘End of Journey’ facility is proposed at the same elevation; 900mm above the reference 1 in 100 annual probability plus 25% allowance for climate change fluvial level (and significantly in excess of standard freeboard guidance).
- 9.1.9 A continuous safe access route is available in all modelled flooding scenarios, including the extreme 1 in 1000 annual probability event and the 1 in 100 annual probability +25% allowance for climate change flood event.
- 9.1.10 A range of Sustainable Drainage Systems (SuDS) will be incorporated across the site to ensure no detrimental impact on surface runoff; this includes a sedum roof incorporated on the new End of Journey facility (which replaces an existing impermeable building), permeable surfacing for new footpaths across soft landscaping, and new rain garden. As such the works

will have no detrimental impact and could serve to reduce the peak runoff from this part of the site.

Summary

- 9.1.11 In conclusion, the proposals will be at very low risk of flooding and will not increase flood risk elsewhere. It is demonstrated that the proposal complies with the NPPF, Planning Practice Guidance (PPG) and the local planning policy with respect to flood risk and is an appropriate development at this location.

Appendix A OpenData Flood Maps

- Site Location Plan
- Site Location (Aerial Photography)
- Area Topography (LiDAR)
- EA Flood Zone Map
- EA Surface Water Flood Risk
- Reservoir Flood Map
- EA Historic Flood Map

Appendix B Surveys and Asset Records

- Topographical Survey by Midlands Survey Ltd. (drawing no. 102475-1)

Appendix C Development Proposals

Development proposal drawings by Stride Treglown:

- 156210-STL-XX-00-DR-A-XXXX-10000 – Proposed GA Plan (End of Journey Facility)
- 156210-STL-XX-00-DR-A-XXXX-17002 – Proposed Site Plan
- 156210-STL-XX-XX-DR-A-XXXX-20001 – Proposed Building Elevations -Sheet 01

Landscape proposal drawings by Place Design:

- 1004_PL_001 – Landscape General Arrangement
- 1004_PL_002 P07 – Rendered Masterplan

Appendix D Modelled Flood Extents

- Modelled flood extents present day scenario drawing by Stantec (drawing no. 332611112-200-0001 P2)
- Modelled flood extents climate change scenario drawing by Stantec (drawing no. 332611112-200-0002 P2)