

Flood Risk Assessment

Forestry England

Hole Farm Community Woodland
19 April 2023

Flood Risk Assessment

Client name: Forestry England
Project name: Hole Farm CommunityWoodland
Revision no: Draft
Date: 19 April 2023
Prepared by: ICF
File name: Flood Risk Assessment.docx

Document history and status

Revision	Date	Description	Author	Checked	Reviewed	Approved
A	20/12/2022	1 st Draft	ICF	AB	-	-
B	03/01/2023	2 nd Draft	ICF	-	-	-
C	19/04/2023	3 rd Draft	ICF	-	-	-

Distribution of copies

Revision	Date issued	Issued to	Comments
A	20/12/2022	Essex CountyCouncil	For Review
B	03/01/2023	Forestry England	For Review
B	03/01/2023	National Highways	For Review

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Glossary

Acronyms

Acronym	Definition
AEP	Annual exceedance
AOD	Above Ordnance Datum
BGS	British Geological Survey
CFMP	Catchment Flood Management Plan
CIRIA	Construction Industry Research and Information Association
Defra	Department for Environment, Food and Rural Affairs
DLUHC	Department for Levelling Up, Housing and Communities
ECC	Essex County Council
FWMA	Flood and Water Management Act
GWMP	Ground Water Management Plan
HADDMS	Highways Agency Drainage Data Management System
LFRMS	Local Flood Risk Management Strategy
LLFA	Lead Local Flood Authority
LPA	Local planning authority
NPPF	National Planning Policy Framework
PFRA	Preliminary Flood Risk Assessment
RBMP	River Basin Management Plan
SFRA	Strategic Flood Risk Assessment
SPA	Special Protection Area
SPZ	Source protection zones
SuDS	Sustainable drainage systems
SWMP	A SurfaceWater Management Plan

Terms and definitions

Term	Definition
Above Ordnance Datum	Vertical datum used by the Ordnance Survey as the basis for deriving altitudes on maps.
Annual exceedance probability	The chance of a flood of a particular magnitude being equalled or exceeded in any one year. For example, the 1% AEP event has a 1 (or (1 in 100) chance of being exceeded in any year
Climate change	Any change in global temperatures and precipitation over time due to natural variability or to human activity.
Ditch	A ditch is a small to moderate depression created to channel water.
Dyke	A dyke is an elongated naturally occurring ridge or artificially constructed fill or wall, which regulates water levels. Note: Notwithstanding its name, the Mardyke is a main river and not a dyke.
Exceedance	When a drainage system has no more capacity or becomes blocked and as a result runoff runs overland as opposed to passing into the drainage system.
Exception test	A test to ensure that flood risk is minimised and appropriately addressed

Term	Definition
Flood risk	The level of flood risk is the product of the frequency or likelihood of the flood events and their consequences.
Flood Zone	Flood Zones show the probability of river and sea flooding, ignoring the presence of existing flood defences.
Fluvial	Relating to the actions, processes and behaviour of a watercourse (river or stream).
Fluvial flooding	Flooding from a river or watercourse.
GIS Viewer	Mapping software developed by National Highways for the Lower Thames Crossing project.
Gleys	A wetland soil that, unless drained, is saturated with groundwater for long enough to develop a characteristic gleyic colour pattern
Greenfield site	An area of agricultural, forest, or other undeveloped site earmarked for commercial, industrial or residential development.
Groundwater	Water that is below the surface of the ground in the saturation zone
Hillwash	A loose deposit of rock debris accumulated through the action of gravity at the base of a cliff or slope.
Impermeable surface	A non-porous surface that generates a higher volume of surface water runoff than porous unsaturated surfaces after rainfall.
Infiltration	This is the process by which water on the ground surface enters the soil. Infiltration is governed by gravity and soil capillary action; the associated rate of infiltration varies for soil type and climatic conditions.
Main river	Watercourses that could contribute to extensive flooding across a catchment and/or alleviate flood risk elsewhere.
Ordinary watercourse	Ordinary watercourses include every river, stream, ditch, drain, cut, dyke, sluice, sewer (other than a public sewer) and a passage through which water flows and that does not form part of a main river.
Pluvial	Flows that relate to, or are characterised by, rainfall.
Pluvial flooding	Pluvial flooding occurs when a heavy downpour of rain saturates the urban drainage system/ground and the excess water cannot be accommodated within the drainage system and/or absorbed by the ground.
Preliminary flood risk assessment	A summary of the risk of flooding from main rivers, the sea and reservoirs in the river basin districts that are wholly or partly within England
River Basin Management Plan	A planning document published by the Department for Environment, Food and Rural Affairs (Defra) and the Environment Agency which sets out how organisations, stakeholders and communities will work together to improve the water environment
Runoff	The flow of water that occurs when excess stormwater, meltwater or other sources flows overland.
Setting	This is defined in the NPPF as 'The surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make positive or negative contribution to the significance of the asset, may affect the ability to appreciate that significance or may be neutral.'

Term	Definition
Sequential Test	A planning principle that seeks to identify, allocate or develop certain types or locations of land before others
Sewer flooding	Flooding caused by a blockage or overflowing of a sewerage or urban drainagesystem.
Source protection zones	Environment Agency defined groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area.
Strategic Flood Risk Assessment	SFRAs are primarily produced by local planning authorities, in consultation with the Environment Agency, and are intended to form the basis for preparing appropriate policies for flood risk management at the local level.
Stream	A body of water confined within a bed and banks.
Sustainable Drainage Systems(SuDS)	Sustainable drainage systems. Methods of management practices and control structures that are designed to manage surface water runoff in a more sustainable manner than some conventional techniques.
SWMP	A Surface Water Management Plan (SWMP) is a framework through which key local partners work together to understand the causes of surface water, groundwater and/or ordinary watercourse flooding and agree the most cost-effective way of managing that risk.
Watercourse	All rivers, streams, drainage ditches, drains, cuts, culverts and dyke that carry water.

1. Introduction

1.1 Context

- 1.1.1 This Flood Risk Assessment (the FRA) supports the planning application for buildings, car parking and an access road for a community woodland scheme (the Scheme).
- 1.1.2 Hole Farm (‘the site’) comprises a farmstead. It is understood that farming operations at Hole Farm have recently ceased.

1.2 The role and objectives of the flood risk assessment

- 1.2.1 The National Planning Policy Framework (NPPF)¹ sets out government's planning policies for England and how these are expected to be applied in relation to, *inter alia*, development and flood risk and states:
- “Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.”*
- 1.2.2 The NPPF requires that the developer should prepare and submit a site specific flood risk assessment to demonstrate that the development shall be free of flood risk for its lifetime without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.
- 1.2.3 This document is the site specific flood risk assessment for the Scheme.

1.3 Basis of assessment

- 1.3.1 The FRA is based on the design as presented on the Landscape Concept Plan (see Appendix A).

1.4 Stakeholders

- 1.4.1 Statutory consultees comprise:
- a. Environment Agency
 - b. Borough of Brentwood
 - c. Essex County Council
- 1.4.2 Non-statutory consultees comprise:

¹ Department for Levelling Up, Housing and Communities, National Planning Policy Framework, 2021 [\[web link\]](#)

- a. Essex and Suffolk Water (water service provider)
- b. Anglian Water (sewerage water provider)

1.5 Informing the FRA

1.5.1 The sources of information used to prepare the FRA are split into the six broad categories as shown in Figure 1.1.

1.5.2 The double headed arrows in Figure 1.1 indicate a liaison-based relationship with information flowing in both directions.

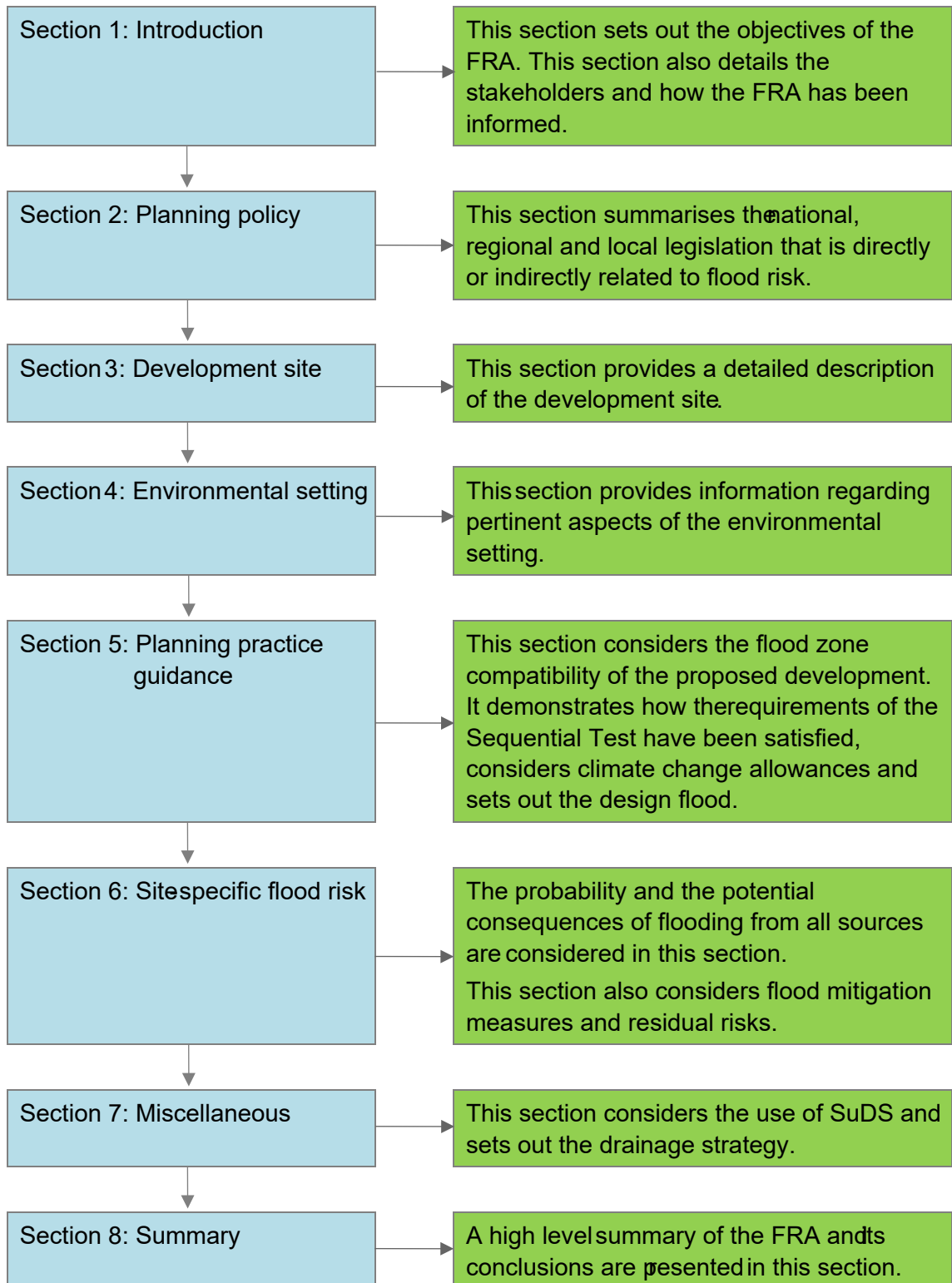
Figure 1.1 Informing the FRA



1.6 Form of FRA

1.6.1 The FRA has presented in eight sections. These sections and a brief description of their contents are set out in Figure 1.2.

Figure 1.2 Form of FRA



2. Planning Policy

2.1 Introduction

2.1.1 The following sections summarise current planning policy, legislation and guidance relating to flood risk.

2.2 National legislation

EU Floods Directive

2.2.1 The EU Floods Directive (2007/60/EC)² aims to provide a consistent approach to flood risk management across all of Europe³. Under these Regulations, there are a series of requirements which take place as part of a six year cycle in the following order.

2.2.2 At the beginning of the cycle, Lead Local Flood Authorities (LLFA) need to prepare or review their preliminary flood risk assessments (PFRA) and their determination and identification of areas of potentially significant flood risk (Flood Risk Areas). LLFAs have a duty to prepare or review their flood hazard and flood risk maps for each of their flood risk areas.

2.2.3 By the end of the cycle, LLFAs must prepare flood risk management plans in order to manage significant flood risk in their Flood Risk Areas. These flood risk management plans should set objectives for flood risk management and outline measures for achieving these objectives.

2.2.4 The site does not lie in a designated Flood Risk Area⁴.

The Flood Risk Regulations 2009

2.2.5 The purpose of the Flood Risk Regulations 2009⁵ is to transpose the EU Floods Directive into domestic law and to implement its provisions. In particular, it places duties on the Environment Agency and local authorities to prepare flood risk assessments, flood risk maps and flood risk management plans.

² Official Journal of the European Union, Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks Accessed October 2022 [\[web link\]](#).

³ The UK is no longer a member of the European Union. EU legislation as it applied to the UK on 31 December 2020 is now a part of UK domestic legislation, under the control of the UK's Parliaments and Assemblies, and is published on [legislation.gov.uk](#). It being kept up to date on [legislation.gov.uk](#) in the same way as other forms of domestic legislation

⁴ Essex County Council Mapper Flood information, accessed April 2023 [\[web link\]](#)

⁵ The Flood Risk Regulations 2009. Accessed October 2022 [\[web link\]](#).

Flood and Water Management Act 2010

- 2.2.6 The Flood and Water Management Act 2010⁶ places duties on the Environment Agency, local authorities, developers and other bodies to manage flood risk.

National Planning Policy Framework

- 2.2.7 The NPPF regulates local planning authorities and decision-makers in drawing up plans and making decisions regarding planning applications, and developers in preparing applications. The principal policies related to flood risk are:
- a. Inappropriate development in areas at risk of flooding should be avoided.
 - b. Strategic policies should be informed by a strategic flood risk assessment and should manage flood risk from all sources.
 - c. All plans should apply a sequential, risk-based approach to the location of development.
- 2.2.8 The NPPF is supported by Planning Practice Guidance⁷ which provides additional guidance to local planning authorities to ensure the effective implementation of planning policy.
- 2.2.9 The FRA has been prepared in accordance with the requirements of the NPPF and its supporting guidance.

National flood and coastal erosion risk management strategy for England

- 2.2.10 The Flood and Water Management Act 2010 places a statutory duty on the Environment Agency to develop a National Flood and Coastal Erosion Risk Management Strategy for England (FCERM).
- 2.2.11 This Strategy describes what needs to be done by all risk management authorities involved in flood and coastal erosion risk management for the benefit of people and places.
- 2.2.12 This Strategy seeks to better manage the risks and consequences of flooding from rivers, the sea, groundwater, reservoirs, ordinary watercourses, surface water and sewers and coastal erosion.
- 2.2.13 The Environment Agency's Approach to Groundwater Protection

⁶ Flood and Water Management Act 2010. Accessed October 2022 [[web link](#)]

⁷ Department for Levelling Up, Housing and Communities Planning Practice Guidance Accessed October 2022 [[web link](#)]

- 2.2.14 The Environment Agency's approach to groundwater protection⁸ contains position statements which provide information about the Environment Agency's approach to managing and protecting groundwater. These position statements detail how the Environment Agency delivers government policy for groundwater and adopts a risk-based approach where legislation allows. Many of the approaches set out in the position statements are not statutory but may be included in, or referenced by, statutory guidance and legislation.
- 2.2.15 Section G of the Environment Agency's approach to groundwater protection includes position statements relating to the discharge of liquid effluents into the ground and outlines where permits may be required for discharge to groundwater. Position statements relevant to the Scheme are set out below.
- 2.2.16 Position Statement G10 notes that the Environment Agency will normally object to new developments that pose an unacceptable risk of pollution to groundwater from sewage effluent, trade effluent or contaminated surface water.
- 2.2.17 Position Statement G11 states that discharges of surface water runoff to ground at sites affected by land contamination, or from sites used for the storage of potential pollutants are likely to require an environmental permit.
- 2.2.18 Position Statement G13 outlines the requirements of infiltration SuDS for surface runoff from roads. Where infiltration SuDS are proposed in a SPZ1, a hydrogeological risk assessment should be undertaken, to ensure that the system does not pose an unacceptable risk to the source of supply.
- 2.2.19 The site does not propose a risk to groundwater and SuDS methods incorporating infiltration techniques would not be used for runoff from roads (see Section 3.5 for further details).

2.3 Regional Policy

Brentwood Local Plan 2016 -2033

- 2.3.1 The Brentwood Local Plan 2016-2033⁹ presents Brentwood Borough Council's vision for how the borough will develop over the next 17 years, from 2016 to 2033. It outlines the Council's strategic priorities and sets out a Spatial Strategy and supporting policies for achieving this vision.

⁸ Environment Agency, Environment Agency's approach to groundwater protection Accessed October 2022[[web link](#)]

⁹ Brentwood Borough Council, Brentwood Local Plan 2016-2033. Accessed October 2022 [[web link](#)]

2.3.2 The Local Plan sets out policies across a broad range of subjects; the policies with an association to flood risk are detailed in Table 2.1 and Table 2.2.

Table 2.1 Strategic Policy NE09: Flood Risk

Ref.	Strategic Policy NE09: Flood Risk
1	New development will be required to avoid areas of flood risk by applying the Sequential and, where necessary, the Exception Tests in accordance with national policy and guidance.
2	<p>A site specific Flood Risk Assessment must assess all sources of flooding. It should demonstrate how flood risk will be managed over the development's lifetime, taking climate change into account. A site specific FRA is required, in accordance with national policy guidance, for the following types of development:</p> <ul style="list-style-type: none"> • All new development greater than 1 ha in size in Flood Zone 1. • All development within a Critical Drainage Area. • All new development (including minor development and change of use) in flood zones 2 and 3. • New development or a change of use to a more vulnerable class which may be subject to other sources of flooding.
3	<p>Where proposals satisfy the Sequential and Exception Tests, design proposals should ensure that:</p> <ul style="list-style-type: none"> • The most vulnerable land uses are located in areas within the site that are at lowest risk of flooding; • Development will be safe for its lifetime taking account of the vulnerability of its users, • Flood risk will not increase elsewhere; • Development would not constrain the natural function of the flood plain, either by impeding flow or reducing storage capacity. • Development is constructed so as to remain operational even at times of flood through resistant and resilient design. • Appropriate mitigation measures are incorporated to address any residual flood risk safely, including safe access and egress for all likely users of the development. • Where necessary incorporate flood resistant and flood resilient design measures such that, in the event of a flood, the development could be quickly brought back into use without significant refurbishment. • Incorporate sustainable drainage systems in line with Policy BE05. • Sustainable drainage, unless there is unambiguous evidence that this would be inappropriate. • Where possible, the development will reduce flood risk overall. • Safe access and escape routes are included where appropriate, as part of an agreed Emergency Response Plan, where required.

Ref.	Strategic Policy NE09: Flood Risk
4	Where the site is additionally located within a Critical Drainage Area (CDA), development should minimise and mitigate surface water runoff in line with Policy BE05 Sustainable Drainage.

Table 2.2 Strategic Policy NE05: Sustainable Drainage

Ref.	Strategic Policy NE05: Sustainable Drainage
1	All developments should incorporate appropriate Sustainable Drainage Systems (SuDS) for the disposal of surface water, in order to avoid any increase in surface water flood risk or adverse impact on water quality.
2	Development within areas identified as a Critical Drainage Area (CDA) on the policies map, should optimise the use of Sustainable Drainage Systems by providing an individually designed mitigation scheme to address the site specific issues and risk, as informed by a site specific Flood Risk Assessment. This could be provided as part of the Drainage Strategy and must address any issues highlighted in the Surface Water Management Plan, where relevant.
3	Greenfield developments, major development and all development within a Critical Drainage Area must achieve a greenfield runoff rate. Where it is demonstrated that this is not possible on brownfield developments then a runoff reduction of 50% minimum should be achieved. The technical approach should be justified in the Drainage Strategy.
4	Applicants are required to submit a surface water Drainage Strategy and a Flood Risk Assessment for all major development as well as for all development within a Critical Drainage Area. The Drainage Strategy must include a SuDS Management Plan setting out the long term management and maintenance arrangement.

Ref.	Strategic Policy NE05: Sustainable Drainage
5	<p>SuDS will be required to meet the following design criteria:</p> <ul style="list-style-type: none"> • The design must follow an index-based approach when managing water quality. Implementation in line with the updated CIRIA suds manual¹⁸ is required. Source control techniques such as green roofs, permeable paving and swales should be used so that rainfall runoff in events up to 5mm does not leave the site. • Suds should be sensitively designed and integrated into the green and blue infrastructure to create high quality public open space and landscaped public realm, in line with strategic policy NE02: green and blue infrastructure. • Maximise opportunities to enhance biodiversity net-gain. • Improve the quality of water discharges and be used in conjunction with water use efficiency measures. • Function effectively over the lifetime of the development. • The preferred hierarchy of managing surface water drainage from any development is through infiltration measures, secondly attenuation and discharge to watercourses, and if these cannot be met, through discharge to surface water only sewers. • Have regard to Essex County Council suds design guide 2020, or as amended.
6	<p>When discharging surface water to a public sewer, developers will be required to provide evidence that capacity exists in the public sewerage network to serve their development, in line with policy requirements in BE02 Water Efficiency and Management.</p>
7	<p>Development proposals should be designed to include permeable surfaces wherever possible. Proposals for impermeable paving, including on small surfaces such as front gardens and driveways, will be strongly resisted unless it can be suitably demonstrated that this is not technically feasible or appropriate.</p>

Sustainable Drainage Systems- Design Guideline – Essex County Council

2.3.3 Essex County Council (ECC) published their guidelines for SuDS in 2020¹⁰.

2.3.4 This guide is primarily intended for use by developers, designers and consultants who are seeking guidance on the LLFAs standards for the design of sustainable surface water drainage in Essex.

2.3.5 It provides guidance on the planning, design and delivery of attractive and high-quality SuDS schemes which should offer multiple benefits to the

¹⁰ Essex County Council Sustainable Drainage Systems Design Guideline, Accessed October 2022 [[web link](#)]

environment and community alike. It should also show that meeting these standards need not be an onerous task and can help add to development.

- 2.3.6 The scope of the design guidance includes all aspects of surface water drainage from collection to discharge, and specific design guidance of SuDS features.
- 2.3.7 The design guidelines state that a flood risk assessment is required to ensure that all flooding risks have been considered when designing the drainage scheme. The LLFA would expect a flood risk assessment to include flood zone maps, surface water flood maps, critical drainage area (CDA) mapping, ground water flood maps and reservoir flood maps. In addition, the LLFA would expect any information regarding relevant mitigation to be included.
- 2.3.8 The climate change allowance detailed in the Design Guide is based on the Environment Agency guidance of climate change allowances for flood risk assessments¹¹. The peak rainfall allowance detailed in the Design Guidance are based on the 2019 of the Environment Agency guidance. Revised peak rainfall intensity allowances are detailed in the current version of the Environment Agency guidance, which was released in 2022 (see Section 5.5 for further details).

Preliminary flood risk assessment for Essex County Council

- 2.3.9 Essex County Council are the LLFA for the administrative county of Essex, as defined under the Flood Risk Regulations 2009.
- 2.3.10 The PFRA sets out the following:
- a. A summary of the methodology adopted for the PFRA with respect to data sources, availability and review procedures.
 - b. A summary of the systems used for data sharing and storing, and provision for quality assurance, security and data licensing arrangements.
 - c. An assessment of historical flood events within the study area from the, and the consequences and impacts of these events.
 - d. An assessment of the potential harmful consequences of future flood events within the study area.
 - e. A review of the provisional national assessment of indicative Flood Risk Areas provided by the Environment Agency and provide explanation and justification for any amendments required to the flood risk areas.

¹¹ Environment Agency, Guidance- Flood risk assessments: climate change allowances Accessed October 2022 [[web link](#)].

- f. A description of arrangements for partnership and collaboration for ongoing collection, assessment and storage of flood risk data and information.
- g. Identification of relevant partner organisations involved in future assessment of flood risk; and summarises means of future and ongoing stakeholder engagement.

2.3.11 The PFRA for Essex indicates that:

- a. There are no reported historical surface water flooding incidents across the site.
- b. The only areas that are susceptible to surface water flood risk are immediately adjacent to watercourses.
- c. The site is susceptible to groundwater flooding.

Level 1 Strategic Flood Risk Assessment for the Borough of Brentwood

2.3.12 The Level 1 Strategic Flood Risk Assessment (SFRA) for the Borough of Brentwood¹² provides an evidence base to support spatial planning decisions at a Borough wide scale.

2.3.13 This Level 1 SFRA addresses the following:

- a. Identification of main rivers, ordinary watercourses and flood zones within the Borough.
- b. Assessment of the potential impact of climate change on flood risk.
- c. Identification of areas at risk from other sources of flooding such as surface and groundwater.
- d. Identification of flood risk management measures including their location and standard.
- e. Provision of guidance on the application of the Sequential Test.
- f. Provision of guidance on flood risk management through the design process.

2.3.14 Several recommendations relating to the management of flood risk within the Borough of Brentwood are made in the SFRA. These key recommendations are summarised below:

- a. Aim to reserve land in Flood Zone 1 for essential infrastructure and where possible highly vulnerable and more vulnerable land uses.

¹² Brentwood Borough Council, Strategic Flood Risk Assessment Level 1, 2018 [[web link](#)]

- b. Should the Council wish to allocate sites with an identified flood risk, then the policy should either be to avoid the areas of flood risk or to assess the risk in more detail through either a Level 2 SFRA work or on a site specific level.
- c. In the absence of a Level 2 Assessment, windfall sites in Flood Zones 2 and 3 should not be accepted unless they include a detailed review of potential flood risks. This will need to include detailed hydraulic modelling.
- d. Sites around unmodelled main river and ordinary watercourses should use the surface water flood risk maps as a proxy for fluvial flood risk.
- e. Manage flood risk through avoidance of risk where possible.
- f. Follow the Sequential approach advocated in NPPF.
- g. Site design in fluvial floodplains should facilitate safe escape.
- h. An emergency evacuation procedure should be implemented for those sites which can feasibly be designed to allow for evacuation out of the flood risk zone.
- i. All new development should attempt to reduce surface water run-off by sustainably managing run-off on site. Flood risk must not increase post development.
- j. All new development greater than 1 hectare in size and all new development in Flood Zones 2 and 3 are required to undertake a Flood Risk Assessment considering all sources of flood risk. Development in Flood Zone 1 greater than 0.25 hectares will be required to undertake a Drainage Impact Assessment. These assessments should include an assessment of climate change.

Catchment Flood Management Plan

- 2.3.15 The site falls in the South Essex Catchment Flood Management Plan area¹³.
- 2.3.16 The South Essex catchment has been divided into nine distinct sub-areas which have similar physical characteristics, sources of flooding and level of risk. One of six flood risk management policies has been allocated to each sub-area.
- 2.3.17 The site falls into sub-area 1 (Crouch catchment and river Mardyke/ Horndon catchment), and the most appropriate policy for sub-area 1 is Policy 6.

¹³ Environment Agency, South Essex Flood Management Plan, 2009 [\[web link\]](#)

- 2.3.18 Policy option 6 applies to areas of low to moderate flood risk where the Environment Agency will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits.
- 2.3.19 The proposed actions to implement Policy 6 in sub-area 1 are:
- a. Produce flood storage studies to investigate the most appropriate storage options and locations for floodplain storage. The studies should also consider opportunities to enhance the environment by improving the natural state of the river and its habitat.
 - b. Identify opportunities where bank and channel maintenance can be reduced to improve the flow between the river and its floodplain to increase water storage on the natural floodplain.
 - c. Continue with the flood warning service including the maintenance of flood warning infrastructure and flood awareness plans.
- 2.3.20 In addition to the above, one further action specific to the River Mardyke/ Horndon catchment is proposed:
- a. Encourage planners to prevent development within the floodplain. The floodplain should be maintained as an asset to make space for water.

River Basin Management Plan

- 2.3.21 The purpose of a river basin management plan (RBMP) is to provide a framework for protecting and enhancing the benefits provided by the water environment. To achieve this, and because water and land resources are intricately linked, it also informs decisions on land use planning. The site lies within the district covered by the Thames RBMP¹⁴.
- 2.3.22 The Thames RBMP sets out the current quality of water bodies in the district and describes the objectives for making further improvements to the ecological and chemical quality.
- 2.3.23 The Thames RBMP is divided into 17 management catchments, with the Scheme lying within the Essex South management catchment.
- 2.3.24 The priority issues to tackle in this catchment are:
- a. Pollution
 - b. Poor water quality from urban and agricultural run-off
 - c. Physical modification due to urbanisation and flood protection.

¹⁴ Environment Agency, Thames river basin district River basin management plan, 2015 [\[web link\]](#)

2.3.25 Future aims in this catchment include:

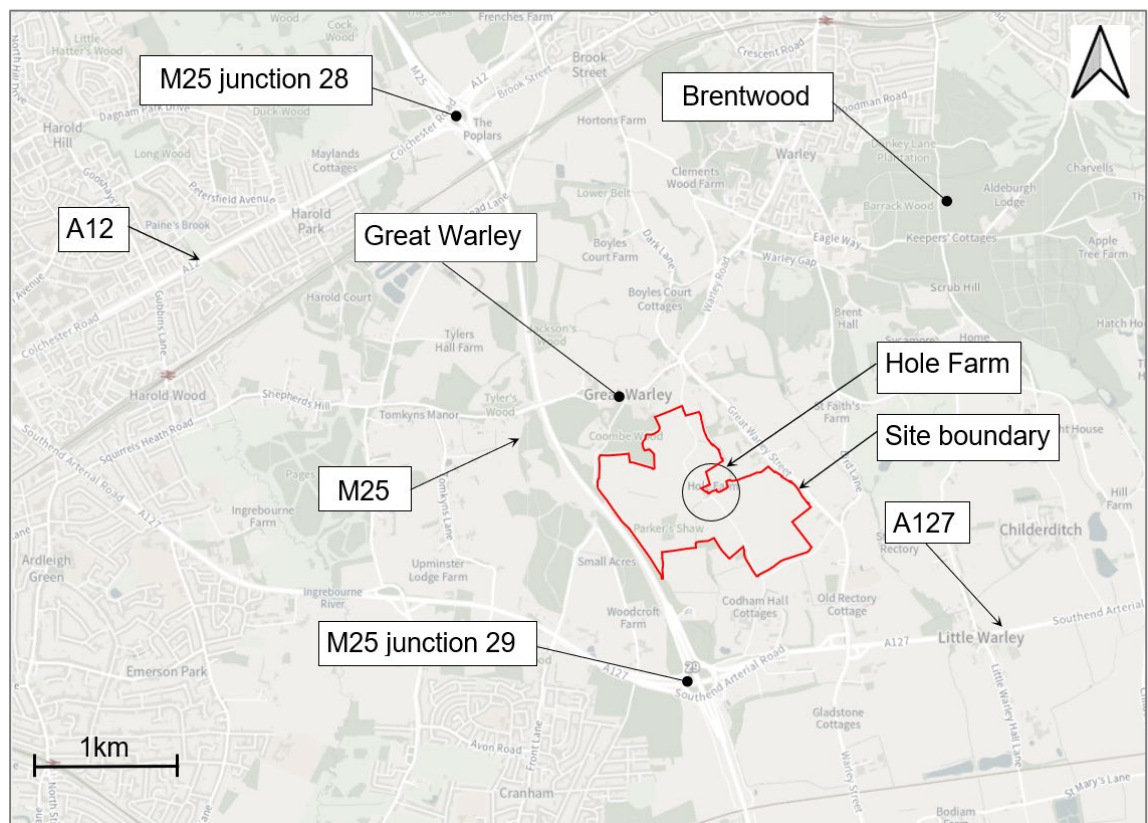
- a. Promote and encourage the use of SuDS in new developments and retrofitting to existing sites within the catchment to reduce the impacts of urban diffuse pollution and phosphate runoff from fertilisers and herbicides.
- b. Development and implementation of a water body wide culvert awareness and removal programme, promoting alternatives to culverting, influencing planning policy and encouraging sustainable development without culverts.

3. Development site

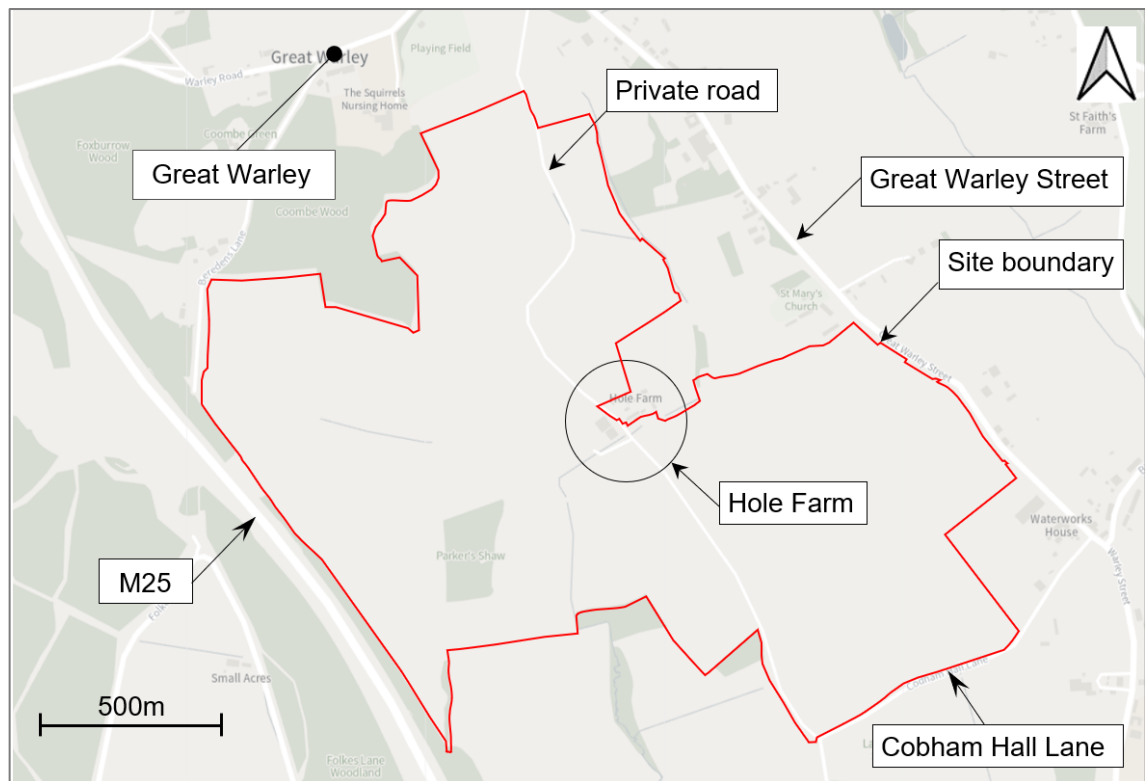
3.1 Site location

- 3.1.1 The site lies immediately to the south-east of Great Warley, in the Borough of Brentwood, which is within the administrative county of Essex (grid ref: TQ585897). Brentford town centre lies approximately 4.3km north-north-east of the site. The address of the site is Hole Farm, Great Warley, Brentwood CM1 3 3JD.
- 3.1.2 The site sits immediately to the east the M25, between junctions 28 and 29.
- 3.1.3 The London Borough of Havering lies immediately to the west of the site.
- 3.1.4 The site covers an area of approximately 99ha (see Appendix A). It was managed as arable farmland but agricultural use ceased in September 2022.
- 3.1.5 Development location plans are presented in Figure 3.1 and Figure 3.2.

Figure 3.1 Development location plan (1 of 2) ¹⁵



¹⁵ National Highways, Lower Thames Crossing- GIS Viewer, accessed April 2023

Figure 3.2 Development location plan (2 of 2) ¹⁶

3.2 Development proposals

3.2.1 The creation of a community woodland facility comprising:

- a. Vehicular access into a 94-space car and coach park, with EV charging points and overflow area
- b. Substation
- c. An open sided visitor shelter
- d. A modular café with covered outdoor seating area, bin store, cycle parking and WC facilities
- e. Demolition of a grain store and development of a community building including staff welfare and office facilities and outdoor terrace
- f. Staff and disabled car parking
- g. Demolition of an agricultural machinery store and construction of a Forestry England Barn
- h. Service yard and vehicle turning circle
- i. Surfaced and unsurfaced woodland paths

¹⁶ National Highways, Lower Thames Crossing – GIS Viewer, accessed April 2023

- j. Creation of six new ponds
- k. Countryside heritage and interpretation boards
- l. Informal natural play areas

3.2.2 A plan of the proposed development is presented in Appendix A.

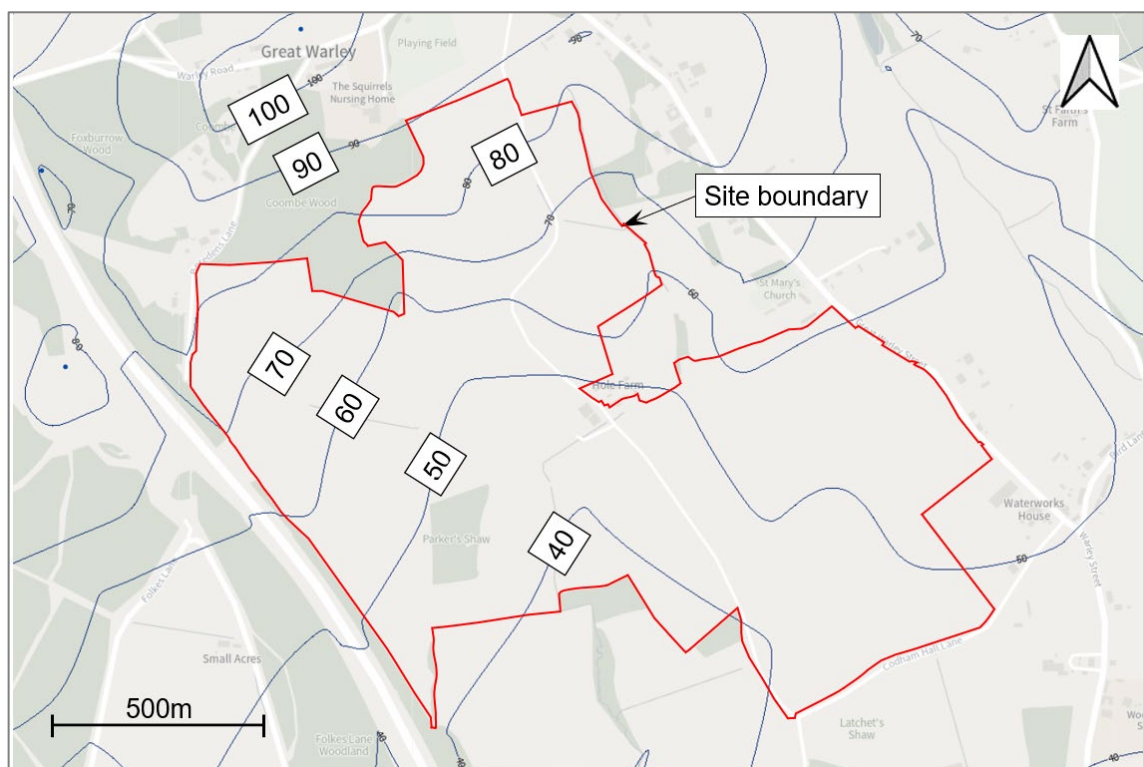
3.2.3 A plan of the site boundary is presented in Appendix B.

4. Environmental setting

4.1 Topography and hydrology

- 4.1.1 The site gently slopes from 90m AOD to 40m AOD in a south-easterly direction.
- 4.1.2 Two distinct valleys run through the site. The first of these meanders across the site in a southerly direction. It starts towards the northern extents of the site and continues southwards beyond the site boundary. A watercourse runs through this valley. A second valley runs in a south-easterly direction through the centre of the site until it reaches the first valley; this valley is dry.
- 4.1.3 A third, less distinct, dry valley runs in a south-westerly direction through the eastern part of the Site. This valley also connects to the first valley.
- 4.1.4 A contour plan for the site is presented in Figure 4.1.

Figure 4.1 Contour plan¹⁷



¹⁷ National Highways, Lower Thames Crossing GIS Viewer, accessed April 2023.

4.2 Water environment

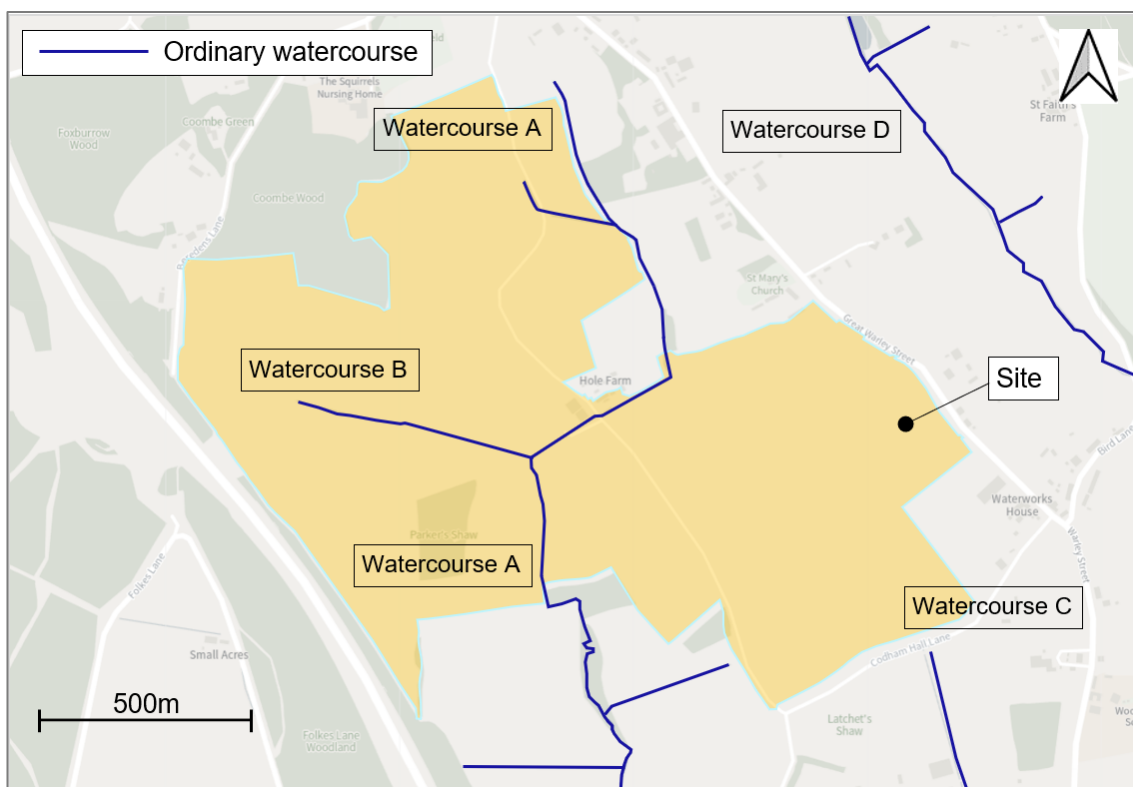
River basin district and management catchment

4.2.1 The site lies within the Thames river basin district and is in the South Essex Management Catchment and the Mardyke Operational Catchment.

Watercourses

4.2.2 The Environment Agency's Statutory Main River Map¹⁸ indicates that there are a number of ordinary watercourses across the site. These watercourses, which run through shallow, but well defined, valleys are presented in Figure 4.2.

Figure 4.2 Ordinary watercourses¹⁹



4.2.3 In addition to the watercourses recorded by the Environment Agency, the site incorporates a network of field ditches and drains. Also, it is understood that site has been extensively mole drained in the past²⁰.

¹⁸ Environment Agency, Statutory Main River Map. Accessed April 2023 [[web link](#)]

¹⁹ National Highways, Lower Thames Crossing GIS Viewer, accessed April 2023. The GIS Viewer sources watercourse mapping data published by the EA

²⁰ Mole drains are unlined circular soil channels which function like pipe drains they are used to optimise the performance of a field-drainage system

4.2.4 Watercourse A continues southwards until it eventually joins the West Mardyke (main river).

Open water bodies

4.2.5 There are currently five ponds onsite, the origin and function of these is unclear. Recent observation suggests they are seasonally dry. Details are presented in Table 4.1.

Table 4.1 Existing surface water bodies

Location	Approximate surface area (m ²)	Description
TQ 5824 9032	113	Woodland pond. Shaded. Dry 14/06/22
TQ 5845 9002	330	Field pond. Deep. Shaded by surrounding Salix. Dry 14/06/22
TQ 5840 8982	333	Field/track edge pond. Shaded by surrounding Salix. Dry 14/06/22
TQ 5827 8949	269	Woodland pond. Shaded. Dry 14/06/22
TQ 5826 8944	275	Woodland pond. Shaded. Dry 14/06/22

Source protection zones

4.2.6 The site lies fully within Source Protection Zone 3 (SPZ3). SPZ3 is the area around a supply source within which all the groundwater ends up at particular abstraction point. This could extend some distance from the source point; the nearest abstraction point is approximately 11 km south of the Hole Farm.

4.3 Statutory and non -statutory designations

4.3.1 The site does not lie in an area that is subject to any statutory land-based designations.

4.3.2 The site lies in areas subject to the following non-statutory land-based designations:

- a. Community Forest

b. Green Belt

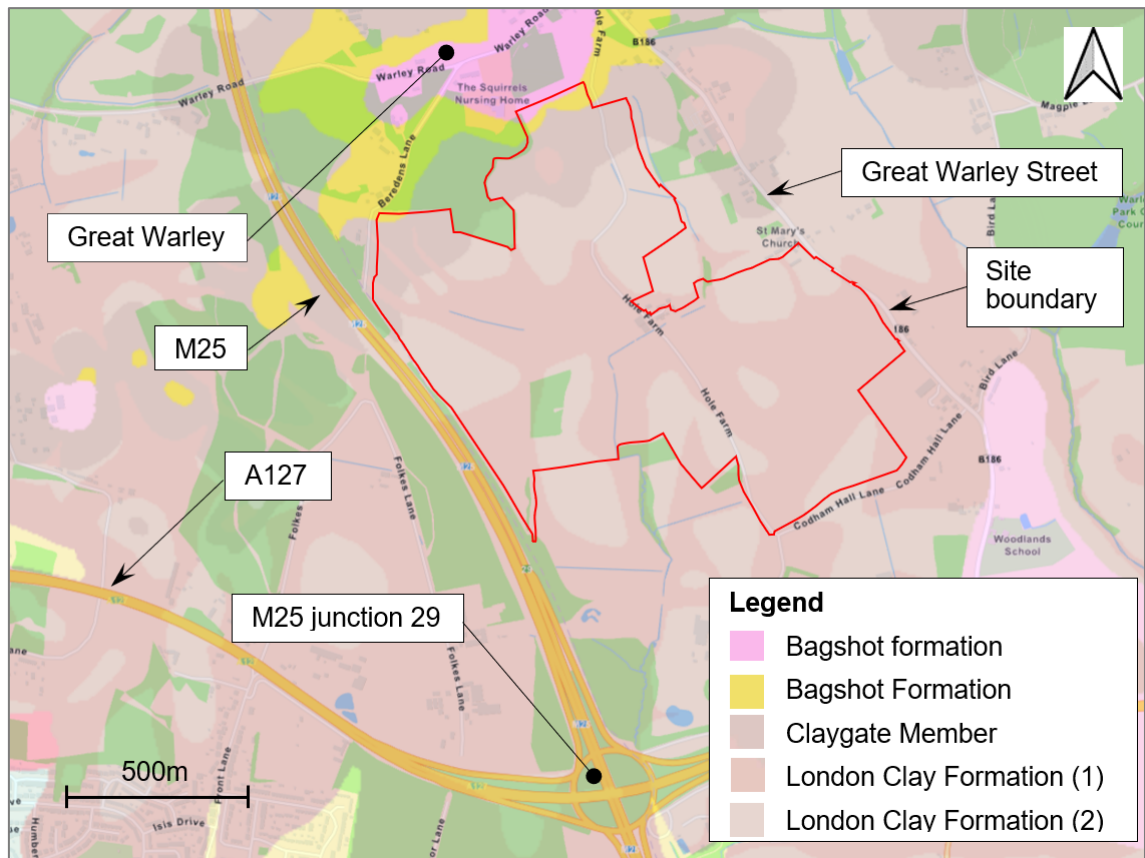
4.4 Geology

4.4.1 The geology is principally London Clay derived clay, silt and sands, with Bagshot and Claygate on the northern boundary.

4.4.2 The site are soils moist to very moist surface water gleys. They are slowly permeable, seasonally wet and slightly acidic but with some base-rich loamy and clayey soils. The soils appear slightly more sandy and drier on the northern boundary.





4.4.3 Bedrock geology data has been obtained from the British Geological Survey's Geology Viewer²¹ and is presented in Figure 4.3 with additional information provided in Table 4.2.

Figure 4.3 Bedrock geology



²¹ British Geological Survey Geology Viewer. Accessed April 2023 [[web link](#)]

Table 4.2 Bedrock geology and superficial deposits

Identifier	Bedrock formation	Superficial deposits
Bagshot Formation 	Most of the Bagshot Formation is composed of pale yellow-brown to pale grey or white, locally orange or crimson, fine- to coarse-grained sand that is frequently micaceous and locally clayey, with sparse glauconite and sparse seams of gravel.	Gravel and sand, clayey near base.
Bagshot Formation 	Most of the Bagshot Formation is composed of pale yellow-brown to pale grey or white, locally orange or crimson, fine- to coarse-grained sand that is frequently micaceous and locally clayey, with sparse glauconite and sparse seams of gravel.	N/A
Claygate Member 	The Claygate Member comprises dark grey clays with sand laminae, passing up into thin alternations of clays, silts and fine-grained sand, with beds of bioturbated silt.	Head – Poorly sorted and poorly stratified, angular rock debris and/or clayey hillwash and soil creep, mantling a hillslope and deposited by solifluction and gelifluction processes.
London Clay Formation (1) 	The London Clay mainly comprises bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay.	N/A
London Clay Formation (2) 	The London Clay mainly comprises bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay.	Head – Poorly sorted and poorly stratified, angular rock debris and/or clayey hillwash and soil creep, mantling a hillslope and deposited by solifluction and gelifluction processes.

4.4.4 Due to the abundance of clays in the bedrock and the gley soils present in the superficial deposits, the use of SuDS methods incorporating infiltration techniques is not appropriate for site drainage.

5. Planning practice guidance

5.1 Introduction

5.1.1 The NPPF is supported by planning practice guidance, which is divided into a number of categories. The guidance category 'Flood risk and coastal change' advises how to account for, and address, the risks associated with flooding in the planning process. This guidance forms the basis of the methodology used to prepare the FRA.

5.1.2 This section considers the compatibility of the proposed development in accordance with the provisions of the NPPF guidance. It demonstrates how the requirements of the Sequential Test have been satisfied, considers climate change allowances and sets out the design flood.

5.2 Flood zones

5.2.1 Table 1 of the NPPF guidance defines four flood zones. The definition of these zones is summarised in Table 5.1.

5.2.2 In Table 5.1, the flooding probability is expressed as the annual exceedance probability (AEP). The AEP is the probability that a flood of a given magnitude will occur within a period of one year and is expressed as a percentage.

Table 5.1 Flood zones

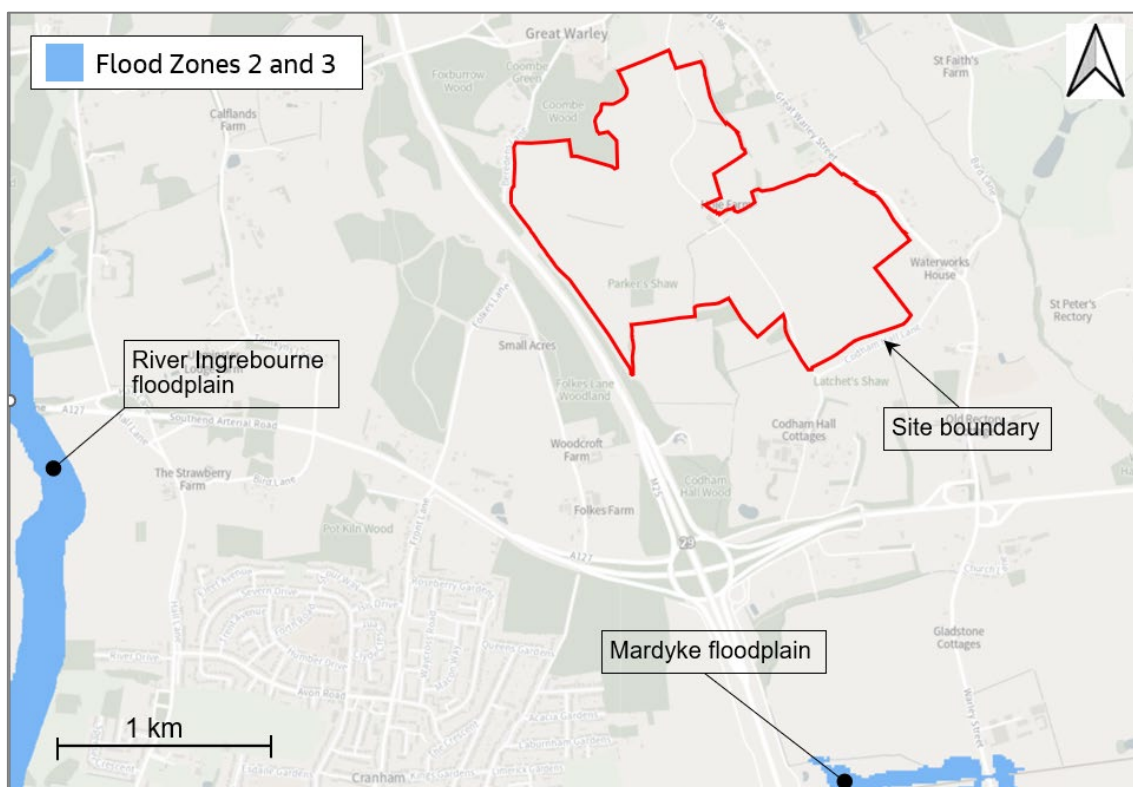
Flood Zone	Definition
Flood Zone 1 Low probability	Land having a less than 0.1% annual probability of river or sea flooding ($AEP \leq 0.1\%$). In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems.
Flood Zone 2 Medium probability	Land having between a 1% and 0.1% annual probability of river flooding ($0.1\% < AEP < 1\%$); or land having between a 0.5% and 0.1% annual probability of sea flooding ($0.5\% < AEP < 1.5\%$). In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage systems.

Flood Zone	Definition
Flood Zone 3a High probability	<p>Land having a 1% or greater annual probability of river flooding (AEP \geq 1%); or land having a 0.5% or greater annual probability of sea (AEP \geq 0.5%).</p> <p>In this zone, developers and local authorities should seek opportunities to:</p> <ul style="list-style-type: none"> • Reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems • Relocate existing development to land in zones with a lower probability of flooding • Create space for flooding to occur by restoring functional floodplain and flood flow pathways, and by identifying, allocating and safeguarding open space for flood storage
Flood Zone 3b Functional floodplain	<p>This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise:</p> <ul style="list-style-type: none"> • Land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively (AEP \geq 3.3%). • Land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding).

5.2.3 Figure 5.1 shows the extents of Flood Zones 2 and 3 in the vicinity of the site, with all other areas designated as Flood Zone 1.

5.2.4 The River Ingrebourne floodplain lies approximately 2.0 km to the west of the site and the Mardyke floodplain lies approximately 1.5 km to the south of the site. The site lies in entirely in Flood Zone 1.

Figure 5.1 Flood Zones 2 and 3²²



5.3 Flood risk vulnerability

Vulnerability classification

5.3.1 NPPF Annex 3²³ sets out five flood risk vulnerability classifications and lists the types of development that fall into each classification. An extract from NPPF Annex 3 is presented in Table 5.2. The development types listed in the table cover all development types included in the Scheme.

Table 5.2 NPPF Annex 3 extract

Vulnerability classification	Development type
Less vulnerable	Buildings used for cafes and hot food takeaways, offices, storage and leisure.
	Land and buildings used for forestry.
	Car parks.
Water compatible	Amenity open space, nature conservation and biodiversity and essential facilities.

²² National Highways, Lower Thames Crossing-GIS Viewer, accessed April 2023. The GIS Viewer uses open data on flood zone data sourced from DEFRA.

²³ Department for Levelling Up, Housing and Communities, National Planning Policy Framework- Annex 3: Flood risk vulnerability classification, accessed April 2023 [[web link](#)]

Flood risk compatibility

5.3.2 Table 5.3 is based on Table 3 of the NPPF guidance. This table shows the compatibility of flood risk vulnerability classifications and Flood Zones.

Table 5.3 Flood risk vulnerability and flood zone compatibility

Flood Zone	Flood risk vulnerability classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a [†]	Exception Test required [†]	✗	Exception Test required	✓	✓
Zone 3b [*]	Exception Test required [*]	✗	✗	✗	✓*

Key

- ✗ Development is not appropriate
- ✓ Development is appropriate
- † In Flood Zone 3 a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.
- * In Flood Zone 3 b (functional floodplain) essential infrastructure that has passed the Exception Test, and water-compatible uses, should be designed and constructed to:
 - a) Remain operational and safe for users in times of flood.
 - b) Result in no net loss of floodplain storage.
 - c) Not impede water flows and not increase flood risk elsewhere

5.3.3 According to Table 5.2, 'water compatible' development is appropriate in all flood zones and 'less vulnerable' development is appropriate in all flood zones other than 3b.

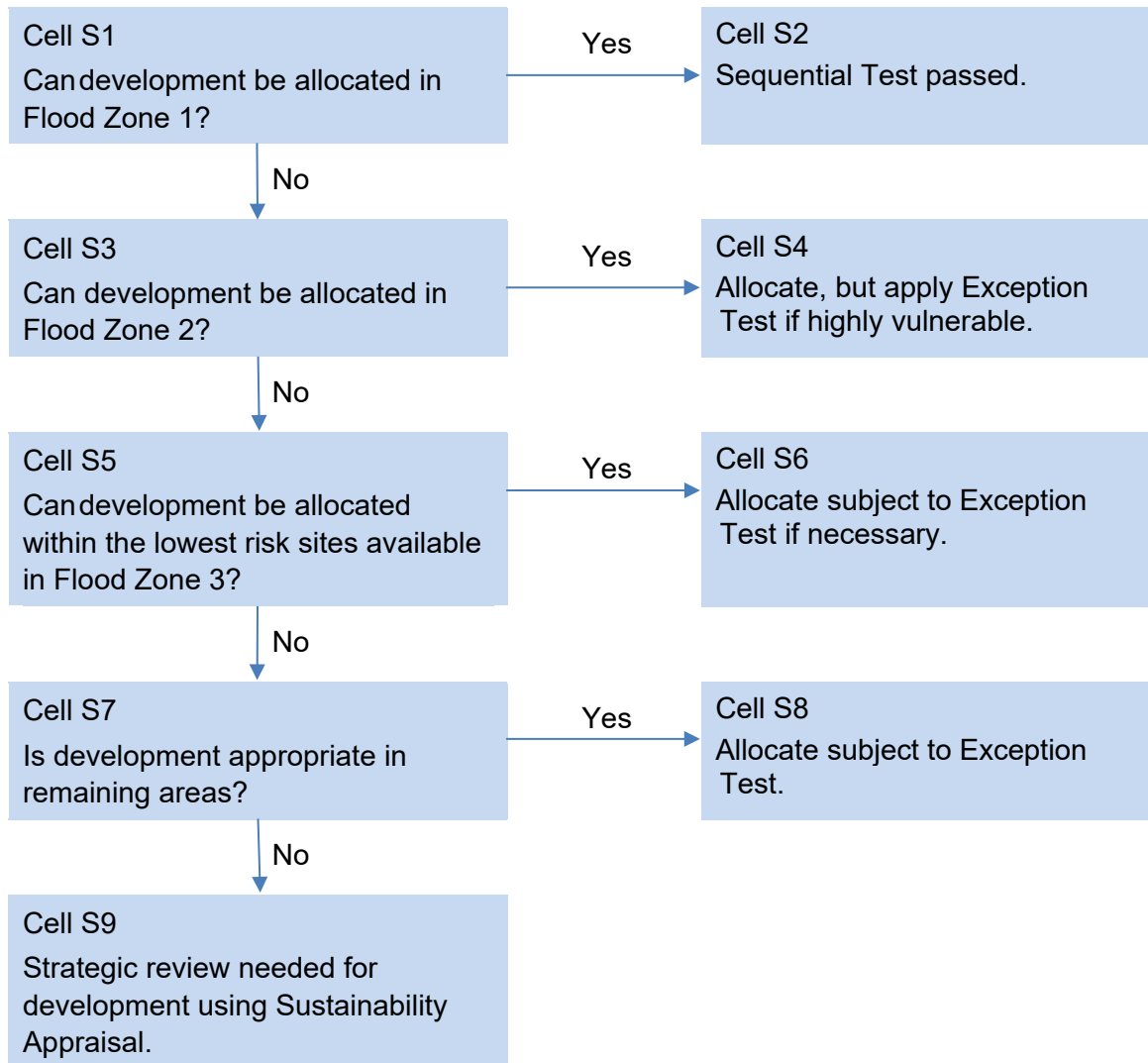
5.3.4 As the site lies entirely within flood Zone 1 (see Figure 5.1), development included in the Scheme is in a compatible flood zone.

5.4 Sequential Test

5.4.1 The Sequential Test is a risk-based approach to locating a development. Its purpose is to either steer new development to areas with the lowest probability of flooding or demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate to the development being proposed.

5.4.2 Application of the Sequential Test is set out in Diagram 2: Application of the Sequential Test for Local Plan Preparation of the NPPF guidance and is reproduced in Figure 5.1.

Figure 5.2 Sequential Test flow chart



5.4.3 The site lies entirely within Flood Zone 1 and as such, satisfies the provisions of the Sequential test (for the Project, the flow chart would conclude at Cell S2)

5.5 Climate change and the design flood

Introduction

5.5.1 Climate change has the potential to increase peak rainfall intensity. This results in a corresponding increase in the rate and volume of runoff being discharged to local watercourses and subsequently creates an escalation in flood risk. Furthermore, sea levels are also projected to increase as a result of climate change

5.5.2 The Environment Agency’s guidance on climate change allowances for flood risk assessments²⁴ has undergone several iterations since publication of UK Climate Change Predictions 2018²⁵. The most recent of these iterations was released in May of 2022.

Climate change allowances

5.5.3 Climate change allowances are predictions of anticipated change for:

- a. Peak river flow
- b. Peak rainfall intensity
- c. Sea level rise
- d. Offshore wind speed and extreme wave height

5.5.4 Of the allowances listed above, only peak rainfall allowances are applicable to the site.

Peak rainfall intensity

5.5.5 Peak rainfall intensity allowances are based on management catchments. The Project lies in the South Essex Management Catchment. Table 5.4 presents the anticipated changes in rainfall intensity for the South Essex management catchment²⁶.

Table 5.4 South Essex peak rainfall allowances

Epoch	Allowance			
	3.3% AEP event		1% AEP event	
	Central	Upper end	Central	Upper end
2050s epoch (2022 and 2060)	20%	35%	20%	45%
2070s epoch (2061 and 2125)	20%	35%	25%	40%
Notes				
1. These peak rainfall allowances are for small catchments (less than 5 km ²)				
2. For shaded cells, refer to Paragraph 5.5.9				

5.5.6 The Environment Agency’s guidance on climate change allowances notes that the method of application of peak rainfall intensities depends upon the lifetime of the development.

²⁴ Environment Agency (2022). Guidance- Flood risk assessments: climate change allowances [[web link](#)]

²⁵ Met Office (2018), UKCP18 Probabilistic Climate Projection [[web link](#)]

²⁶ Environment Agency (2022), Guidance- Peak rainfall climate change allowances by management catchment [[web link](#)]

- 5.5.7 The Scheme is planned to be open in 2024 and have a minimum lifetime of at least 75 years (ie up to 2099)²⁷. The Project should therefore be assessed for the 2070s epoch
- 5.5.8 The guidance goes on to state that development shall be designed so that for the upper end allowance in the 1% AEP event:
- a. There is no increase in flood risk elsewhere.
 - b. The development will be safe from surface water flooding.
- 5.5.9 Notwithstanding the above, the Environment Agency's guidance notes that in some locations, the allowance for the 2050s epoch is higher than that for the 2070s epoch. The guidance states that where this is the case, and development has a lifetime beyond 2061, the higher of the two allowances should be adopted. On this basis, the shaded cells in Table 5.4 should be adopted for the design of drainage assets other than carriageways. Carriageways are generally designed to allow some flooding so road drainage would be designed with a 20% uplift peak rainfall with a sensitivity check based on a 40% uplift.

5.6 Design flood

- 5.6.1 This is a flood event of a given annual flood probability. Following NPPF guidance, the design flood for the Scheme has been taken as:
- a. River flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year) plus an appropriate allowance for climate change.
 - b. Surface water flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year) plus an appropriate allowance for climate change.
- 5.6.2 A third criterion regarding tidal flooding has not been considered as it is not relevant for the scheme.

²⁷ The NPPG guidance notes that the lifetime of a non-residential development depends on the characteristics of that development but a period of at least 75 years is likely to form a starting point for assessment.

6. Site-specific flood risk

6.1 Introduction

6.1.1 The FRA must consider all sources of flood risk. These comprise the following:

- a. Fluvial
- b. Surface water
- c. Groundwater
- d. Reservoirs
- e. Water mains
- f. Sewers

6.2 Watercourses (fluvial)

6.2.1 Fluvial flooding occurs when the flow in a watercourse exceeds its capacity. The flow in a watercourse is a primarily a function of runoff from adjacent land and inflow of tributaries. Typically, fluvial flooding is a result of intense or sustained rainfall and can be exacerbated if the watercourse outfall is subject to blockage or tide locking, or at times when the catchment is waterlogged.

6.2.2 As the site lies wholly within Flood Zone 1, the risk of fluvial flooding is considered to be negligible (see Figure 5.1).

6.3 Surface water (pluvial)

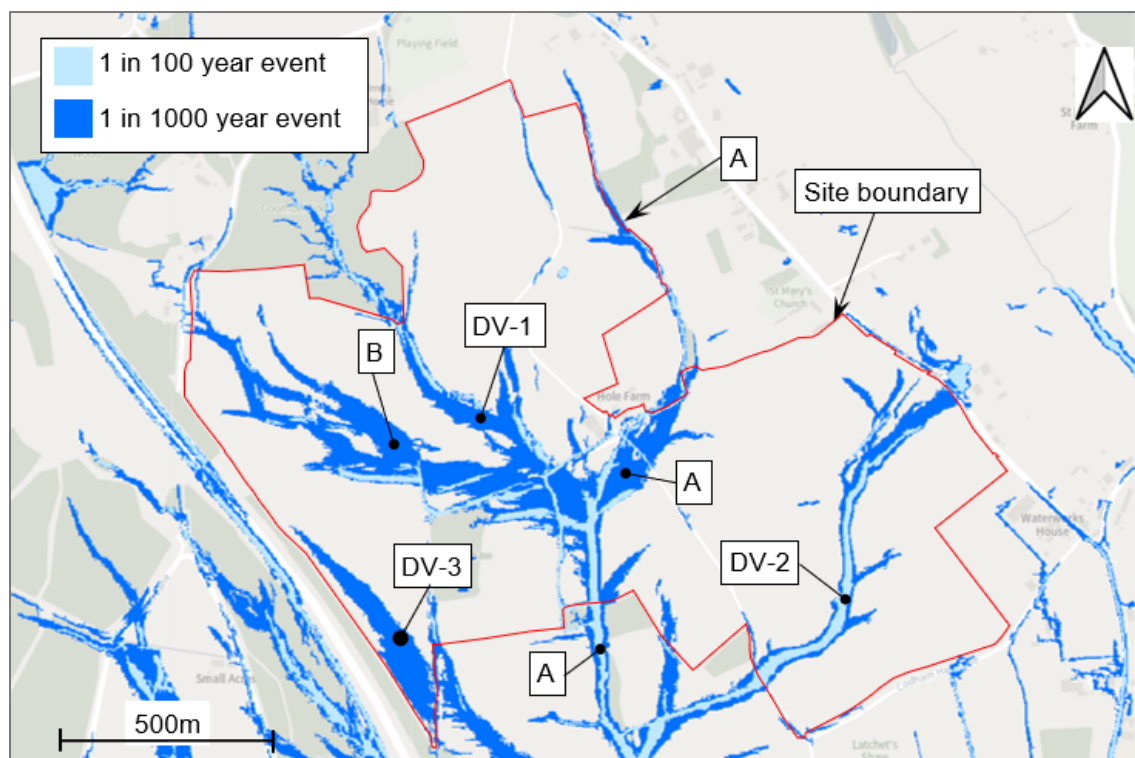
6.3.1 Surface water flooding occurs when intense or sustained rain overwhelms the local drainage systems or gives rise to overland runoff. Local drainage systems comprise natural infiltration to groundwater, watercourses, surface water sewers, combined sewers and sustainable drainage system features.

6.3.2 Surface water flooding can be exacerbated when land has a low permeability, is waterlogged, frozen or developed.

6.3.3 The sporadic and intense nature of rainfall that causes surface water flooding makes it difficult to accurately predict or pinpoint where flooding will occur or how severe it will be. Furthermore, local features can greatly affect the probability and severity of flooding and impact drainage infrastructure works may not be taken into account.

6.3.4 The extents of surface water flooding at the site for the I in 100 and 1 in 1000 year storms is presented in Figure 6.1.

Figure 6.1 Flood risk from surface water - Extent of flooding ²⁸



- 6.3.5 Figure 6.1 indicates that surface water flood risk for the design flood (1 in 100 year event) is relatively minor
- 6.3.6 Figure 6.1 Indicates surface water flooding generally follows watercourses (ref A and B) and the dry valleys (ref DV-1, DV-2 and DV-3)
- 6.3.7 Figure 6.1 should be viewed with regard to local topography (Figure 4.1) and local watercourses (Figure 4.2).
- 6.3.8 The inclusion of ponds across the site would mitigate surface water flooding by providing additional storage in the drainage network.
- 6.3.9 The ponds would reduce flood risk on a catchment wide scale by holding back and slowing down the flow of flood water before it reaches downstream receptors.
- 6.3.10 The site is not within 20m of a main river.

6.4 Groundwater flooding

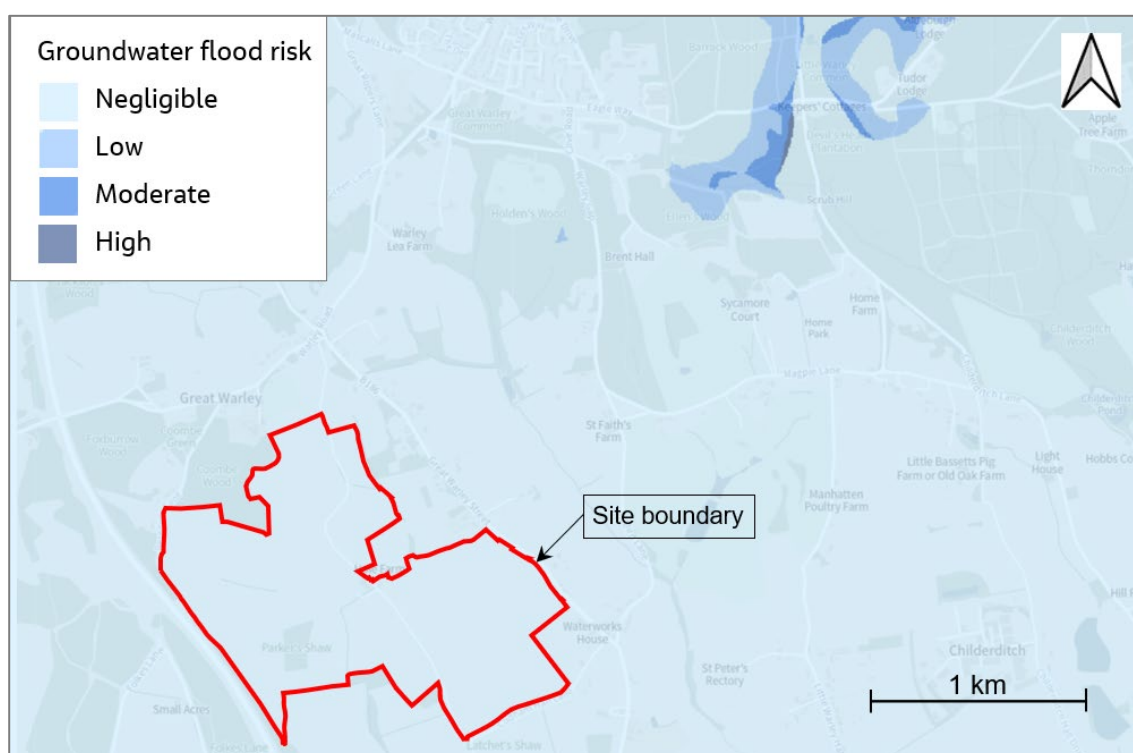
- 6.4.1 Flooding from groundwater can happen when the level of water within the rock or soil that makes up the land surface (known as the water table) rises. The level of the water table changes with the seasons due to variations in

²⁸ National Highways, Lower Thames Crossing – GIS Viewer, accessed April 2023. The GIS Viewer sources flood mapping data published by the Environment Agency.

long term rainfall and water abstraction. When the water table rises and reaches ground level, water starts to emerge on the surface and flooding can happen.

- 6.4.2 Groundwater flooding takes longer to dissipate because groundwater moves much more slowly than surface water and will take time to flow away underground.
- 6.4.3 Data included in the GIS viewer²⁹ indicates that groundwater flood risk across the site is negligible. An extract from the GIS Viewer showing groundwater flood risk is presented in Figure 6.2.

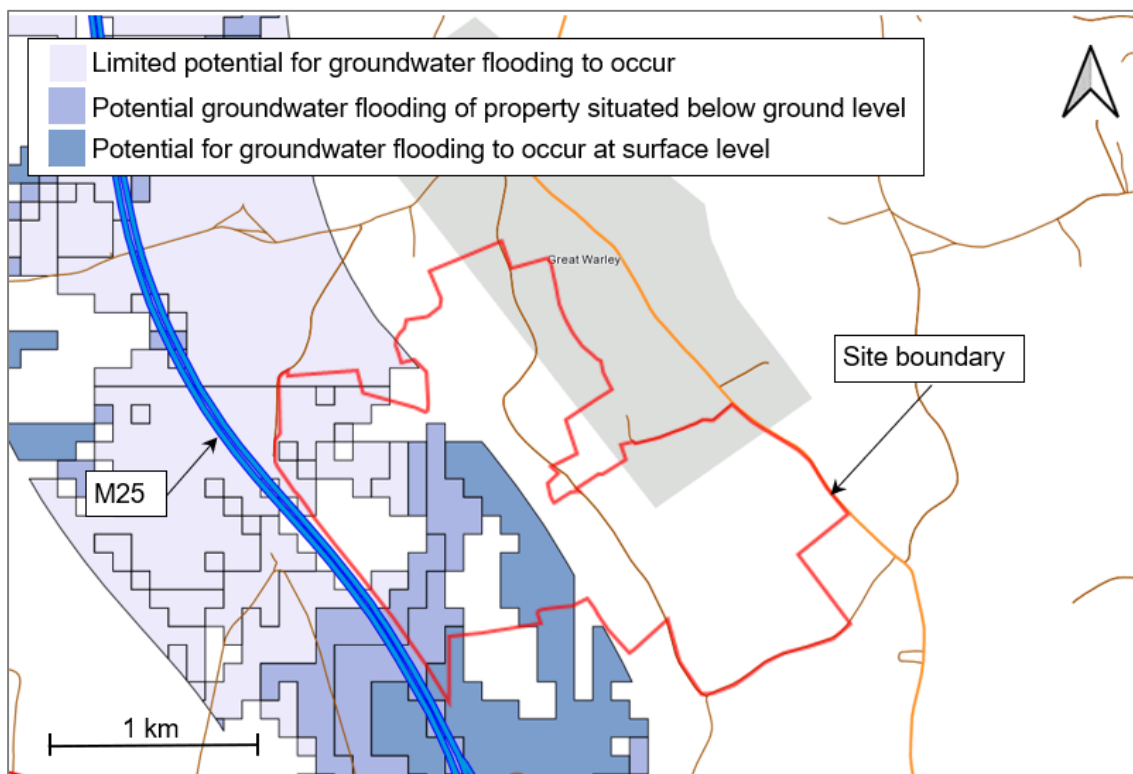
Figure 6.2 Groundwater flood risk



- 6.4.4 Groundwater flood risk data included in the Highways Agency Drainage Data Management System (HADDMS) indicates that there is potential for groundwater flooding to occur at ground level in the western part of the site; see Figure 6.3.
- 6.4.5 As HADDMS only provides data specific to motorways and major (trunk) roads, the groundwater flood data provided only covers a strip of land either side of the M25. The actual extents of land with potential to groundwater flooding may extend further east of the area shown in Figure 6.3.

²⁹ National Highways, Lower Thames Crossing- GIS Viewer, accessed April 2023. The GIS Viewer sources groundwater flood mapping data published by the BlueSky Digital Solutions Ltd.

Figure 6.3 Groundwater flood risk – Western ³⁰



6.4.6 In the absence of a consistent groundwater data, a precautionary approach to groundwater flood risk has been adopted. To this end the HADDMS data has been used to inform groundwater risk. Site investigation could be undertaken to confirm the risk of groundwater flooding.

6.5 Reservoirs

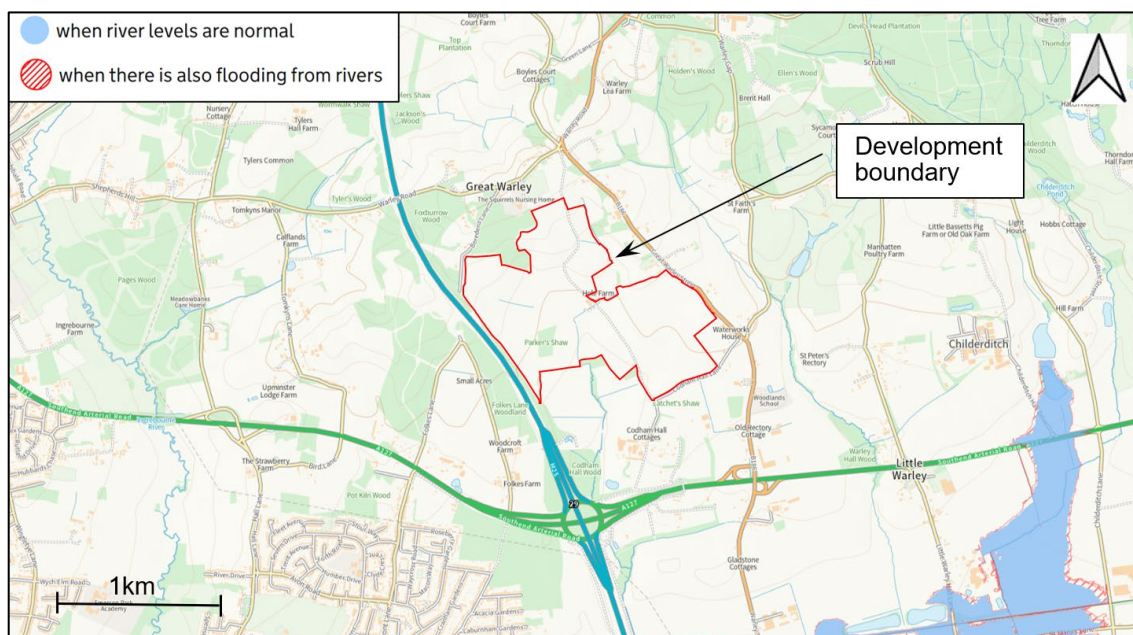
6.5.1 Most reservoirs hold large volumes of water and are above ground level. Safe operation and management of reservoirs to reduce the risk of failure and the flooding that could result is paramount. A reservoir failure (breach or uncontrolled release) could have major consequences, including loss of life. However, there has been no loss of life due to a reservoir failure in UK since the introduction of reservoir safety legislation (1930).

6.5.2 The long-term flood risk information map for reservoirs indicates that the site is not in an area at risk from reservoir flooding.

6.5.3 Flood risk from reservoirs is presented in Figure 6.

³⁰ Highways England, HADDMS - Drainage Data Management System. Accessed April 2023.

Figure 6.4 Flood risk from reservoirs ³¹



6.6 Water mains and sewers

6.6.1 When trunk sewers are blocked or overwhelmed, they have the potential to cause flooding. When sewer rising mains are damaged or burst, they also have the potential to cause flooding. As there are no such assets in the vicinity site, the risk of flooding from sewers is considered to be negligible.

6.6.2 All water mains have the potential to cause flooding if they are damaged or burst, with transmission mains clearly presenting the bigger risk. As there are no such assets in the vicinity site, the risk of flooding from water is considered to be negligible.

6.7 Flood mitigation and residual flood risk

6.7.1 Flood mitigation measures in the site are detailed in Table 6.1

Table 6.1 Flood mitigation measures

Element	Mitigation measure
Drainage design	Climate change allowances would be incorporated in the highway drainage design. Refer to the Drainage Strategy for further details.

³¹ Environment Agency, Check the long term flood risk for an area in England Accessed April 2023 [[web link](#)]

Element	Mitigation measure
	The design would ensure that the level of impermeable surfaces are high enough to allow runoff to freely drain to a discharge point under gravity. Refer to the Drainage Strategy for further details.
	The design would ensure that the 300mm freeboard on the detention basins is able to accommodate Upper end peak rainfall intensity allowance for the design flood (1 in 100 year event). Refer to the Drainage Strategy for further details.
	In line with national and regional planning policy, the design would incorporate SuDS features wherever possible and practicable.
Watercourses	The site drainage network would ensure that watercourse connectivity is retained (some channels would be retained but others would be realigned and/or replaced by ponds).
	The use of culverts would only be included where unavoidable.
Groundwater inundation	Ponds, basins and swales that form part of the drainage system would be lined to ensure that system storage capacity is not compromised by groundwater intrusion. Subject to the results of additional groundwater information, this mitigation measure may not be required (see Section 6.4).

6.7.2 Residual flood risk and is presented in Table 6.2.

Table 6.2 Residual flood risk

Residual risk	Mitigation measure
Overwhelming of the highway drainage network due to a severe storm event or a blockage may lead to onsite and/or offsite flooding	A planned, risk based maintenance programme would be established. Planned maintenance interventions would ensure efficient operation of the drainage network.
Overtopping of the retention pond may occur in the event of a severe storm; this may lead to development of secondary flow paths with surface water flooding in lower-lying areas	Overland flow paths would be established to manage any overtopped flows where appropriate. The pond would be located away from sensitive receptors to avoid potential risks resulting from residual impacts.

7. Miscellaneous

7.1 Drainage

Drainage strategy

7.1.1 The drainage strategy for the site is described in a separate report.

Use of SuDS

7.1.2 The use of SuDS would be included in the site drainage design wherever appropriate. This approach complies with the requirements of:

- a. Brentwood Local Plan 2016-2033
- b. Sustainable Drainage Systems- Design Guideline – Essex County Council
- c. Thames RBMP

7.1.3 The site geology is not suited to the use of SuDS methods incorporating infiltration techniques (see Section 3.5 for further details).

7.2 Environmental permits

7.2.1 The Environment Agency guidance on environmental permits³² notes that a permit may be required for the following types of flood risk work:

- a. In, under, over or near a main river (including where the river is in a culvert)
- b. On or near a flood defence on a main river
- c. In the flood plain of a main river
- d. On or near a sea defence

7.2.2 As there are no main rivers or sea defences in or near the site, the requirement for an environmental permit will not be triggered.

7.3 Consultation with the LLFA

7.3.1 Determination of the size of retention ponds and discharge rates to ordinary watercourses would be agreed in consultation with the LLFA.

³² Environment Agency, Guidance- Check if you need an environmental permit. Accessed April 2023 [[web link](#)]

8. Summary

8.1 Flood risk

8.1.1 All sources of flood risk have been considered. The likelihood of each source of flooding is presented in Table 8.1.

Table 8.1 Summary of flood risk sources

Flood type	Fluvial	Surface water	Groundwater	Reservoirs	Water mains	Sewers
Likelihood	N	P	P	N	N	N
Legend N Negligible P Potential						

8.1.2 As noted in Section 6.4, data on groundwater flood risk is inconsistent. A precautionary approach has been adopted for groundwater flood risk by using the data indicating the greater level of risk

8.2 Flood risk mitigation measures

8.2.1 Flood risk mitigation measures have been identified and comprise the following:

- a. Climate change allowances would be incorporated in the highway drainage design.
- b. The level of impermeable surfaces would be set high enough to allow runoff to freely drain to a discharge point under gravity.
- c. The retention pond would have sufficient freeboard to accommodate Upper end peak rainfall intensity allowance for a 1 in 100 year event with allowances for climate change and a 300mm freeboard.
- d. Watercourse connectivity would be retained.
- e. The use of culverts would only be included where unavoidable.

8.2.2 Residual flood risks have been identified and mitigation measures have been proposed. These comprise:

- a. The risk of overwhelming of the highway drainage network due to a severe storm event or a blockage may lead to onsite and/or offsite

flooding would be mitigated by establishing a planned, risk based maintenance programme.

- b. The risk of overtopping of the retention pond may would be mitigated by establishing overland flow paths locating the ponds away from sensitive receptors.

8.3 Planning practice guidance

- 8.3.1 The NPPF guidance includes a checklist for a site-specific FRA. The checklist is presented in Table 8.2 along with the requirements for satisfying each checklist item. The section in which achievement of each the checklist item is established is also identified in Table 8.2.

Table 8.2 NPPF Guidance- FRA Checklist

Ref	Checklist item	Requirement	Section
1	Development site and location	Full details of the application site.	4
2	Development proposals	A general summary of the development proposals.	4
3	Sequential test	A description of how the sequential test has been applied along with the evidence to demonstrate how the requirements of the test have been met.	5
4	Climate change	Show how flood risk at the site is likely to be affected by climate change.	5
5	Site-specific flood risk	A description of the risk of flooding to and from the Scheme over its expected lifetime, including appropriate allowances for the impacts of climate change.	6
6	Surface water management	A description of the existing and proposed surface water management arrangements at the site is to be provided.	N/ A ³³
7	Exception test	A description of how the exception test has been applied along with the evidence to support development in Flood Zones 2 and 3.	N/ A ³⁴

³³ The Surface water management strategy is presented as a separate report.

³⁴ An exception test is not enquired for the Project as it lies in Flood Zone 1 (see Section 5.2).

Ref	Checklist item	Requirement	Section
8	Residual risks	A description of any residual risks that remain after the flood risk management and mitigation measures are implemented.	6

8.4 Flood risk assessments in Flood Zone 1

8.4.1 Specific guidance on preparing flood risk assessment in Flood Zone 1 is provided by the Environment Agency and Department for Environment, Food and Rural Affairs³⁵.

8.4.2 This guidance sets out a series of actions that must be undertaken when preparing a flood risk assessment in Flood Zone 1; these actions are summarised in Table 8.3.

Table 8.3 Actions required to carry out a flood risk assessment

Ref	Checklist item	Requirement	Section
1	Research your development site	Contact key stakeholders about flood risk in the area.	1
2	Plans	Review SFRA	4
3	Surveys	Check if your development is within 20m of a main river.	6
4	Assessments	Check whether an environmental permit is required for the work to be undertaken	7

8.5 Conclusions

8.5.1 This FRA has been undertaken in accordance with the relevant provisions of the NPPF and its associated guidelines, as demonstrated in Table 8.2 and Table 8.3.

8.5.2 The Scheme complies with national, regional and local flood policy.

8.5.3 The FRA has considered the risk of flooding from all sources and concludes that the site is at risk of groundwater flooding and surface water flooding.

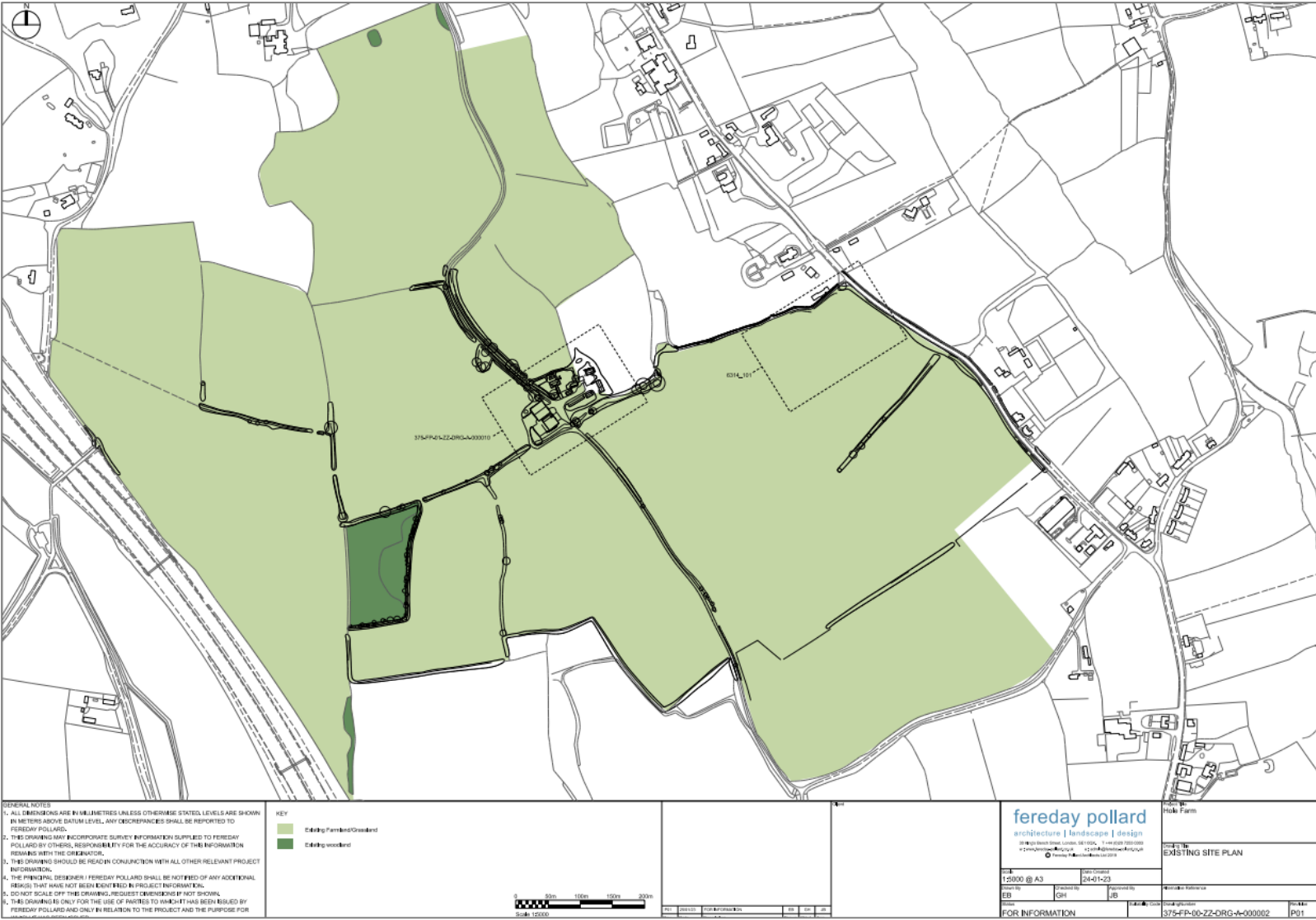
8.5.4 Measures to mitigate surface water and groundwater flood risk have been identified and residual risks have been assessed.

³⁵ Environment Agency and Department for Environment, Food & Rural Affairs Guidance- Flood risk assessment in flood zone 1 and critical drainage area. Accessed October 2022 ([web link](#)).

- 8.5.5 Provided that the mitigation measures are adopted, it is concluded that the Scheme will be safe for its users over its lifetime, will not result in a loss of floodplain storage and will not cause flooding elsewhere.
- 8.5.6 The proposed increase in storage in the drainage network (ponds) would hold back water and relieve potential flooding in downstream parts of the catchment.

Appendix A. Development Proposals

Existing Site Plan



Proposed Site Plan



Car Pak Layout



GENERAL NOTES
 1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED. LEVELS ARE SHOWN IN METERS ABOVE DATUM LEVEL. ANY DISCREPANCIES SHALL BE REPORTED TO FEREDAY POLLARD.
 2. THIS DRAWING MAY INCORPORATE SURVEY INFORMATION SUPPLIED TO FEREDAY POLLARD BY OTHERS. RESPONSIBILITY FOR THE ACCURACY OF THIS INFORMATION REMAINS WITH THE ORIGINATOR.
 3. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT PROJECT INFORMATION.
 4. THE PRINCIPAL DESIGNER / FEREDAY POLLARD SHALL BE NOTIFIED OF ANY ADDITIONAL RISKS THAT HAVE NOT BEEN IDENTIFIED IN PROJECT INFORMATION.
 5. DO NOT SCALE OFF THIS DRAWING. REQUEST DIMENSIONS IF NOT SHOWN.
 6. THIS DRAWING IS ONLY FOR THE USE OF PARTIES TO WHICH IT HAS BEEN ISSUED BY FEREDAY POLLARD AND ONLY IN RELATION TO THE PROJECT AND THE PURPOSE FOR WHICH IT HAS BEEN ISSUED.

KEY

- Planning application boundary
- Proposed buildings
- Proposed covered areas
- Surface path type A - 3m width prime aggregate with a wearing course of tar and chippings, grey granite kerbs
- Surface path type B - 2m width tarmac with coloured surface dressing of natural angled stone chippings
- Surface path type C - 2m width unsealed prime aggregate with compacted 6mm to dust grey granite angled chippings
- Surface path type D - 3m width prime aggregate with a wearing course of tar and chippings, grey granite kerbs
- Surface path type E - 3m width tarmac with grey granite surface dressing

Part of separate permitted development application by Forestry England

- Proposed open space
- Proposed meadow
- Proposed shrub
- Hedges
- Existing footpath (P101)
- Proposed and existing woodland
- Proposed natural regeneration
- Proposed feature planting
- Existing trees
- Proposed trees

Scale: 1:1000 @ A3

FORESTRY ENGLAND

REV	DATE	DESCRIPTION	BY	CHKD	APP
01	15/08/23	FOR APPROVAL	UB	GH	EB
02	15/08/23	FOR APPROVAL	UB	GH	EB
03	15/08/23	FOR APPROVAL	UB	GH	EB
04	15/08/23	FOR APPROVAL	UB	GH	EB
05	15/08/23	FOR APPROVAL	UB	GH	EB

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PROPOSED CAR PARK LOCATION PLAN

1:500 @ A1/1:1000 @ A3
 Date Issued: 03-02-23
 Drawn By: GH
 Checked By: UB
 Approved By: EB

FOR APPROVAL

Project Reference: 375-FP-02-ZZ-DRG-L-000100
 Revision: PD4