

Strategic Flood Risk Assessment

Site Assessments

Epping Forest District Council

March 2018

Quality Information

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Non Technical Summary

In April 2015 Epping Forest District Council (DC) prepared a Level 1 Strategic Flood Risk Assessment (SFRA) to inform the preparation of their Local Plan, including the application of the Sequential Test to future development sites.

As part of the Council's site selection process to identify future development sites for allocation in the Local Plan, the Council has taken a sequential approach to selecting sites, so that prioritisation has been given to those sites in Flood Zone 1. For a small number of sites, part of the site boundary is located in Flood Zones 2 and/or 3. However, for these sites, the indicative development capacity and the policy requirements associated with the site in the Local Plan make clear that development is not proposed on the parts of the site which are affected by Flood Zones 2 or 3.

In accordance with the National Planning Policy Framework (NPPF) and supporting Planning Practice Guidance (PPG), where sites allocated for More Vulnerable development are located partially within Flood Zone 3, it is necessary to apply the Exception Test.

The flood risk posed to each of the development sites has been assessed within this document, based on available information and datasets. It has been identified which sites require the Exception Test and recommendations have been provided regarding the issues that will need to be addressed as part of a site specific Flood Risk Assessment (FRA) at the planning application stage should each site be taken forward for development.

Table 1 provides a summary of the findings of this Site Assessment document.

Table 1 Summary of Sites and Findings

Site ID	Site Name	Flood Zone (%)			Summary of Findings
		FZ1	FZ2	FZ3	
Sites for Residential Use					
NAZE.R1	Land at Perry Hill	92	0	8	<p>Exception Test required.</p> <p>Majority of the site (92%) in Flood Zone 1 and through considered management of flood risk it is likely that a development layout could be determined to pass the Exception Test.</p> <p>Revised climate change modelling will be required as part of a site specific FRA at the planning application stage.</p> <p>Site specific FRA required at the planning application stage to demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.</p>
NAZE.R4	Land at St Leonards Farm	81	1	18	<p>Exception Test required.</p> <p>Majority of the site (81%) in Flood Zone 1 and through considered management of flood risk it is likely that a development layout could be determined to pass the Exception Test.</p> <p>Revised climate change modelling will be required as part of a site specific FRA at the planning application stage.</p>
SP 4.2	Water Lane Area	99.7	0.1	0.2	<p>Exception Test required.</p> <p>Site largely within Flood Zone 1 (99.7%) and through considered management of flood risk it is likely that a development layout could be determined to pass the Exception Test.</p> <p>Revised climate change modelling will be required as part of a site specific FRA at the planning application stage.</p>

Site ID	Site Name	Flood Zone (%)			Summary of Findings
		FZ1	FZ2	FZ3	
SP 4.3	East of Harlow	90	3	7	Exception Test required. Majority of the site (90%) in Flood Zone 1 and through considered management of flood risk it is likely that a development layout could be determined to pass the Exception Test. Revised climate change modelling will be required as part of a site specific FRA at planning application stage.
NWB.R3	Land south of Vicarage Lane	97	1	2	Exception Test required. Majority of the site (97%) in Flood Zone 1 and through considered management of flood risk it is likely that a development layout could be determined to pass the Exception Test. Revised climate change modelling will be required as part of a site specific FRA at the planning application stage.
LOU.R11	Land west of Roding Road	98	0	2	Exception Test required. Majority of the site (98%) in Flood Zone 1 and through considered management of flood risk it is likely that a development layout could be determined to pass the Exception Test. Revised climate change modelling will be required as part of a site specific FRA at the planning application stage.

Sites for Employment Use

LOU.E2	Langston Road Industrial Estate	91	8	1	
LSHR.E1	The Maltings	90	9	1	
NAZE.E1	The Old Waterworks	0	53	47	
NAZE.E2	Land west of Sedge Green	42	58	0	
NAZE.E3	Bridge Works and Glassworks	0	19	81	
NAZE.E4	Hillgrove Business Park	0	66	24	
NAZE.E6	Millbrook Business Park	89	6	5	Development is classified as Less Vulnerable.
NAZE.E7	Land at Winston Farm	97	0	3	Exception Test not required.
THOR.E4	Weald Hall Lane Industrial Area	18	70	12	Site specific FRA required at the planning application stage to demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.
HONG.E1	Nash Hall Industrial Estate	98	1	1	
RUR.E17	Brookside Garage	99	0	1	
RUR.E20	Land at Stewarts Farm	39.4	60	0.4	
RUR.E23	Hobbs Cross Business Centre	50	4	46	
WAL.E4	Cartersfield Road / Brooker Road	96	3	1	
WAL.E5	Meridian Business Park and Sainsbury's Distribution Centre	75	19	6	
WAL.E6	Galley Hill Road Industrial Estate	60	38.2	1.8	
WAL.E8	Land north of A121	99.9	0.08	0.01	

Sites in Flood Zone 1 with risk of flooding from Ordinary Watercourses

CHIG.R5	Part of Chigwell Nurseries	100	0	0	Sites are within Flood Zone 1. Exception Test not required.
EPP.R1	Land South of Epping - West	100	0	0	
EPP.R2	Land South of Epping - East	100	0	0	Site specific FRA required at the planning application stage to demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.
LOU.E1	Oakwood Hill Industrial Estate, Loughton, IG10 3DQ	100	0	0	

Site ID	Site Name	Flood Zone (%)			Summary of Findings
		FZ1	FZ2	FZ3	
NAZE.R2	The Fencing Centre, Pecks Hill	100	0	0	
ONG.R5	Land at Greensted Road	100	0	0	
RUR.E3	Matching Airfield/The Paper Store	100	0	0	
RUR.E10	Little Hyde Hall Farm	100	0	0	
RUR.E11	Quickbury Farm	100	0	0	
RUR.E13	Warlies Park House	100	0	0	
RUR.E14	Matching Airfield/The Paper Store	100	0	0	
RUR.T3	James Mead, Waltham Road	100	0	0	
SP 4.1	Land to east of Rye Hill Road	100	0	0	
STAP.R1	Land at Oakfield Road	100	0	0	
STAP.R3	The Drive, Stapleford Road	100	0	0	
THYB.R1	Land at Forest Drive, Theydon Bois	100	0	0	
THYB.R2	Theydon Bois London Underground Car Park	100	0	0	
WAL.R1	Land Lying to the west side of Galley Hill Road	100	0	0	
WAL.R2	Lea Valley Nursery	100	0	0	
WAL.R3	Land adjoining Parklands	100	0	0	

The large majority of the sites identified by Epping Forest DC for development will not require the application of the Exception Test. There are 6 sites proposed for residential use that are located partially within Flood Zones 2 and/or 3 which will require the application of the Exception Test. However, in each case, the large majority of the site area is within Flood Zone 1 and it is considered that with careful planning it will be possible to develop these sites appropriately to ensure that the future development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall. The Local Plan site allocation and indicative capacity assessment has been undertaken on the basis that development will not take place on any part of the site that is in Flood Zones 2 and/or 3. Specific recommendations have been provided within each site assessment regarding how this could be achieved, and it will include the development of appropriate hydraulic modelling at the master planning and planning application stage to more accurately appraise the risk of fluvial flooding across the site and inform the specific layout and design of the proposed development. This modelling should include consideration of a range of climate change scenarios in line with the latest guidance, published by the Environment Agency in February 2016.

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1. Introduction

1.1 Background

- 1.1.1 In April 2015, Epping Forest District Council (DC) prepared a Level 1 Strategic Flood Risk Assessment¹ (SFRA) Update to support the development of the emerging Epping Forest DC Local Plan. The Level 1 SFRA Update was prepared in accordance with the National Planning Policy Framework² (NPPF) and the supporting Planning Practice Guidance³ (PPG).
- 1.1.2 The purpose of the Level 1 SFRA Update was to collate and analyse the most up to date flood risk information for use by Epping Forest DC in the application of the Sequential Test to potential development sites and the preparation of robust planning documents. The NPPF advocates a sequential, risk-based approach to the location of development, whereby areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. The aim should be to keep development out of medium and high flood risk areas (Flood Zones 2 and 3) and other areas affected by other sources of flooding where possible.
- 1.1.3 However the NPPF recognises that it is not always possible to limit development to the areas of lowest flood risk. In these cases, the Exception Test, as set out in paragraph 102 of the NPPF, is a method to demonstrate and help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available.
- 1.1.4 The NPPF (Section 10 paragraph 102) states that “for the Exception Test to be passed:
- i. it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared;
 - ii. a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall”.
- 1.1.5 Table 1-1 sets out the circumstances under which the Exception Test needs to be applied. For the sites being put forward by Epping Forest DC (20171113_Site_Allocations.shp), this is primarily where residential sites (classified as More Vulnerable in the NPPF) are being proposed in areas of Flood Zone 3. Sites for employment use are classified as Less Vulnerable in the NPPF, and therefore it is not necessary to apply the Exception Test.

Table 1-1 Flood risk vulnerability classification and flood zone compatibility

Flood Zone	Flood risk vulnerability classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	✓	✓	✓	✓	✓
2	✓	Exception required	test ✓	✓	✓
3a	Exception required	test X	Exception required	test ✓	✓
3b	Exception required	test X	X	X	✓

✓ Development is appropriate X Development should not be permitted.

¹ AECOM, April 2015, Epping Forest DC Strategic Flood Risk Assessment.

² https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf

³ <https://www.gov.uk/government/collections/planning-practice-guidance>

- 1.1.6 Since the preparation of the Level 1 SFRA Update for Epping Forest DC, a number of sites have been identified for future growth and development in the District, some of which are not located entirely within Flood Zone 1. As a result, further information is required regarding these sites, to determine the suitability of their selection, and to identify any issues that will need to be considered in order to satisfy the requirements of part (ii) of the Exception Test as part of a site specific FRA at the planning application stage.
- 1.1.7 The purpose of this Site Assessment Report is to provide the necessary further information regarding these sites. The Report is structured as follows:
- **Section 2** provides details of the information and datasets that have been used to inform the site assessments including the methodology that has been applied to consider the impacts of climate change.
 - **Section 3.2** presents a pro forma for 6 sites currently proposed for **residential** use. The pro forma details the site assessments and recommendations regarding the issues that will need to be considered in order to satisfy part (ii) of the Exception Test as part of a site specific FRA at the planning application stage.
 - NAZE.R1 Land at Perry Hill
 - NAZE.R4 Land at St Leonards Farm
 - SP 4.2 Water Lane Area
 - SP 4.3 East of Harlow
 - NWB.R3 Land south of Vicarage Lane
 - LOU.R11 Land west of Roding Road
 - **Section 3.3** presents a pro forma for 17 sites currently proposed for **employment** use. These sites do not require the application of the Exception Test, in accordance with the NPPF, as set out in Table 1-1, however recommendations have been provided which should be considered as part of a site specific FRA for the sites at the planning application stage to ensure that future development on the site is safe and does not increase flood risk to the site or surrounding area.
 - LOU.E2 Langston Road Industrial Estate
 - LSHR.E1 The Maltings
 - NAZE.E1 The Old Waterworks
 - NAZE.E2 Land west of Sedge Green
 - NAZE.E3 Bridge Works and Glassworks
 - NAZE.E4 Hillgrove Business Park
 - NAZE.E6 Millbrook Business Park
 - NAZE.E7 Land at Winston Farm
 - THOR.E4 Weald Hall Lane Industrial Area
 - HONG.E1 Nash Hall Industrial Estate
 - RUR.E17 Brookside Garage
 - RUR.E20 Land at Stewarts Farm
 - RUR.E23 Hobbs Cross Business Centre
 - WAL.E4 Cartersfield Road / Brooker Road
 - WAL.E5 Meridian Business Park and Sainsbury's Distribution Centre
 - WAL.E6 Galley Hill Road Industrial Estate
 - WAL.E8 Land north of A121
 - Furthermore, when reviewing the sites that Epping Forest DC identified for potential development, it was noted that a further 20 sites are not shown to be located within Flood Zone 2 or 3 but do **have**

ordinary watercourses passing through, or close by to the site. It is important that the risk of flooding from ordinary watercourses is taken into account during the assessment of flood risk. The Risk of Flooding from Surface Water (RoFfSW) mapping has therefore been used to provide an indication of the risk of flooding from overland flow including these ordinary watercourses. **Section 4** provides details of these sites along with recommendations for consideration during the preparation of site specific FRAs for these sites at the planning application stage.

- RUR.E13 Warlies Park House, Horseshoe Hill, EN9 3SL
- RUR.E10 Little Hyde Hall Farm, Hatfield Heath Road, CM21 9HX
- LOU.E1 Oakwood Hill Industrial Estate, Loughton, IG10 3DQ
- RUR.E3 Matching Airfield/The Paper Store, Anchor Lane, Abbess Roding, CM5 0JR
- RUR.E11 Quickbury Farm, Hatfield Heath Road, CM21 9HY
- RUR.E14 Matching Airfield/The Paper Store, Anchor Lane, Abbess Roding, CM5 0JR
- STAP.R1 Land at Oakfield Road, Stapleford Abbots, Essex, RM4 1JH
- THYB.R2 Theydon Bois London Underground Car Park, Station Approach, CM16 7HR
- ONG.R5 Land at Greensted Road, Chipping Ongar, Essex, CM5 9HJ
- RUR.T3 James Mead, Waltham Road, Long Green, Nazeing, Essex, EN9 2LU
- WAL.R1 Land Lying to the west side of Galley Hill Road, Northern Portion
- WAL.R2 Lea Valley Nursery, Crooked Mile, Waltham Abbey
- WAL.R3 Land adjoining Parklands, Waltham Abbey
- THYB.R1 Land at Forest Drive, Theydon Bois
- NAZE.R2 The Fencing Centre, Pecks Hill, Nazeing, EN9 2NY
- CHIG.R5 Part of Chigwell Nurseries, 245 High Road, Chigwell, Essex, 1G7 5BL
- EPP.R2 Land South of Epping - East
- EPP.R1 Land South of Epping - West
- SP 4.1 Land to east of Rye Hill Road, London Road, Harlow, Essex, CM18 7HT
- STAP.R3 The Drive, Stapleford Road, Stapleford Abbots, Essex, RM4 1EJ

2. Datasets and Methodology

2.1 Information and Datasets

2.1.1 Epping Forest DC has supplied a GIS layer of the sites that they wish to be assessed (20171113_Site_Allocations.shp). The following datasets have been used to assess the flood risk to the potential development sites:

- OS Mapping;
- Detailed River Network;
- Flood Map for Planning (Flood Zone 2, 3);
- Fluvial Modelling Outputs for River Lee (CH2M Hill, 2014), Upper Roding (JBA 2016), Middle Roding (JBA 2012) and Stort (JBA 2015);
- Flood Defences (Asset Information Management System);
- Environment Agency Recorded Flood Outlines;
- Flood Incidents (from all sources);
- Risk of Flooding from Surface Water Mapping;
- Areas Susceptible to Groundwater Flooding Mapping; and,
- BGS Bedrock and Superficial Geology.

2.1.2 Full details regarding these datasets are included in the Level 1 SFRA Update Report.

2.2 Climate Change

2.2.1 The NPPF requires LPAs to consider the impact of climate change on flood risk and take this into account in land use planning. In hydraulic modelling studies to date, recommended national precautionary sensitivity ranges for use in the planning system included a 20% increase for peak river flows. As a result a 20% increase was typically applied to the 1% AEP (1 in 100 year) design event, and mapped to provide an indication of the extent of flood risk including climate change.

2.2.2 In February 2016 the Environment Agency published revised guidance on climate change allowances in an update to the document 'Adapting to Climate Change: Advice to Flood and Coastal Erosion Risk Management Authorities'⁴. This version of the document reflects an assessment completed by the Environment Agency between 2013 and 2015 using United Kingdom Climate Projections 2009 (UKCP09) data, to produce more representative climate change allowances for river basin districts across England. The allowances for the Thames river basin district are of relevance to Epping Forest and are set out in Table 2-1.

Table 2-1 Peak river flow allowances for Thames river basin district (use 1961 to 1990 baseline)

River basin district	Allowance category	Total potential change anticipated for '2020s' (2015 to 2039)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
Thames	Upper end (90 th)	25%	35%	70%
	Higher central (70 th)	15%	25%	35%
	Central (50 th)	10%	15%	25%

2.2.3 In order to determine which range of allowance should be assessed for a proposed development or plan, the flood zone and vulnerability classification should be considered, as set out below.

⁴ Environment Agency, February 2016, Adapting to Climate Change: Advice to Flood and Coastal Erosion Risk Management Authorities. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/516116/LIT_5707.pdf

2.2.4 In Flood Zone 2

- essential infrastructure – use the higher central and upper end to assess a range of allowances
- highly vulnerable – use the higher central and upper end to assess a range of allowances
- more vulnerable – use the central and higher central to assess a range of allowances
- less vulnerable – use the central allowance
- water compatible – use none of the allowances

2.2.5 In Flood Zone 3a

- essential infrastructure – use the upper end allowance
- highly vulnerable – development should not be permitted
- more vulnerable – use the higher central and upper end to assess a range of allowances
- less vulnerable – use the central and higher central to assess a range of allowances
- water compatible – use the central allowance

2.2.6 In Flood Zone 3b

- essential infrastructure – use the upper end allowance
- highly vulnerable – development should not be permitted
- more vulnerable – development should not be permitted
- less vulnerable – development should not be permitted
- water compatible – use the central allowance

2.2.7 The lifetime of the development should be considered when determining which future climate change allowance time period should be used. The lifetime of a proposed development should be judged based on the characteristics of the development. In the case of residential developments, a minimum lifetime of 100 years should be taken when selecting climate change allowance percentages. For other types of development, the applicant should assess how long they anticipate the development to be in place for, and justify the lifetime of the development. Otherwise, a 75 year lifetime should be used.

2.2.8 For the purposes of strategic planning, the '2070 to 2115' allowances in Table 2-1 should be used.

2.2.9 As part of the existing hydraulic modelling studies that have been made available for this SFRA for the Rivers Lee, Stort, and Upper and Middle Roding, simulations have been run for the 1% AEP (1 in 100 year) event including a standard percentage increase in river flow to account for the implications of climate change. This is typically applied as a 20% increase to fluvial flows based on previous climate change guidance. As a result, modelling results assessing a full suite of allowances such as those presented in Table 2-1 are not currently available.

2.2.10 The use of updated climate change allowances is imperative in site-specific FRAs and as such, it would be desirable to map these new outlies for the site assessments within this report. However, this is a time consuming exercise entailing the rerunning of Environment Agency hydraulic models for each of the main river watercourses which cannot be accommodated within the current scope and programme for the site assessments.

2.2.11 In the absence of the updated allowances and based on the information currently available, either the previous allowances (20%) or a surrogate event of the 0.1% AEP (1 in 1000 year) fluvial event can be mapped to represent an estimated 1% AEP (1 in 100 year) event with allowances for the updated climate change allowance.

2.2.12 As such, a climate change assessment, using a stage discharge relationship, has been undertaken to assess the validity of using the 0.1% AEP (1 in 1000 year) as a proxy event. The suggested approach set out in the guidance document published by the Environment Agency 'Flood Risk Assessment: Climate Change Allowances'⁵ has been referred to in this process.

⁵ Environment Agency (2016) East Anglia, Essex, Norfolk and Suffolk Area – Flood Risk Assessment: Climate Change Allowances.

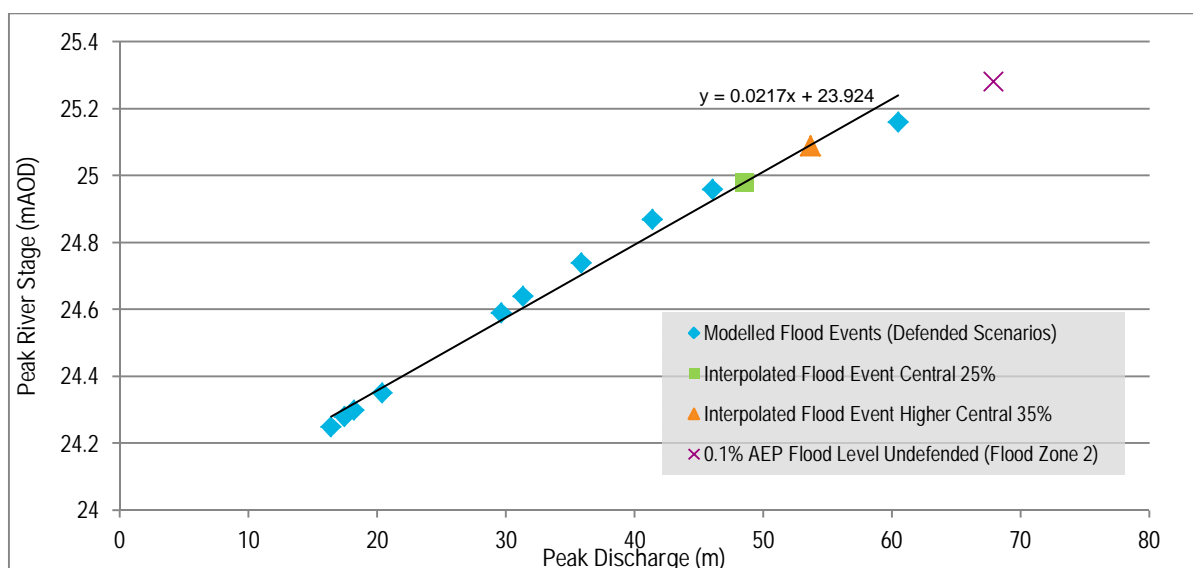
2.3 Stage-Discharge Relationship Analysis

- 2.3.1 For each of the hydraulic models for the River Lee, Stort, Middle Roding and Upper Roding, an output file was provided detailing the flows (discharge) and levels (stage) at each node within the model for each of the simulated return periods e.g. 5% AEP (1 in 20 year), 2% AEP (1 in 50 year), 3.3% AEP (1 in 75 year), 1% AEP (1 in 100 year), 1 % AEP (1 in 100 year) plus 20% allowance for climate change, 0.5% AEP (1 in 200 year), 0.1% AEP (1 in 1000 year).
- 2.3.2 Using the node closest to each site, the data for stage and discharge for all modelled scenarios was plotted and a trend line fitted to the stage-discharge relationship.
- 2.3.3 Based on the existing modelled discharge values for the available return periods, values were interpolated for the discharge for the following climate change events, as set out in the guidance:
- § Central allowance (1% AEP (1 in 100 year return period) event including 25%)
 - § Higher central (1% AEP (1 in 100 year return period) event including 35%)
 - § Upper end (1% AEP (1 in 100 year return period) event including 70%)
- 2.3.4 The equation for the stage-discharge relationship was then used to calculate the stage for the 3 scenarios.
- 2.3.5 The resulting water levels were then compared with the level for the 1 in 1000 year event⁶ which corresponds to Flood Zone 2, to determine the suitability of using the Flood Zone 2 outline as a conservative proxy for climate change in the vicinity of the site.
- 2.3.6 A graph showing the stage-discharge relationship for the node closest to each site is provided in each site assessment pro forma, where hydraulic modelling is available.
- 2.3.7 An example is provided below for one of the sites:

Stage-Discharge Relationship Example: NAZE.E3

- 2.3.8 The site is shown to be located within Flood Zone 2 (19%) and Flood Zone 3 (81%) associated with the Nazeing Drain and River Lee Navigation. Modelled peak flow and water levels were extracted from the Environment Agency River Lee hydraulic model adjacent to the site at node WGA56. The proposed use for the site is employment use with is classified as Less Vulnerable. Therefore flows for the 1% AEP (1 in 100 year) plus 25% and 1% AEP (1 in 100 year) plus 35% climate change were estimated based on the trend in the stage-discharge relationship for the modelled flood events (Figure 2-1 and Table 2-2).

Figure 2-1 Stage-discharge relationship for the River Lee at WGA56, Broxbourne



⁶ It is noted that in some cases flood levels were available for the defended and undefended scenarios. The delineation of Flood Zone 2 in the Flood Map for Planning (Rivers and Sea) does not include the presence of defences, and therefore in these cases the flood level for the 0.1% AEP (1 in 1000 year) for the undefended scenario has been referred to.

Table 2-2 Analysis of existing modelled flood water levels (CB014)

Flood Event	Defended Model Scenarios		Undefended Model Scenarios	
	Flow (m3/s)	River Stage (m AOD)	Flow (m3/s)	River Stage (m AOD)
1 in 2 year	16.4	24.25	-	-
1 in 5 year	17.45	24.28	-	-
1 in 10 year	18.18	24.3	-	-
1 in 20 year	20.39	24.35	-	-
1 in 50 year	29.63	24.59	-	-
1 in 75 year	31.34	24.64	-	-
1 in 100 year	35.88	24.74	57.61	25.14
1 in 100 year plus 20% climate change	46.06	24.96	-	-
1 in 200 year	41.4	24.87	-	-
1 in 1000 year	60.49	25.16	67.91	25.28
Interpolated Events				
1 in 100 year plus 25% climate change	48.61	24.98	-	-
1 in 100 year plus 35% climate change	53.70	25.09	-	-

- 2.3.9 The analysis demonstrates that based on an interpolation of the existing River Lee modelled flood levels for a range of return periods, utilising the 0.1% AEP (1 in 1000 year) as a conservative proxy for the 1% AEP (1 in 100 year) plus 35% allowance for climate change is appropriate at this site.
- 2.3.10 Developers should note that the Environment Agency guidance should be used as a guide only and it is anticipated that there will be greater emphasis for site specific FRAs to include additional modelling scenarios to determine the future flood risk with respect to climate change where hydraulic modelling data is not available.
- 2.3.11 It is recommended that developers contact the Environment Agency at the pre-planning application stage to confirm site specific flood risk assessment approach, on a case by case basis.**

2.4 Site Recommendations

- 2.4.1 Within each site pro forma, recommendations have been made for the issues that will need to be addressed as part of future development of the site to inform the preparation of a site specific Flood Risk Assessment (FRA) and support part (ii) of the Exception Test. The recommendations presented are consistent with policies set out in the submission version of the Epping Forest Local Plan⁷ (2017).

⁷ Epping Forest District Council Local Plan Submission Version 2017. <http://www.efdclocalplan.org/submission-version-2017/>

3. Site Assessments

3.1 Overview

3.1.1 This section comprises site specific assessments for each of the sites that are identified within Flood Zones 2 and 3. For each site a summary of the risk to the site has been prepared, along with the outcomes of the analysis of the stage-discharge relationships for the relevant watercourse and recommendations for the issues that will need to be considered on the site as part of the preparation of a site specific FRA for the site at the planning application stage. The sites have been grouped into those identified for residential use and those for employment use.

3.2 Residential Sites

3.2.1 Table 3-1 provides an overview of the potential sites for residential development, including site reference and address, the proportion within each flood zone, and the nearest watercourse and availability of hydraulic modelling from the Environment Agency.

Table 3-1 Potential Sites for Residential Development

Site Ref	Address	Flood Zone (%)			Watercourse	Modelling Availability
		FZ1	FZ2	FZ3		
NAZE.R1	Land at Perry Hill	92	0	8	Lower Navigation	Lee River (CH2M Hill, 2014).
NAZE.R4	Land at St Leonards Farm	81	1	18	Lichen Brook	River Lee (CH2M Hill, 2014).
SP 4.2	Water Lane Area	99.7	0.1	0.2	Parndon Brook, part of Lee catchment.	Not included in the River Lee Model (CH2M Hill, 2014).
SP 4.3	East of Harlow	90	3	7	Pincey Brook, tributary of the Stort.	Not included in the Stort Model (JBA 2015).
NWB.R3	Land south of Vicarage Lane	97	1	2	Queens Brook / North Weald Brook	Upper Roding (JBA 2016).
LOU.R11	Land west of Roding Road	98	0	2	Loughton Brook, tributary of Roding.	Not included in the Middle Roding model (JBA 2012).

Site Assessment Summary – NAZE.R1 Land at Perry Hill

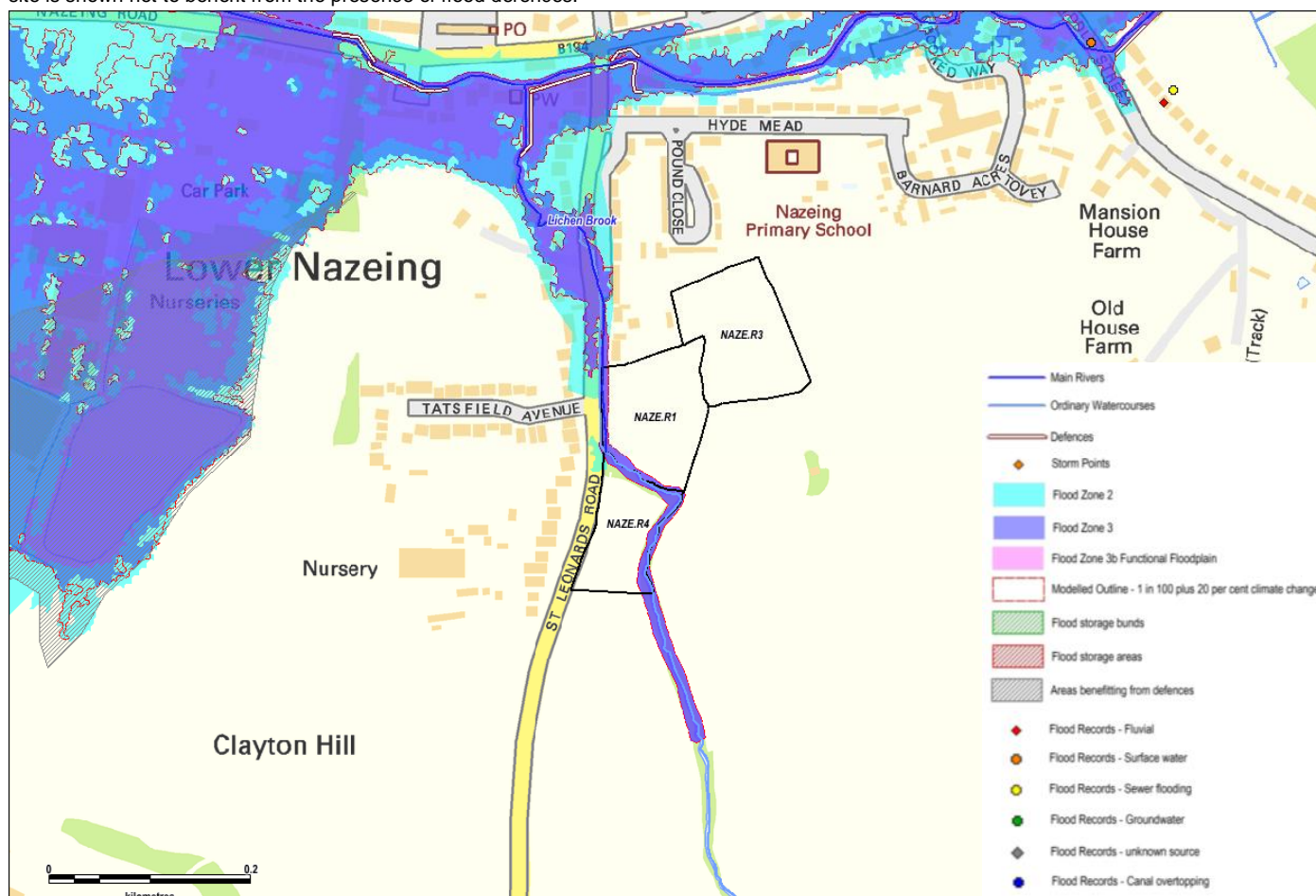
Allocation Reference: NAZE.R1	Address: Nazeing, Essex	Area (ha): 1.19	Proposed Use: Residential	Vulnerability Classification: More Vulnerable
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Fluvial Flood Risk

Flood Zone 1: 92%	Flood Zone 2: -%	Flood Zone 3a: -%	Flood Zone 3b: 8%
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Flood Zones and Flood Defences

The Lichen Brook flows north along the southern and western boundaries of the NAZE.R1 site. A small area of Flood Zone 3b (8%) is located within this site, corresponding with this main river. Flood Zone 3b is defined as land where water has to be stored in times of flood. It is not appropriate to locate development within this area. The majority of the site, and much of the area surrounding the site, is designated as Flood Zone 1 (92%). The site is shown not to benefit from the presence of flood defences.



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Figure A Flood Map for Planning (Rivers and Sea)

Historic Records

The Environment Agency Historic Flood Map records an incident of fluvial flooding within this area in December 2000. An additional two fluvial flooding events have been recorded within 1km of the site.

Climate Change

In accordance with the PPG, for More Vulnerable development proposed in Flood Zone 3, the Higher Central (35%) and Upper End (70%) climate change allowances should be considered. Analysis of the stage-discharge relationship along the Lichen Brook identifies that the 0.1% AEP (1 in 1000 year) flood level for the undefended model scenario, which corresponds to Flood Zone 2, is greater than the flood level calculated for the Higher Central climate change allowance and very similar to the Upper End scenario. The outline of Flood Zone 2 is therefore appropriate to use as a proxy when considering the impact of climate change on flood risk for this site and surrounding area.

Site Assessment Summary – NAZE.R1 Land at Perry Hill

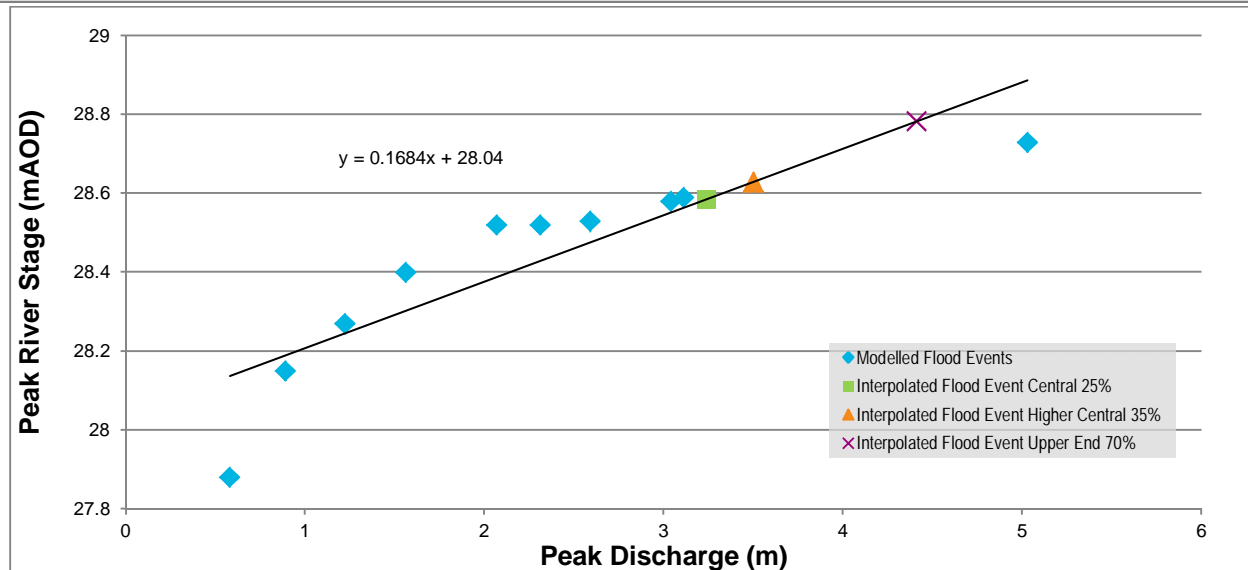


Figure B Stage-Discharge relationship at Node LBO350 of the River Lee Modelling Study 2014

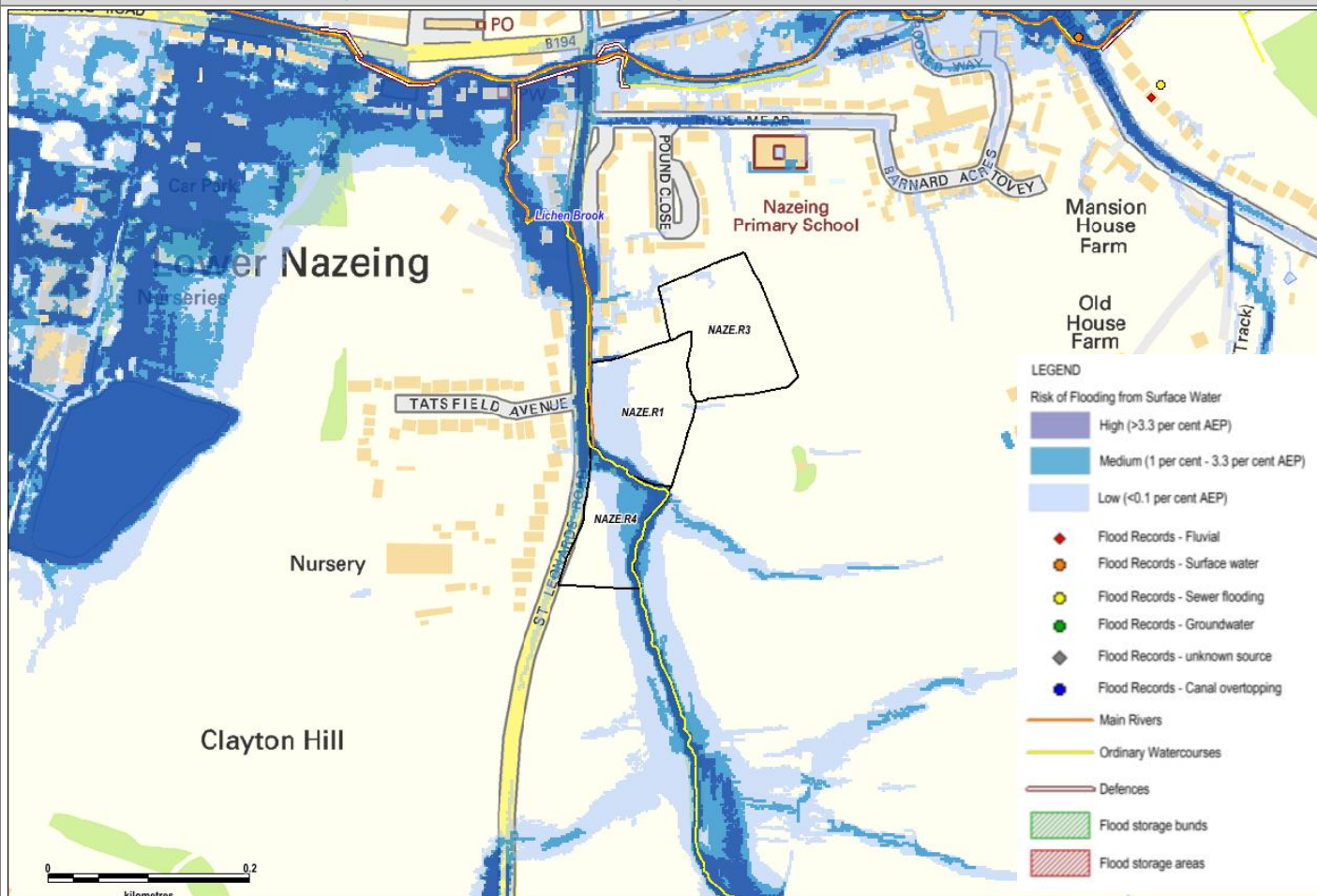
Surface Water Flood Risk

Risk of Flooding from Surface Water (RoFSW)

The RoFSW mapping indicates that the eastern half of this site is not at risk of flooding from surface water. Most of the remaining area of the site is at risk of surface water flooding, primarily at low risk, however, areas within approximately 50m of the southern and western perimeters of the site are at high risk. These areas of high risk are flow paths, which flow north along St Leonards Road, at over 0.25 m/s. These flow paths should be considered carefully in the development of the site layout to ensure that new development is not placed at surface water flood risk, and that the position of any new development does not divert the flow path to a neighbouring area. It should also be noted that there is a small parcel of land in the north-west of the site that is not at risk of surface water flooding, however it is completely surrounded by low to high risk regions so access / egress may need to be considered at the site planning stage.

There have been 8 reported incidents of surface water flooding within 1km of the site.

Site Assessment Summary – NAZE.R1 Land at Perry Hill



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Figure C Risk of Flooding from Surface Water (RoFSW)

Geology:

The underlying geology is London Clay formation. This type of geology comprises clay, silt and sand and is typically not very permeable, resulting in rapid runoff of surface water across the ground surface. There is no information available on the composition of superficial deposits overlying this bedrock geology.

Groundwater Flood Risk

The ASTGWF mapping (also presented in the Level 1 SFRA, Appendix B Figure 9) indicates that the site lies within a region which has a low susceptibility to groundwater flooding (<25%). The risk of groundwater flooding in this area is therefore generally considered to be low. This will need to be confirmed during site investigation survey.

Other Sources

The Environment Agency ‘Risk of Flooding from Reservoirs’ mapping indicates that the site is not at risk from flooding due to reservoirs.

Site Specific Recommendations

Fluvial Modelling

As part of a site specific FRA for this site at the planning application stage, additional hydraulic modelling will be required comparing a range of probability events to determine the impact of climate change on the risk of flooding at this location. The 1% AEP (1 in 100 year) flood event including the Higher Central (35%) and Upper End (70%) allowance are of relevance to the proposed Less Vulnerable development. The modelling will also need to address any potential impact the proposed development may have on flood risk to the surrounding area.

Set-back Distance

Due to the close proximity of the Lichen Brook Main River, development should be set back at least 8m from the watercourse. The Environment Agency will need to be consulted and an Environmental Permit obtained for any works within 8m of the watercourse.

Site Assessment Summary – NAZE.R1 Land at Perry Hill

Site Layout and Design

Development is not permitted in areas of Flood Zone 3b; these must be maintained as areas where floodwater can be stored in times of flood.

A sequential approach to site layout should be applied, whereby sensitive elements of the development are directed towards areas of lowest flood risk. Given that the large majority of the site (92%) is located within Flood Zone 1, this should be achievable.

The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of SuDS, taking care to consider SuDS features in accordance with the hierarchy of SuDS (i.e. considering infiltration measures first wherever possible). The suitability of locating proposed surface water drainage features within the fluvial floodplain must be considered, as they may be rendered ineffective during times of fluvial flooding.

Finished Floor Levels

Finished floor levels should be set at least 300mm freeboard above the flood level for 1% AEP event including an appropriate allowance for climate change. In this case, for More Vulnerable development in Flood Zone 3a, the higher central (35%) climate change allowance should be used and should be tested against the upper end (70%) climate change allowance also.

Floodplain Compensation

Land raising and any built development should be avoided within Flood Zone 3. Where alterations to the floodplain are proposed, compensatory floodplain storage will need to be provided on a level-for-level and volume-for-volume basis with respect to the 1% AEP (1 in 100 year) design event, including an allowance for climate change. The land used to provide compensation storage will need to be in hydraulic connectivity with the existing floodplain, but not already part of the floodplain.

Access / Egress

It will be necessary to consider whether safe dry access to and from the site can be achieved. The main access to the site is provided along St Leonards Road, which passes over Lichen Brook, and through associated regions of Flood Zones 2 and 3. Surface water flood risk should also be considered.

Safe Refuge

Given the proximity to the Lichen Brook and the potential for the access / egress route to be affected by flooding, internal access should be provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. An area of safe refuge should be located above the 1% AEP fluvial flood level including an allowance for climate change. This refuge will have to be permanent and accessible to all occupants and users of the site.

Resilience Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. Guidance on resilience measures can be found in the 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' published by The Department for Communities and Local Government (CLG).

Emergency Planning

The site is shown to be within an Environment Agency Flood Warning Area for the Nazeing Brook at Lower Nazeing. Due to the proximity of the site to the watercourse, Flood Response Plans should be prepared by residents of the site.

LLFA Consultation

It is recommended that potential developers contact Essex CC as the LLFA for further information prior to taking forward site specific plans.

Summary

Based on the strategic assessment of flood risk and the recommendations for mitigation measures set out above, it is considered that proposed development on this site could be suitably designed to satisfy part ii) of the Exception Test subject to the submission of a detailed site specific FRA at the master planning and planning application stage.

Site Assessment Summary – NAZE.R4 Land at St Leonards Farm

Allocation Reference: NAZE.R4	Address: St. Leonards Road, Waltham Abbey, Nazeing, EN9 2HG	Area (ha): 0.82	Proposed Use: Residential	Vulnerability Classification: More Vulnerable
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Fluvial Flood Risk

Flood Zone 1: 81%	Flood Zone 2: 1%	Flood Zone 3a: -%	Flood Zone 3b: 18%
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Flood Zones and Flood Defences

The Lichen Brook flows north along the eastern and northern boundaries of the NAZE.R4 site. An area of Flood Zone 3b (18%) is located within this site, corresponding with the location of the main river. Flood Zone 3b is defined as land where water has to be stored in times of flood. It is not appropriate to locate development within this area. The majority of the site, and much of surrounding area, is designated as Flood Zone 1 (91%). The site is shown not to benefit from the presence of flood defences.



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Figure A Flood Map for Planning (Rivers and Sea)

Historic Records

The Environment Agency Historic Flood Map does not record any incidents of fluvial flooding within this area. Two fluvial flooding events have been recorded within 1km of the site.

Climate Change

In accordance with the PPG, for More Vulnerable development proposed in Flood Zone 3, the Higher Central (35%) and Upper End (70%) climate change allowances should be considered. Analysis of the stage-discharge relationship along the Lichen Brook identifies that the 0.1% AEP (1 in 1000 year) flood level for the undefended model scenario, which corresponds to Flood Zone 2, is greater than the flood level calculated for the Higher Central climate change allowance and very similar to the Upper End scenario. The outline of Flood Zone 2 is therefore appropriate to use as a proxy when considering the impact of climate change on flood risk for this site and surrounding area.

Site Assessment Summary – NAZE.R4 Land at St Leonards Farm

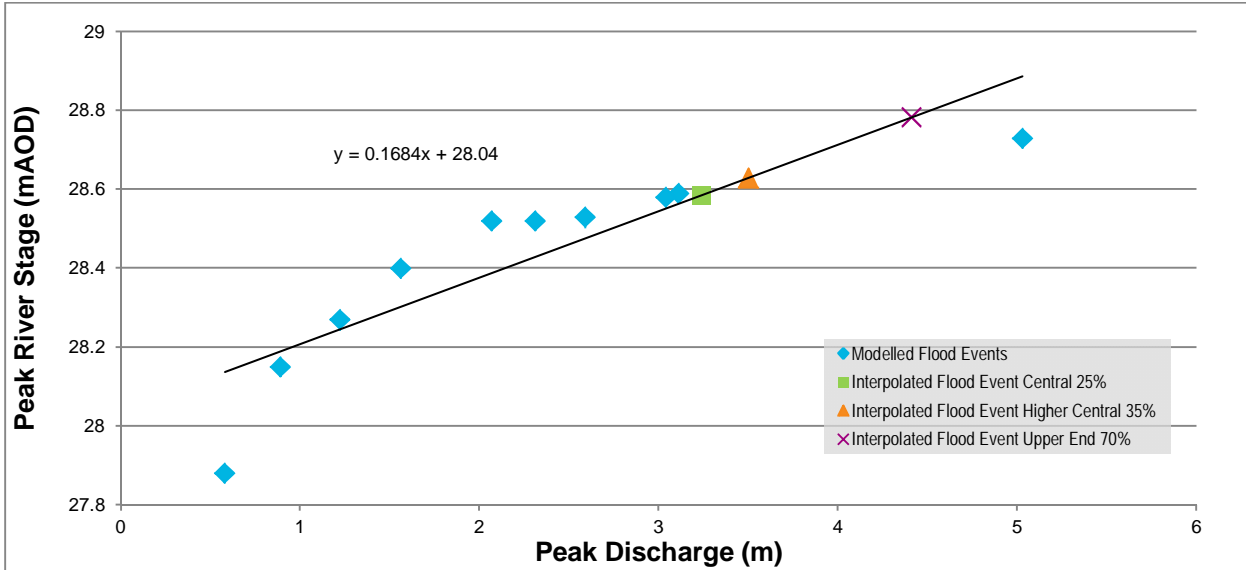


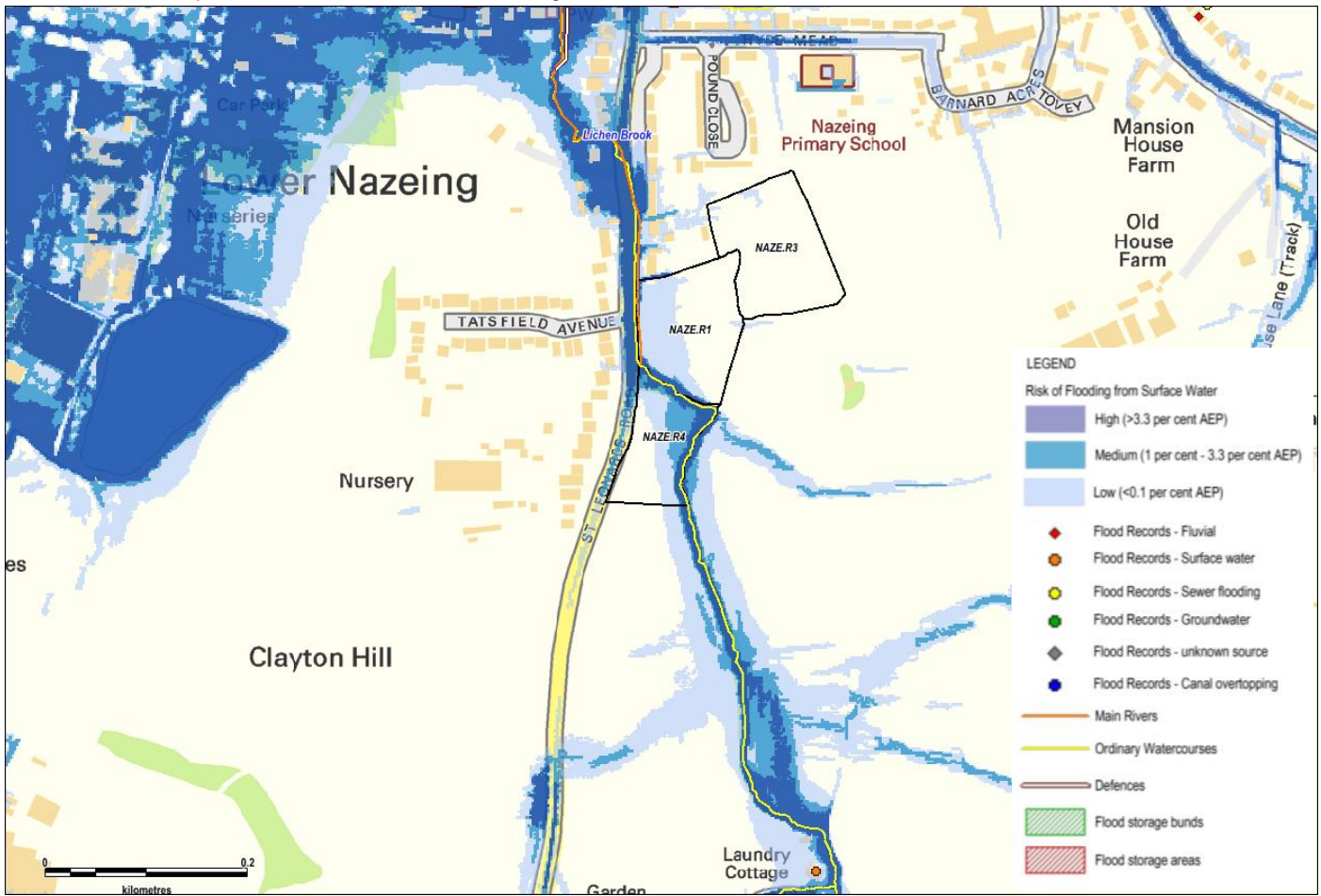
Figure B Stage-Discharge relationship at Node LBO350 of the River Lee Modelling Study 2014

Surface Water Flood Risk

Risk of Flooding from Surface Water (RoFSW)

The RoFSW mapping indicates that the site is roughly split into two half, that in the south-west where there is no risk of surface water flooding, and that in the north-east where the majority of the region is at a low to medium risk of flooding from surface water. Along the eastern and northern perimeter of the site, however, is a high risk flow path, flowing towards St Leonards Road with a flood velocity upwards of 0.25 m/s. These flow paths should be considered carefully in the development of the site layout to ensure that new development is not placed at surface water flood risk, and that the position of any new development does not divert the flow path to a neighbouring area.

There have been 8 reported incidents of surface water flooding within 1km of the site.



Site Assessment Summary – NAZE.R4 Land at St Leonards Farm

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Figure C Risk of Flooding from Surface Water (RoFSW)

Geology:

The underlying geology is London Clay formation. This type of geology comprises clay, silt and sand and is typically not very permeable, resulting in rapid runoff of surface water across the ground surface.

Groundwater Flood Risk

The AStGWF mapping (also presented in the Level 1 SFRA, Appendix B Figure 9) indicates that the site lies within a region which has a low susceptibility to groundwater flooding (<25%). The risk of groundwater flooding in this area is therefore generally considered to be low. This will need to be confirmed during site investigation survey.

Other Sources

The Environment Agency 'Risk of Flooding from Reservoirs' mapping indicates that the site is not at risk from flooding due to reservoirs.

Site Specific Recommendations

Fluvial Modelling

As part of a site specific FRA for this site at the planning application stage, additional hydraulic modelling will be required comparing a range of probability events to determine the impact of climate change on the risk of flooding at this location. The 1% AEP (1 in 100 year) flood event including the Higher Central (35%) and Upper End (70%) allowance are of relevance to the proposed Less Vulnerable development. The modelling will also need to address any potential impact the proposed development may have on flood risk to the surrounding area.

Set-back Distance

Due to the close proximity of the Lichen Brook Main River, development should be set back at least 8m from the watercourse. The Environment Agency will need to be consulted and an Environmental Permit obtained for any works within 8m of the watercourse.

Site Layout and Design

Development is not permitted in areas of Flood Zone 3b; these must be maintained as areas where floodwater can be stored in times of flood.

A sequential approach to site layout should be applied, whereby sensitive elements of the development are directed towards areas of lowest flood risk.

Residential development should be avoided in areas defined as risk of surface water flooding; instead lower vulnerability uses including landscaped open space should be located here.

The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of SuDS, taking care to consider SuDS features in accordance with the hierarchy of SuDS (i.e. considering infiltration measures first wherever possible). The suitability of locating proposed surface water drainage features within the fluvial floodplain must be considered, as they may be rendered ineffective during times of fluvial flooding.

Finished Floor Levels

Finished floor levels should be set at least 300mm freeboard above the flood level for 1% AEP event including an appropriate allowance for climate change. In this case, for More Vulnerable development in Flood Zone 3a, the higher central (35%) climate change allowance should be used and should be tested against the upper end (70%) climate change allowance also.

Floodplain Compensation

Land raising and any built development should be avoided within Flood Zone 3. Where alterations to the floodplain are proposed, compensatory floodplain storage will need to be provided on a level-for-level and volume-for-volume basis with respect to the 1% AEP (1 in 100 year) design event, including an allowance for climate change. The land used to provide compensation storage will need to be in hydraulic connectivity with the existing floodplain, but not already part of the floodplain.

Access / Egress

It will be necessary to consider whether safe dry access to and from the site can be achieved. The main access to the site is provided along St Leonards Road, from which there is a safe route to areas of Flood Zone 1 to the south.

Resilience Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. Guidance on resilience measures can be found in the 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' published by The Department for Communities and Local Government (CLG).

Emergency Planning

The site is shown to be within an Environment Agency Flood Warning Area for the Nazeing Brook at Lower Nazeing. Due to the proximity of the site

Site Assessment Summary – NAZE.R4 Land at St Leonards Farm

to the watercourse, Flood Response Plans should be prepared by residents of the site.

LLFA Consultation

It is recommended that potential developers contact Essex CC as the LLFA for further information prior to taking forward site specific plans.

Summary

Based on the strategic assessment of flood risk and the recommendations for mitigation measures set out above, it is considered that proposed development on this site could be suitably designed to satisfy part ii) of the Exception Test subject to the submission of a detailed site specific FRA at the master planning and planning application stage.

Site Assessment Summary – SP 4.2 Water Lane Area

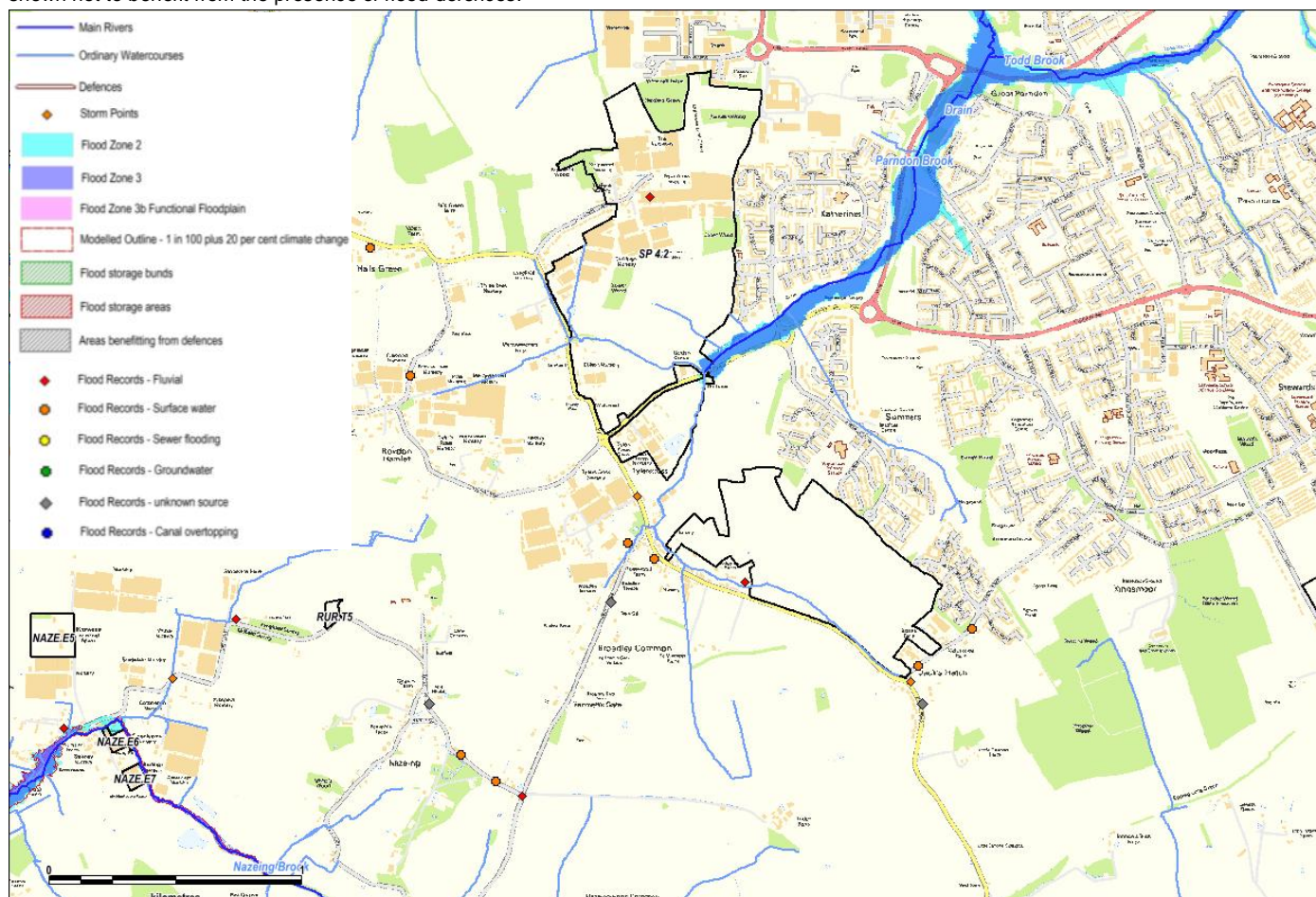
Allocation Reference: SP 4.2	Address: West of Harlow	Area (ha): 117.04	Proposed Use: Residential	Vulnerability Classification: More Vulnerable
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Fluvial Flood Risk

Flood Zone 1: 99.7%	Flood Zone 2: 0.1%	Flood Zone 3a: 0.2%	Flood Zone 3b: -%
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Flood Zones and Flood Defences

SP 4.2 is split into three separate, unconnected parcels of land. Five ordinary watercourses pass through, or flow close to, this large site. The only main river which poses a risk to the site is Parndon Brook which originates close to the centre of the site, near to The Forge, and flows towards the east, away from the site. Due to the close vicinity of parts of this river to the site, a small area of SP 4.2 is delineated as Flood Zone 2 and 3a. This is located in the central region of the site, close to The Forge. The significant majority of the site is located within Flood Zone 1 (99.7%). The site is shown not to benefit from the presence of flood defences.



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Figure A Flood Map for Planning (Rivers and Sea)

Historic Records

The Environment Agency Historic Flood Map records one incident of fluvial flooding within this area, this took place in March 1947. A further two fluvial flooding incidents have been reported within 1km of the site. One of these aforementioned flooding incidents occurred within the site, close to Four Acres Nursey, the other approximately 30m west of the southernmost parcel of land, close to Silcocks Farm

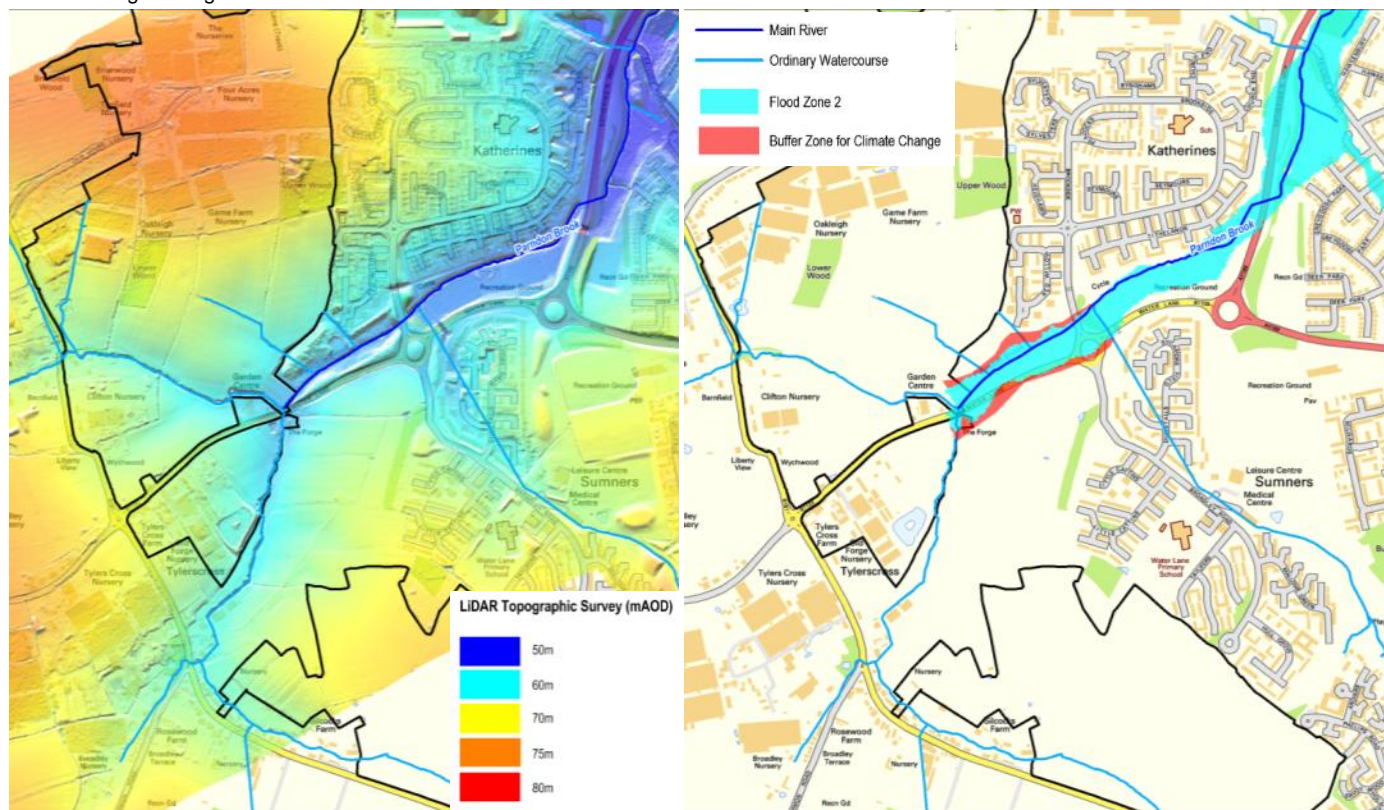
Climate Change

In accordance with the PPG, for More Vulnerable development proposed in Flood Zone 3, the Higher Central (35%) and Higher Central (70%) climate change allowances should be considered. Pardon Brook is part of the Lee catchment; however there is no modelling currently available for this watercourse and therefore stage-discharge analysis is not possible.

In the absence of available model data, the LiDAR topographic survey data has been obtained for the site. In order to provide some indication of the area that could be susceptible to flooding in the future as a result of climate change, the topography along the extent of Flood Zone 2 has been reviewed, and a buffer zone has been established to show the area that would be inundated with flood levels at 1m greater than the Flood Zone 2 extent. This is a very conservative approach, but enables an understanding of the local floodplain and the area that could be impacted when

Site Assessment Summary – SP 4.2 Water Lane Area

considering a large flood event. The LiDAR topography data and buffer zone is shown in Figure B. It shows a zone of varying width, approximately 10-20m along the edge of Flood Zone 2.



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Figure B LiDAR Topography and Proxy Climate Change Buffer Zone

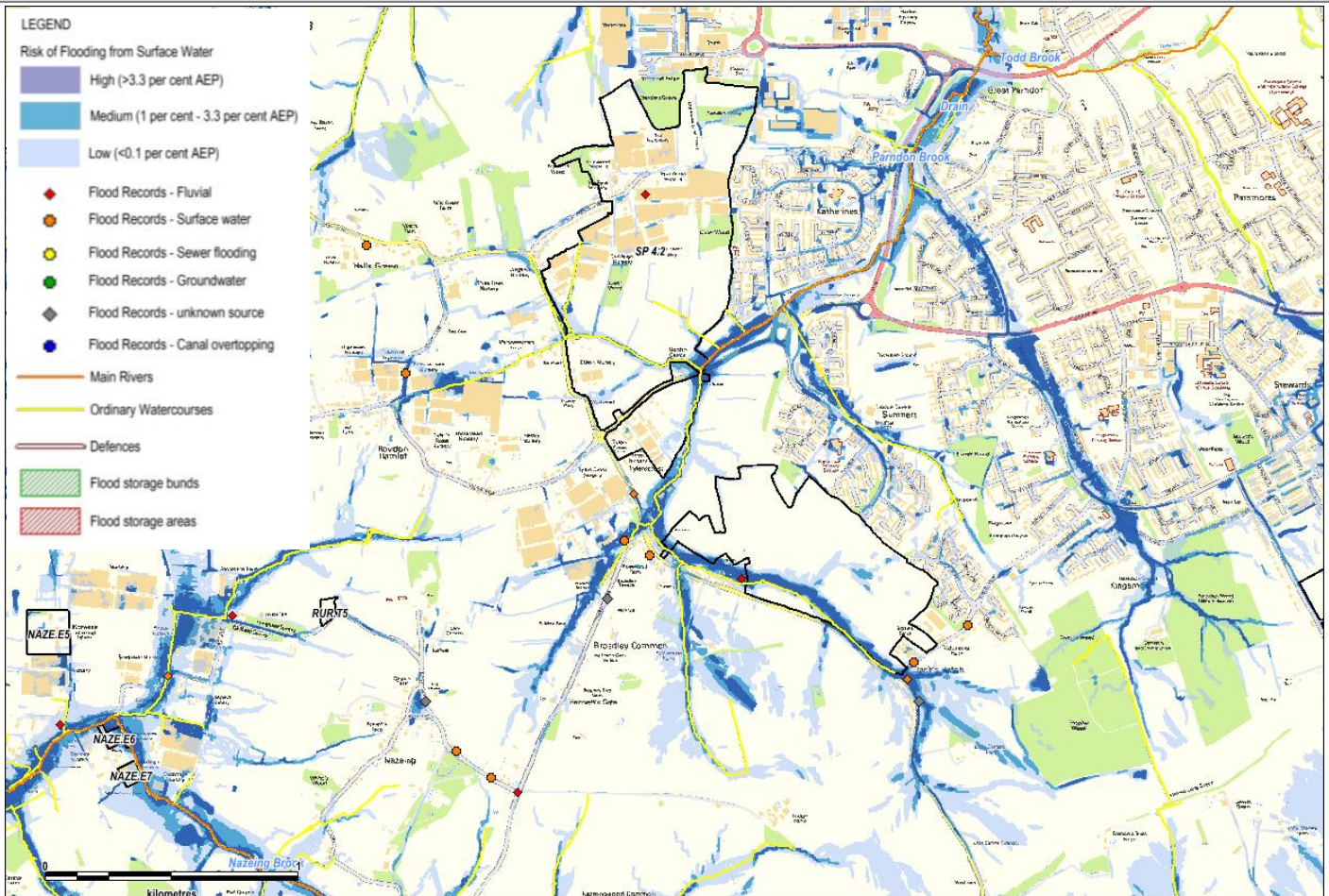
Surface Water Flood Risk

Risk of Flooding from Surface Water (RoFSW)

The RoFSW mapping indicates that the vast majority of this site is not at risk of flooding from surface water. There are a number of low to medium risk flow pathways located within the two northern parcels of land, however the region with the greatest surface water flood risk is that of the southernmost parcel of land. Flowing north-west along the southern border of this site lies a high risk flow pathway (approximately 50m wide) which often crosses into the site. Associated with this high risk flow pathway are other flow pathways which diverge from the central pathway. The majority of these are of low to medium risk. All these flow paths should be considered carefully in the development of the site layout to ensure that new development is not placed at surface water flood risk, and that the position of any new development does not divert the flow path to a neighbouring area.

There have been 8 reported incident of surface water flooding within 1km of the site.

Site Assessment Summary – SP 4.2 Water Lane Area



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Figure C Risk of Flooding from Surface Water (RoFSW)

Geology:

The underlying geology is London Clay formation. This type of geology comprises clay, silt and sand and is typically not very permeable, resulting in rapid runoff of surface water across the ground surface. Overlying this is a layer of Lowestoft Formation, this also comprises of sands, gravels, silts and clays.

Groundwater Flood Risk

The ASTGWF mapping (also presented in the Level 1 SFRA, Appendix B Figure 9) indicates that the site lies within a region which has a low susceptibility to groundwater flooding (<25%). The risk of groundwater flooding in this area is therefore generally considered to be low. This will need to be confirmed during site investigation survey.

Other Sources

The Environment Agency ‘Risk of Flooding from Reservoirs’ mapping indicates that the site is not at risk from flooding due to reservoir failure.

Site Specific Recommendations

Fluvial Modelling

As part of a site specific FRA for this site at the planning application stage, additional hydraulic modelling will be required to determine the risk of flooding associated with the Parndon Brook and the network of Ordinary Watercourses. The modelling should compare a range of probability events to determine the impact of climate change on the risk of flooding at this location. The 1% AEP (1 in 100 year) flood event including the Higher Central (35%) and Upper End (70%) allowance are of relevance to the proposed More Vulnerable development. The modelling will also need to address any potential impact the proposed development may have on flood risk to the surrounding area.

Site Layout and Design

A sequential approach to site layout should be applied, whereby sensitive elements of the development are directed towards areas of lowest flood risk. Development should not be permitted in areas of Flood Zone 3b Functional Floodplain. Residential development should be avoided in areas defined as risk of surface water flooding; instead lower vulnerability uses including landscaped open space should be located here.

Site Assessment Summary – SP 4.2 Water Lane Area

The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of SuDS, taking care to consider SuDS features in accordance with the hierarchy of SuDS (i.e. considering infiltration measures first wherever possible). The suitability of locating proposed surface water drainage features within the fluvial floodplain must be considered, as they may be rendered ineffective during times of fluvial flooding.

Set-back Distance

Development should be set back at least 8m from the Parndon Brook Main River. The Environment Agency will need to be consulted and an Environmental Permit obtained for any works within 8m of the watercourse.

Any work affecting the ordinary watercourses may require consent under Section 23 Land Drainage Act (1991) from Essex County Council as the Lead Local Flood Authority (LLFA). Essex CC should therefore be consulted early in the site planning process.

Finished Floor Levels

Finished floor levels should be set at least 300mm freeboard above the flood level for 1% AEP event including an appropriate allowance for climate change. In this case, for More Vulnerable development in Flood Zone 3a, the higher central (35%) climate change allowance should be used and should be tested against the upper end (70%) climate change allowance also.

Floodplain Compensation

Land raising and any built development should be avoided within Flood Zone 3. Where alterations to the floodplain are proposed, compensatory floodplain storage will need to be provided on a level-for-level and volume-for-volume basis with respect to the 1% AEP (1 in 100 year) design event, including an allowance for climate change. The land used to provide compensation storage will need to be in hydraulic connectivity with the existing floodplain, but not already part of the floodplain.

Access / Egress

It will be necessary to consider whether safe dry access to and from the site can be achieved. There are many access/egress routes to and from the site. Due to Water Lane crossing Parndon Brook, and passing through the associated Flood Zone 3a, this route may need to be avoided.

Safe Refuge

Given the proximity to the ordinary watercourse and the potential for the access / egress route to be affected by flooding, internal access should be provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. An area of safe refuge should be located above the 1% AEP fluvial flood level including an allowance for climate change. This refuge will have to be permanent and accessible to all occupants and users of the site.

Resilience Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. Guidance on resilience measures can be found in the 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' published by The Department for Communities and Local Government (CLG).

Emergency Planning

The site is not shown to be within an Environment Agency Flood Warning Area. Site occupants should register to receive the warning service further down the catchment associated with the Canons Brook at Harlow FWA. Due to the network of watercourses in the area, Flood Response Plans may need to be prepared by future occupants of the site.

LLFA Consultation

It is recommended that potential developers contact Essex CC as the LLFA for further information prior to taking forward site specific plans.

Summary

Based on the strategic assessment of flood risk and the recommendations for mitigation measures set out above, it is considered that proposed development on this site could be suitably designed to satisfy part ii) of the Exception Test subject to the submission of a detailed site specific FRA at the master planning and planning application stage.

Site Assessment Summary – SP 4.3 East of Harlow

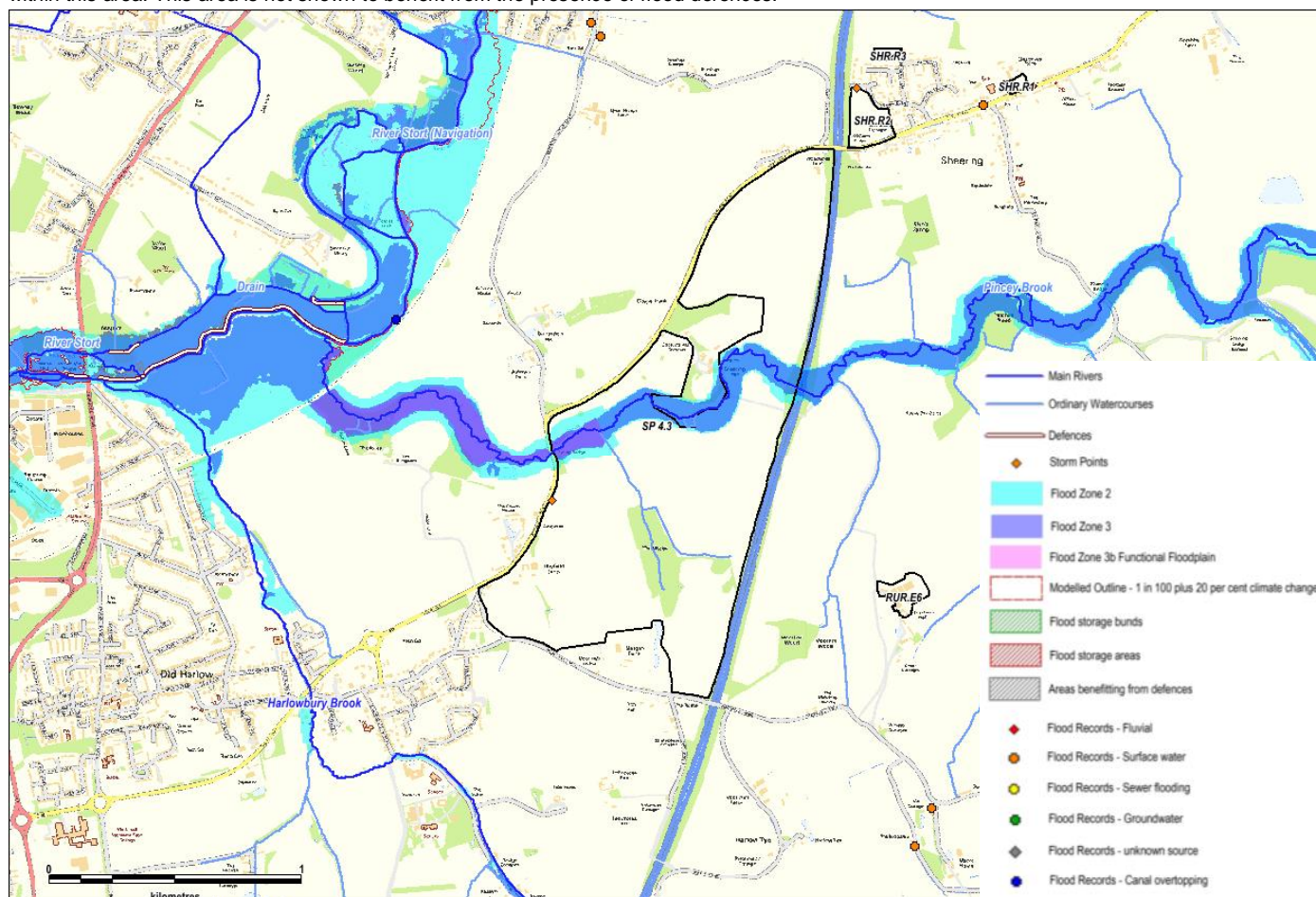
Allocation Reference: SP 4.3	Address: North of Church Langley and South of Sheering Road, Harlow, Essex, CM17 0NG	Area (ha): 128.2	Proposed Use: Residential	Vulnerability Classification: More Vulnerable
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Fluvial Flood Risk

Flood Zone 1: 90%	Flood Zone 2: 3%	Flood Zone 3a: 6%	Flood Zone 3b: 1%
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Flood Zones and Flood Defences

The majority of the site (90%) is designated as Flood Zone 1; however a band of Flood Zone 3a, approximately 100m wide, meanders through the centre of the site. This is a result of the Pincey Brook passing through the site. In the west of the site, this region of Flood Zone 3a is replaced by a region of Flood Zone 3b. Flood Zone 3b is defined as land where water has to be stored in times of flood. It is not appropriate to locate development within this area. This area is not shown to benefit from the presence of flood defences.



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Figure A Flood Map for Planning (Rivers and Sea)

Historic Records

The Environment Agency Historic Flood Map records one incident of fluvial flooding within this area, this took place in December 2000.

Climate Change

In accordance with the PPG, for Less Vulnerable development proposed in Flood Zone 3, the Higher Central (35%) and Upper End (70%) climate change allowances should be considered. Pincey Brook is a tributary of the Stort; however no modelling is currently available for this watercourse and therefore analysis of the stage-discharge relationship has not been possible.

In the absence of available model data, the LiDAR topographic survey data has been obtained for the site. In order to provide a high level conservative indication of the area that could be susceptible to flooding in the future as a result of climate change, the topography along the extent of Flood Zone 2 has been reviewed, and a buffer zone has been established to show the area that would be inundated with flood levels at 1m greater than the Flood Zone 2 extent. This is a very conservative approach, but enables an understanding of the local floodplain and the area that could be impacted when considering a large flood event. The LiDAR topography data and buffer zone is shown in Figure B. It shows a zone of varying width, approximately 10-20m along the edge of Flood Zone 2.

Site Assessment Summary – SP 4.3 East of Harlow



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Figure B LiDAR Topography and Proxy Climate Change Buffer Zone

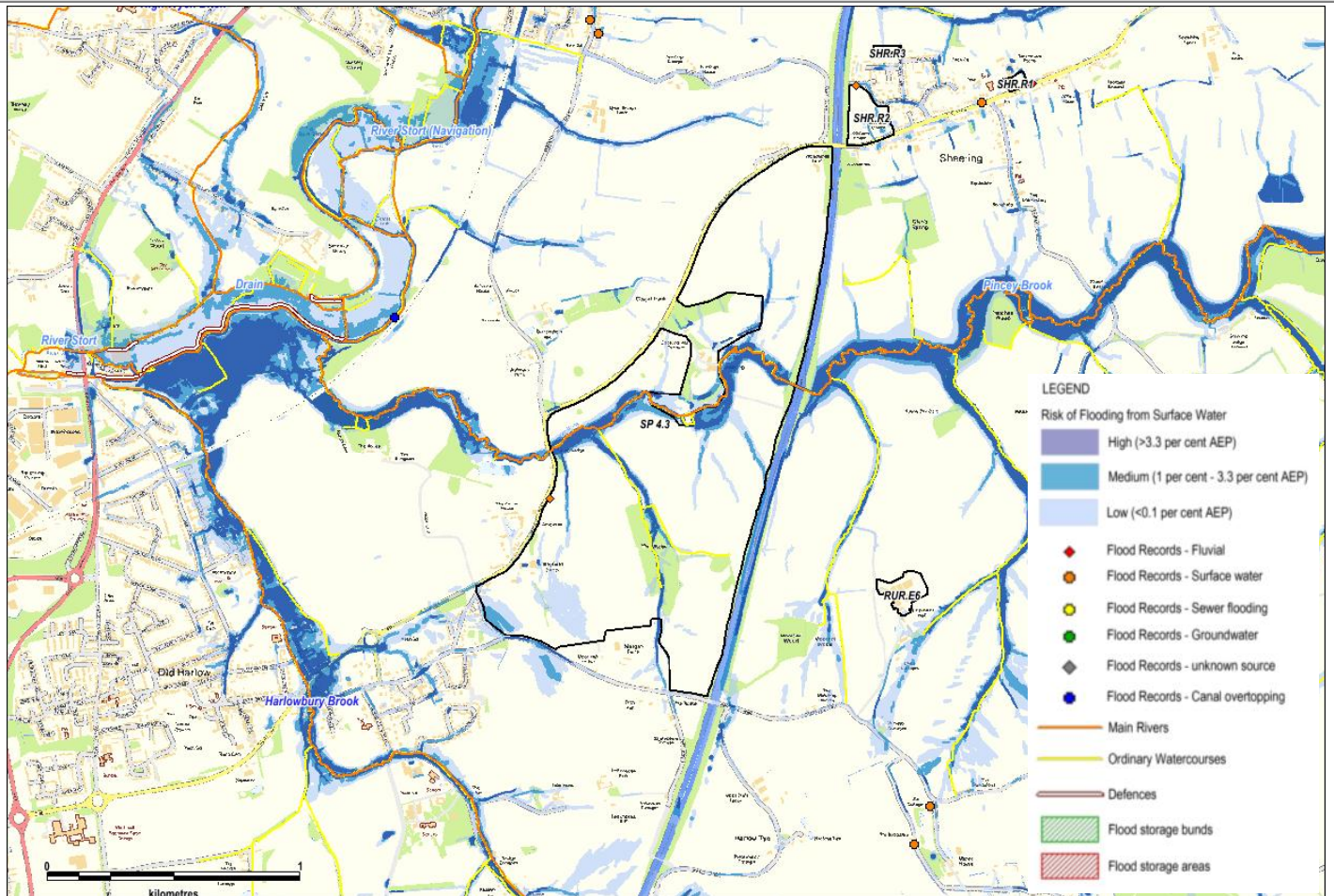
Surface Water Flood Risk

Risk of Flooding from Surface Water (RoFSW)

The RoFSW mapping indicates that a large part of this site is not at risk of flooding from surface water. Meandering through the centre of the site is high risk flow pathway, with pathways of lower risk diverging from the high risk pathway along its reach. These lower risk pathways extend throughout the site. All these flow paths should be considered carefully in the development of the site layout to ensure that new development is not placed at surface water flood risk, and that the position of any new development does not divert the flow path to a neighbouring area. There are regions in the south-west which are susceptible to ponding. Much of the surrounding area, excluding that impacted by the central meandering flow path, is at little risk of surface water flooding.

There have been 8 reported incident of surface water flooding within 1km of the site, one of which occurring within the boundary of the site.

Site Assessment Summary – SP 4.3 East of Harlow



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Figure C Risk of Flooding from Surface Water (RoFSW)

Geology:

The underlying geology is London Clay formation. This type of geology comprises clay, silt and sand and is typically not very permeable, resulting in rapid runoff of surface water across the ground surface. Overlying this is a layer of Lowestoft Formation, this also comprises of sands, gravels, silts and clays.

Groundwater Flood Risk

The ASTGWF mapping (also presented in the Level 1 SFRA, Appendix B Figure 9) indicates that the majority of the site lies within a region which has a low susceptibility to groundwater flooding (<25%). The risk of groundwater flooding in this area is therefore generally considered to be low. However, the south-western most corner of the site lies in a region which has a medium susceptibility to groundwater flooding (>=25% <50%), whilst the south-eastern region of the site is in a region which is not thought to be susceptible. This information will need to be confirmed during site investigation survey.

Other Sources

The Environment Agency 'Risk of Flooding from Reservoirs' mapping indicates that the central region of the site, i.e. that which was previously identified as Flood Zone 3, is at risk from flooding due to reservoir failure. Given the regular inspection of these reservoirs in accordance with the Reservoirs Act 1975, flooding from reservoirs is considered to be a managed risk.

Site Specific Recommendations

Fluvial Modelling

As part of a site specific FRA for this site at the master planning stage, hydraulic modelling of the Pincey Brook and associated tributaries should be undertaken to determine the risk of flooding across the site. The modelling should compare a range of probability events to determine the impact of climate change on the risk of flooding at this location. The 1% AEP (1 in 100 year) flood event including the Higher Central (35%) and Upper End (70%) allowance are of relevance to the proposed More Vulnerable development type. The modelling will also need to address any potential impact the proposed development may have on flood risk to the surrounding area.

Site Assessment Summary – SP 4.3 East of Harlow

Site Layout and Design

Given the number of watercourses in the site, and their location across the centre of the site area and the existing access route, the potential to develop this site will be constrained. The provision of a road network to serve potential new development will be a key consideration early in the master planning of the site.

Development should not be located within Flood Zones 2 or 3, as set out in Policy SP5 of the Local Plan (Submission Version), Section H. (iv) of which states that: “No built development will be permitted on land within Flood Zone 2 and 3 as indicated on the Environment Agency maps”.

Development should not be permitted in areas of Flood Zone 3b Functional Floodplain in line with the NPPF. A sequential approach to site layout should be applied, whereby sensitive elements of the development are directed towards areas of lowest flood risk.

Residential development should be avoided in areas defined as risk of surface water flooding; instead lower vulnerability uses including landscaped open space should be located here.

The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of SuDS, taking care to consider SuDS features in accordance with the hierarchy of SuDS (i.e. considering infiltration measures first wherever possible). Policy SP5 of the Local Plan (Submission Version), Section H. (xvi) makes provision for “Measures to ensure the restriction of surface water run-off from the site into Pincey Brook to no more than existing rates”.

The suitability of locating proposed surface water drainage features within the fluvial floodplain must be considered, as they may be rendered ineffective during times of fluvial flooding.

Any work affecting the ordinary watercourses may require consent under Section 23 Land Drainage Act (1991) from Essex County Council as the Lead Local Flood Authority (LLFA). Essex CC should therefore be consulted early in the site planning process.

Set-back Distance

Development should be set back at least 8m from the Pincey Brook Main River. The Environment Agency will need to be consulted and an Environmental Permit obtained for any works within 8m of the watercourse.

Access / Egress

Given the number of watercourses in this area, the provision of safe dry access to and from all parts of the site will be a key consideration in the master planning of the whole site to demonstrate that new development and new access routes will not be adversely affected by flooding. There are several existing access/egress routes to and from the site. Due to Sheering Road crossing Pincey Brook, and passing through the associated Flood Zone 3a, there should be restrictions put in place on the use of this route. If located in the region north of where Sheering Lower Road meets Sheering Road then the preferred route is to exit the site travelling north along Sheering Road. If located in the region south of the Flood Zone 3a band the preferred route is to take the Sheering Road southbound.

The new road network serving the proposed site will need to be carefully designed to ensure that it is safe from flooding and does not increase the risk of flooding to the local area.

Finished Floor Levels

Finished floor levels should be set at least 300mm freeboard above the flood level for 1% AEP event including an appropriate allowance for climate change. In this case, for More Vulnerable development in Flood Zone 3a, the higher central (35%) climate change allowance should be used and should be tested against the upper end (70%) climate change allowance also.

Floodplain Compensation

Land raising and any built development should be avoided within Flood Zone 3. Where alterations to the floodplain are proposed, compensatory floodplain storage will need to be provided on a level-for-level and volume-for-volume basis with respect to the 1% AEP (1 in 100 year) design event, including an allowance for climate change. The land used to provide compensation storage will need to be in hydraulic connectivity with the existing floodplain, but not already part of the floodplain.

Safe Refuge

Given the proximity to the ordinary watercourse and the potential for the access / egress routes to be affected by flooding, internal access should be provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. An area of safe refuge should be located above the 1% AEP fluvial flood level including an allowance for climate change. This refuge will have to be permanent and accessible to all occupants and users of the site.

Resilience Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. Guidance on resilience measures can be found in the ‘Improving the Flood Performance of New Buildings, Flood Resilient Construction’ published by The Department for Communities and Local Government (CLG).

Emergency Planning

The site is shown to be within an Environment Agency Flood Warning Area, the Princey Brook near Sheering Flood warning area. Site occupants

Site Assessment Summary – SP 4.3 East of Harlow

should register to receive the warning service. Due to the proximity of parts of the site to watercourses, Flood Response Plans should be prepared by residents of the site.

LLFA Consultation

It is recommended that potential developers contact Essex CC as the LLFA for further information prior to taking forward site specific plans.

Summary

Based on the strategic assessment of flood risk and the recommendations for mitigation measures set out above, it is considered that proposed development on this site could be suitably designed to satisfy part ii) of the Exception Test subject to submission of a detailed site specific FRA at the master planning and planning application stage. However it is noted that given the significant constraints on the site with respect to flood risk, this is likely to have an impact on the layout and density of new development that can be safely delivered.

Site Assessment Summary – NWB.R3 Land south of Vicarage Lane

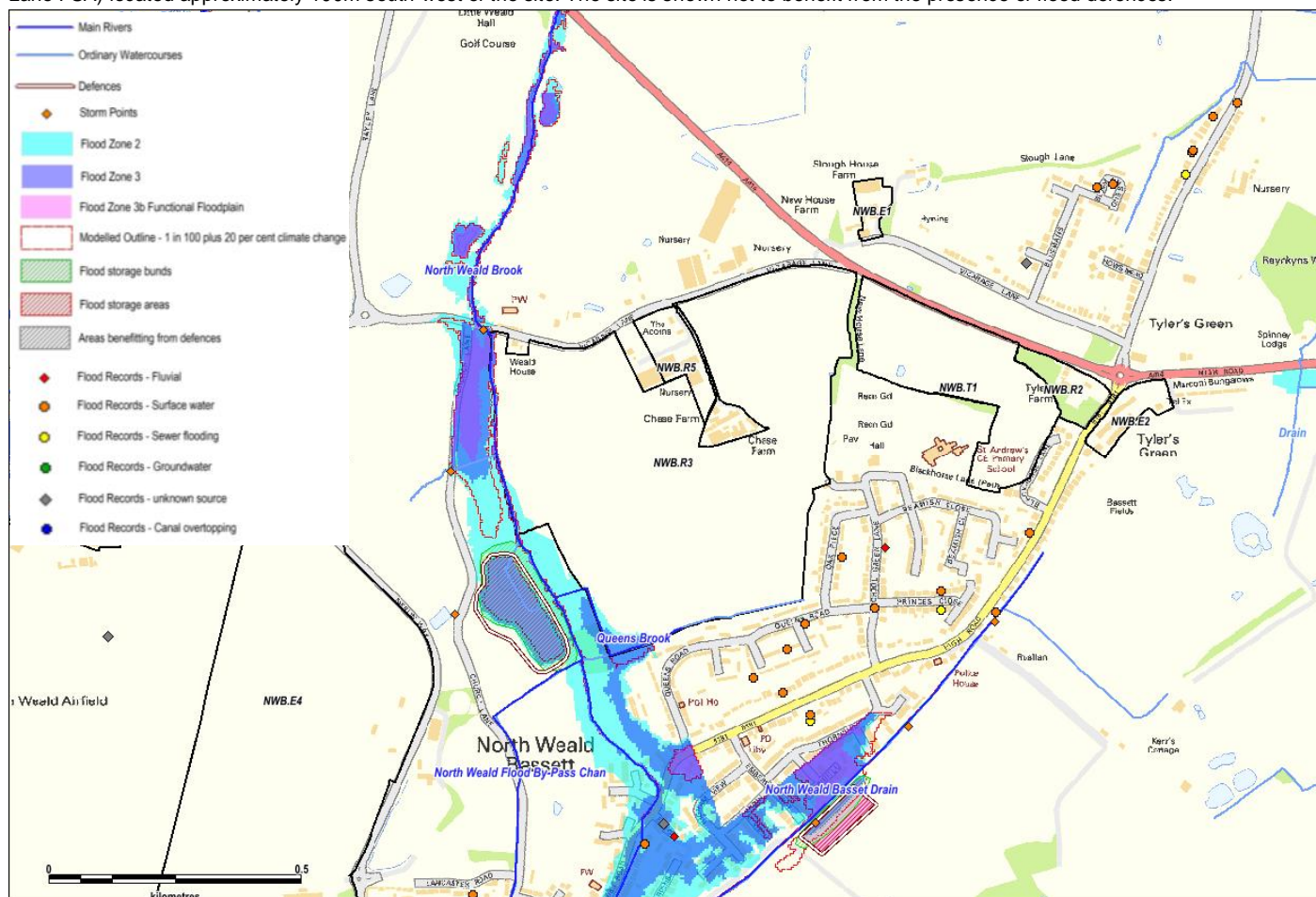
Allocation Reference: NWB.R3	Address: South of Vicarage Lane	Area (ha): 34.6	Proposed Use: Residential	Vulnerability Classification: More Vulnerable
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Fluvial Flood Risk

Flood Zone 1: 97%	Flood Zone 2: 1%	Flood Zone 3a: 1%	Flood Zone 3b: 1%
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Flood Zones and Flood Defences

The southern and western boundaries of this site are surrounded by main rivers: Queens Brook and North Weald Brook respectively, with a complex network of channels located south of the site. The majority of the site is designated as Flood Zone 1 (97%), however there are small regions of Flood Zones 2 (1%), 3a (1%) and 3b (1%) located within approximately 30m of the western border. Flood Zone 3b is defined as land where water has to be stored in times of flood. It is not appropriate to locate development within this area. There is a flood storage area (Church Lane FSA) located approximately 100m south-west of the site. The site is shown not to benefit from the presence of flood defences.



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Figure A Flood Map for Planning (Rivers and Sea)

Historic Records

The Environment Agency Historic Flood Map records one incident of fluvial flooding within this area, this occurred in December 1981. A further six fluvial flooding events have been recorded within 1km of the site, the majority of which occurred south of the site around Station Road Drain.

Climate Change

In accordance with the PPG, for More development proposed in Flood Zone 3, the Higher Central (35%) and Upper End (70%) climate change allowances should be considered. Analysis of the stage-discharge relationship along the North Weald Brook identifies that the 0.1% AEP (1 in 1000 year) flood level scenario, which corresponds to Flood Zone 2, is greater than the flood levels calculated for the Central and Higher Central climate change allowances, and equal to the interpolated flood event for the Upper End (the Upper End scenario is approximately 500mm greater than the 1000 year extent). The outline of Flood Zone 2 is therefore appropriate to use as a proxy when considering the impact of climate change on flood risk for this site and surrounding area.

Site Assessment Summary – NWB.R3 Land south of Vicarage Lane

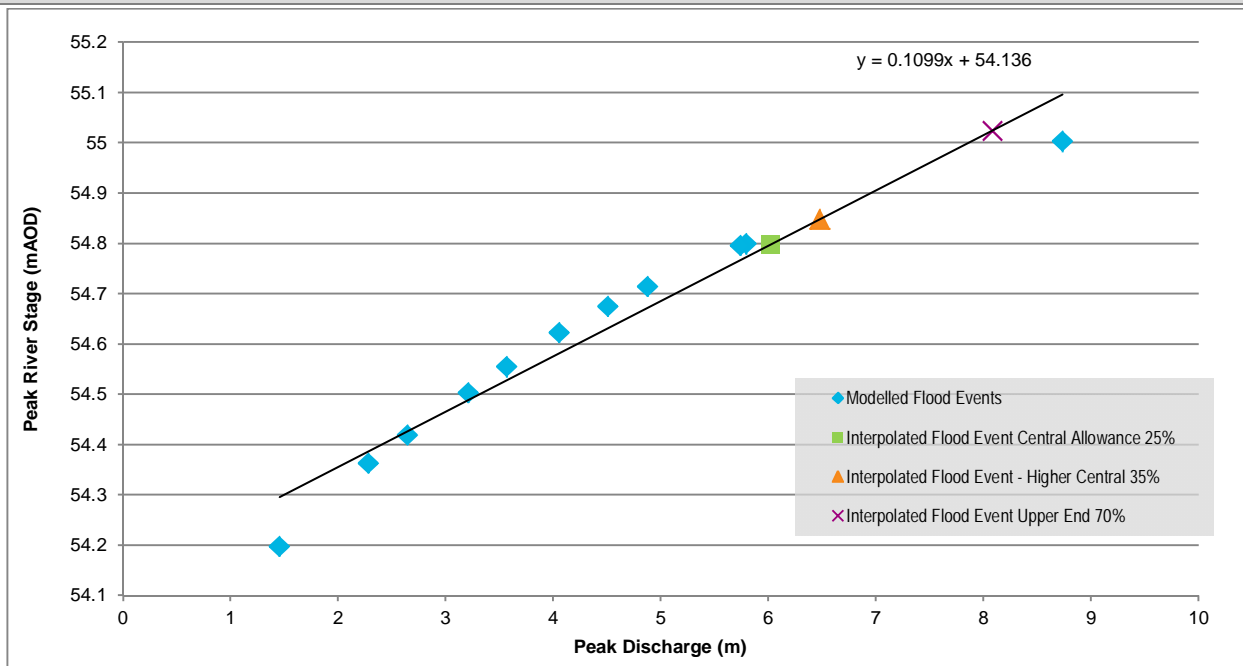


Figure B Stage-Discharge relationship at Node NWB005 of the Upper Roding Modelling Study 2016

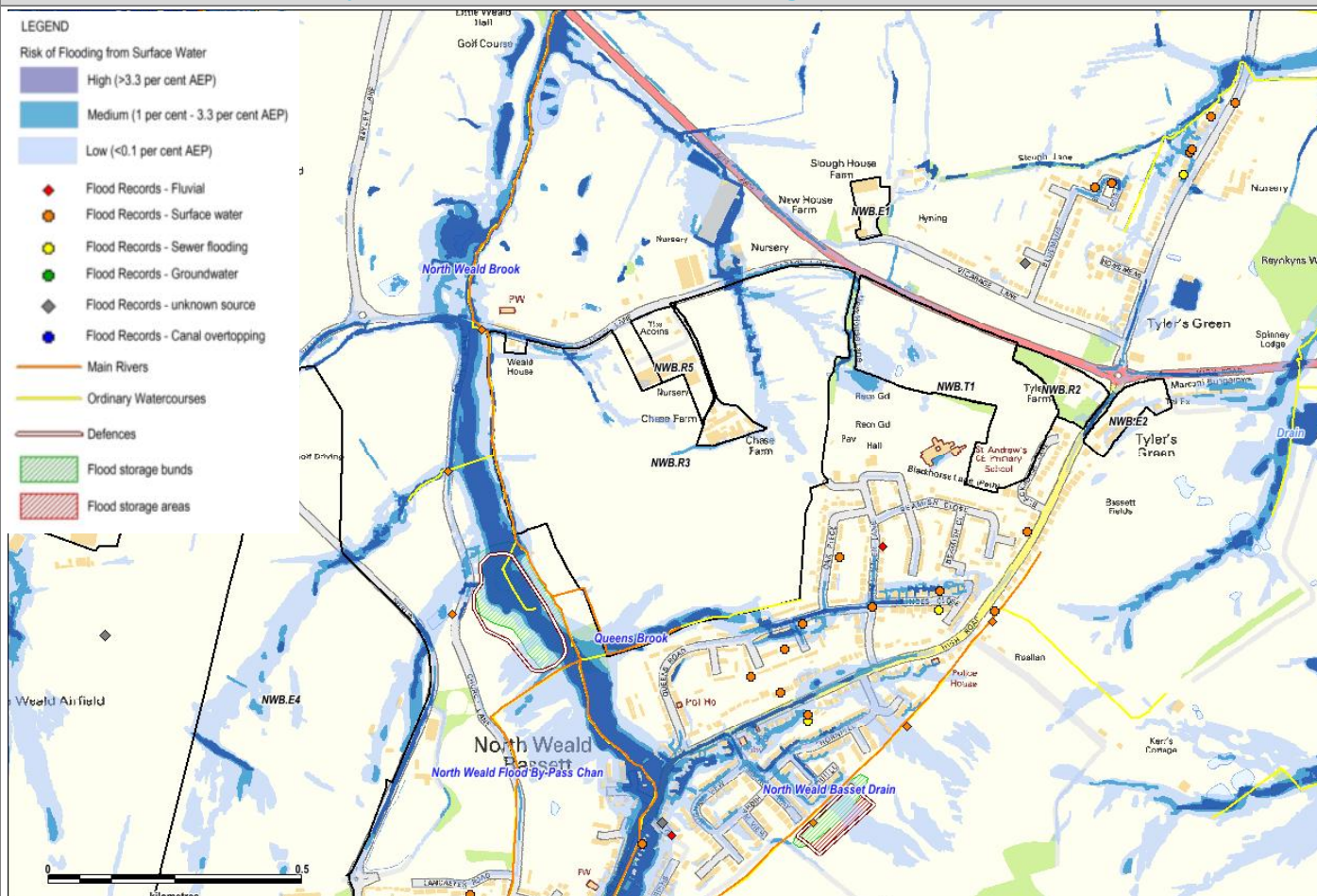
Surface Water Flood Risk

Risk of Flooding from Surface Water (RoFSW)

The RoFSW mapping indicates that a large proportion of this site is not at risk from surface water flooding, however, scattered through this site are flow paths of varying degrees of risk (low to high). Those of primary importance include those located in the north of the site which flow north towards Vicarage Lane West, with flood velocities potentially exceeding 0.25 m/s, however the flood depth expected to be less than 300mm. There are also high risk flow paths which travel along the southern and western boundaries of the site. These flow paths should be considered carefully in the development of the site layout to ensure that new development is not placed at surface water flood risk, and that the position of any new development does not divert the flow path to a neighbouring area.

There have been 32 reported incidents of surface water flooding within 1km of the site.

Site Assessment Summary – NWB.R3 Land south of Vicarage Lane



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Figure C Risk of Flooding from Surface Water (RoFSW)

Geology:

The underlying geology is London Clay formation. This type of geology comprises clay, silt and sand and is typically not very permeable, resulting in rapid runoff of surface water across the ground surface. Overlying this is a layer of Lowestoft Formation, this also comprises of sands, gravels, silts and clays.

Groundwater Flood Risk

The ASTGWF mapping (also presented in the Level 1 SFRA, Appendix B Figure 9) indicates that the site lies within a region which has a low susceptibility to groundwater flooding (<25%). The risk of groundwater flooding in this area is therefore generally considered to be low. This will need to be confirmed during site investigation survey.

Other Sources

The Environment Agency ‘Risk of Flooding from Reservoirs’ mapping indicates that the site is not at risk from flooding due to reservoirs.

Site Specific Recommendations

Fluvial Modelling

As part of a site specific FRA for this site, additional hydraulic modelling of the Queens Brook and North Weald Brook should be undertaken to compare a range of probability events to determine the impact of climate change on the risk of flooding at this location. The 1% AEP (1 in 100 year) flood event including the Higher Central (35%) and Upper End (70%) allowance are of relevance to the proposed More Vulnerable development type. The modelling may also need to address any potential impact the proposed development may have on flood risk to the surrounding area.

Set-back Distance

Development should be set back at least 8m from the Queens Brook and North Weald Brook. The Environment Agency will need to be consulted and an Environmental Permit obtained for any works within 8m of the watercourse.

Any work affecting the ordinary watercourses feeding into the Main Rivers may require consent under Section 23 Land Drainage Act (1991) from

Site Assessment Summary – NWB.R3 Land south of Vicarage Lane

Essex County Council as the Lead Local Flood Authority (LLFA). Essex CC should be consulted early in the site planning process.

Site Layout and Design

A sequential approach to site layout should be applied, whereby sensitive elements of the development are directed towards areas of lowest flood risk.

Residential development should be avoided in areas defined as risk of surface water flooding, such as the north east and southern edge of the site; instead lower vulnerability uses including landscaped open space should be located here.

The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of SuDS, taking care to consider SuDS features in accordance with the hierarchy of SuDS (i.e. considering infiltration measures first wherever possible). The suitability of locating proposed surface water drainage features within the fluvial floodplain must be considered, as they may be rendered ineffective during times of fluvial flooding.

Finished Floor Levels

Finished floor levels should be set at least 300mm freeboard above the flood level for 1% AEP event including an appropriate allowance for climate change. In this case, for More Vulnerable development in Flood Zone 3a, the higher central (35%) climate change allowance should be used and should be tested against the upper end (70%) climate change allowance also.

Floodplain Compensation

Land raising and any built development should be avoided within Flood Zone 3. Where alterations to the floodplain are proposed, compensatory floodplain storage will need to be provided on a level-for-level and volume-for-volume basis with respect to the 1% AEP (1 in 100 year) design event, including an allowance for climate change. The land used to provide compensation storage will need to be in hydraulic connectivity with the existing floodplain, but not already part of the floodplain.

Access / Egress

It will be necessary to consider whether safe dry access to and from the site can be achieved. The site is surrounded in the south and west by main watercourses and corresponding areas of Flood Zones 2 and 3b. The main access to the site is provided along Vicarage Lane and Church Lane, both of which pass over through regions of Flood Zones 2 and 3.

Safe Refuge

Given the proximity to the ordinary watercourse and the potential for the access / egress routes to be affected by flooding, internal access should be provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. An area of safe refuge should be located above the 1% AEP fluvial flood level including an allowance for climate change. This refuge will have to be permanent and accessible to all occupants and users of the site.

Resilience Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. Guidance on resilience measures can be found in the 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' published by The Department for Communities and Local Government (CLG).

Emergency Planning

The site is not identified to be within an Environment Agency Flood Warning Area. Site occupants should register to receive the warning service associated with the Cripsey Brook at Moreton FWA further down the catchment. Due to the proximity of parts of the site to watercourses, Flood Response Plans should be prepared by occupants of the site.

LLFA Consultation

It is recommended that potential developers contact Essex CC as the LLFA for further information prior to taking forward site specific plans.

Summary

Based on the strategic assessment of flood risk and the recommendations for mitigation measures set out above, it is considered that proposed development on this site could be suitably designed to satisfy part ii) of the Exception Test subject to submission of a detailed site specific FRA at the master planning and planning application stage.

Site Assessment Summary – LOU.R11 Land west of Roding Road

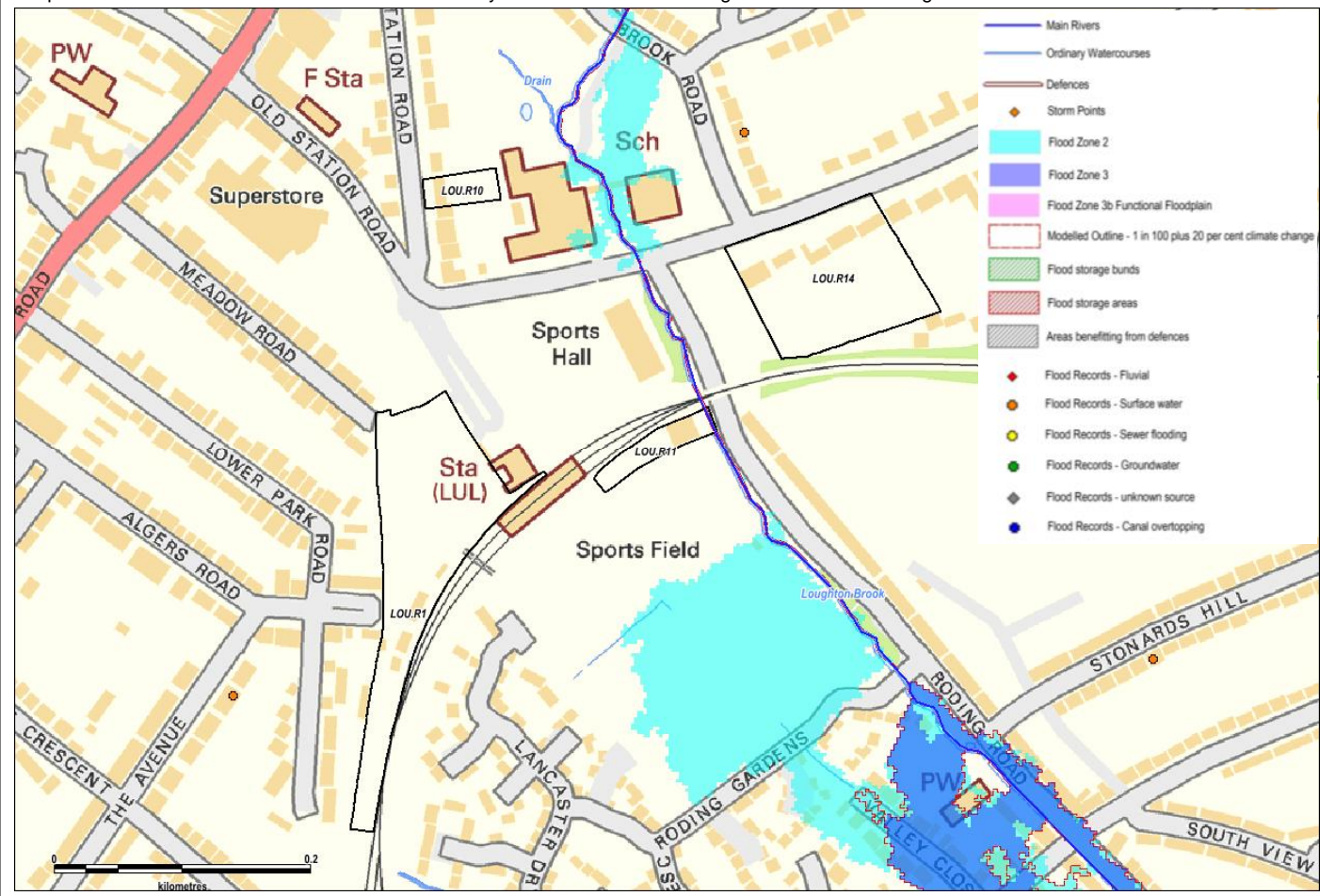
Allocation Reference: LOU.R11	Address: Roding Road, Loughton, IG10 3ED	Area (ha): 0.19	Proposed Use: Residential	Vulnerability Classification: More Vulnerable
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Fluvial Flood Risk

Flood Zone 1: 98%	Flood Zone 2: 0%	Flood Zone 3a: 0%	Flood Zone 3b: 2%
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Flood Zones and Flood Defences

Loughton Brook, a tributary of the Roding, runs through the north-eastern edge of the site. Associated with this river is a small region of Flood Zone 3b (2%) within this site. The Flood Zone 3b functional floodplain is defined as land where water has to be stored in times of flood. It is not appropriate to locate development within this area. The remaining 98% of the site is designated as Flood Zone 1. This area does not benefit from the presence of flood defences. There is also relatively little risk of fluvial flooding within the surrounding area of the site.



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Figure A Flood Map for Planning (Rivers and Sea)

Historic Records

The Environment Agency Historic Flood Map does not record any incidents of fluvial flooding within this area.

Climate Change

In accordance with the PPG, for More Vulnerable development proposed in Flood Zone 3b, development must not be permitted. Development must be set back from the functional floodplain. For More Vulnerable development proposed in Flood Zone 3 the Central (25%) and Higher Central (35%) climate change allowances should be considered. Loughton Brook is a tributary of the Middle Roding. The Middle Roding covers this watercourse, however the node file used for the stage-discharge analysis provided for the SFRA does not cover this watercourse and therefore analysis of the stage-discharge relationship has not been possible for this site.

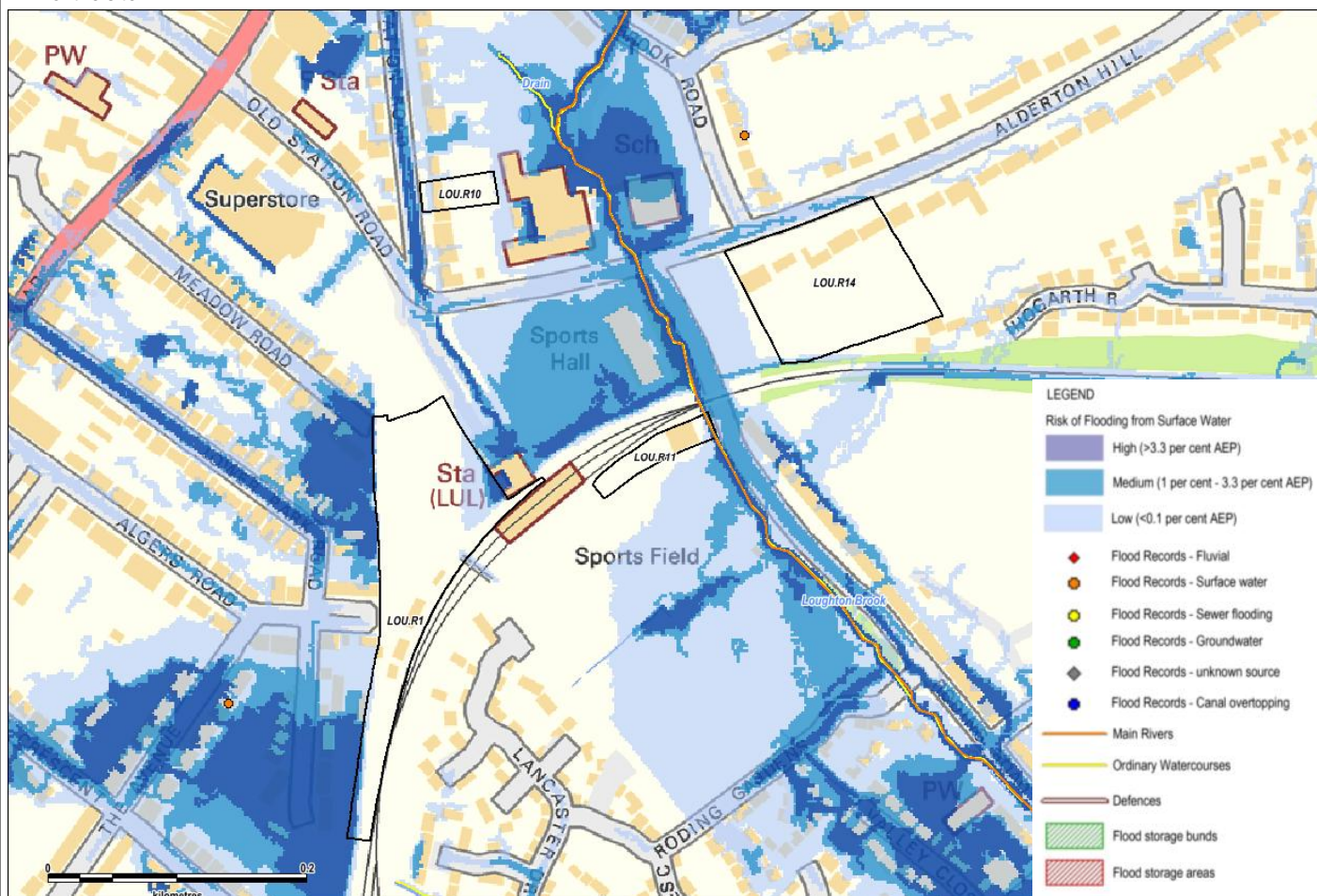
Surface Water Flood Risk

Risk of Flooding from Surface Water (RoFSW)

The RoFSW mapping indicates that the majority of the site is at minimal risk of surface water flooding. There is a high risk surface water flow path located adjacent to Loughton Brook. This flow path should be considered carefully in the development of the site layout to ensure that proposed

Site Assessment Summary – LOU.R11 Land west of Roding Road

development is not placed at surface water flood risk, and that the position of any new development does not divert the flow path to a neighbouring area. In contrast to the minimal risk of surface water flooding within the site, a large proportion of the surrounding area is at risk of surface water flooding, especially along Roding Road and Roding Gardens. There have been approximately 30 reported surface water flooding incidents within 1km of the site.



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Figure B Risk of Flooding from Surface Water (RoFSW)

Geology:

The underlying geology is London Clay formation. This type of geology comprises clay, silt and sand and is typically not very permeable, resulting in rapid runoff of surface water across the ground surface. Overlying this is a layer of Lowestoft Formation, this also comprises of sands, gravels, silts and clays. In contrast to the bedrock geology, which is typically not very permeable, the superficial deposits of alluvium contains sufficient, saturated permeable material to yield significant quantities of water to wells and springs, reducing the build-up of surface water across the ground surface.

Historic Records:

There has been one reported groundwater flooding incident within 1km of the site. This was located south-west of the site and occurred in May 2006.

Groundwater Flood Risk

The AS_tGWF mapping (also presented in the Level 1 SFRA, Appendix B Figure 9) indicates that this site has medium susceptibility to groundwater flooding.

Other Sources

The Environment Agency 'Risk of Flooding from Reservoirs' mapping indicates that the north of the site is at risk of flooding from reservoirs. Given the regular inspection of these reservoirs in accordance with the Reservoirs Act 1975, flooding from reservoirs is considered to be a managed risk.

Site Specific Recommendations

Fluvial Modelling

As part of a site specific FRA for this site, additional hydraulic modelling of the Loughton Brook should be undertaken to compare a range of

Site Assessment Summary – LOU.R11 Land west of Roding Road

probability events to determine the impact of climate change on the risk of flooding at this location. The 1% AEP (1 in 100 year) flood event including the Higher Central (35%) and Upper End (70%) allowance are of relevance to the proposed More Vulnerable development type. The modelling may also need to address any potential impact the proposed development may have on flood risk to the surrounding area.

Set-back Distance

Development should be set back at least 8m from the Loughton Brook. The Environment Agency will need to be consulted and an Environmental Permit obtained for any works within 8m of the watercourse.

Site Layout and Design

A sequential approach to site layout should be applied, whereby sensitive elements of the development are directed towards areas of lowest flood risk.

The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of SuDS, taking care to consider SuDS features in accordance with the hierarchy of SuDS (i.e. considering infiltration measures first wherever possible).

Finished Floor Levels

Finished floor levels should be set at least 300mm freeboard above the flood level for 1% AEP event including an appropriate allowance for climate change. In this case, for More Vulnerable development in Flood Zone 3a, the higher central (35%) climate change allowance should be used and should be tested against the upper end (70%) climate change allowance also.

Floodplain Compensation

Land raising and any built development should be avoided within Flood Zone 3. Where alterations to the floodplain are proposed, compensatory floodplain storage will need to be provided on a level-for-level and volume-for-volume basis with respect to the 1% AEP (1 in 100 year) design event, including an allowance for climate change. The land used to provide compensation storage will need to be in hydraulic connectivity with the existing floodplain, but not already part of the floodplain.

Access / Egress

It will be necessary to consider whether safe dry access to and from the site can be achieved. The site is located south of Loughton Brook and corresponding areas of Flood Zone 2 and 3b. The main access to the site is provided along Roding Road, which passes over Loughton Brook, and is also at high risk of surface water flooding.

Safe Refuge

Given the proximity to the ordinary watercourse and the potential for the access / egress routes to be affected by flooding, internal access should be provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. An area of safe refuge should be located above the 1% AEP fluvial flood level including an allowance for climate change. This refuge will have to be permanent and accessible to all occupants and users of the site.

Resilience Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. Guidance on resilience measures can be found in the 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' published by The Department for Communities and Local Government (CLG).

Emergency Planning

The site is not shown to be within an Environment Agency Flood Warning Area. Site occupants should register to receive the Upper River Roding Flood Alert warning service. Due to the proximity of parts of the site to watercourses, Flood Response Plans should be prepared by occupants of the site.

LLFA Consultation

It is recommended that potential developers contact Essex CC as the LLFA for further information prior to taking forward site specific plans.

Summary

Based on the strategic assessment of flood risk and the recommendations for mitigation measures set out above, it is considered that proposed development on this site could be suitably designed to satisfy part ii) of the Exception Test subject to submission of a detailed site specific FRA at the planning application stage.

3.3 Employment Sites

3.3.1 Table 3-2 provides an overview of the potential sites for employment use, including site reference and address, the proportion within each flood zone, and the nearest watercourse and availability of hydraulic modelling from the Environment Agency.

3.3.2 It is noted that employment sites are generally considered Less Vulnerable and therefore the formal application of the Exception Test is not required in accordance with the NPPF, as set out in Table 1-1. However it will still be necessary to consider the recommendations provided in each pro forma as part of a site specific FRA for the site at the planning application stage to ensure that future development on the site is safe and does not increase flood risk to the site or surrounding area.

Table 3-2 Potential Sites for Employment Use

Site Ref	Address	Flood Zone (%)			Watercourse	Modelling Availability
		FZ1	FZ2	FZ3		
LOU.E2	Langston Road Industrial Estate	91	8	1	Loughton Hall Farm Ditch, tributary of Roding.	Middle Roding (JBA 2012).
LSHR.E1	The Maltings	90	9	1	River Stort.	Stort (JBA 2015).
NAZE.E1	The Old Waterworks	0	53	47	Nazeing Drain, Lower Lee Navigation.	River Lee (CH2M Hill, 2014).
NAZE.E2	Land west of Sedge Green	42	58	0	Nazeing Drain	River Lee (CH2M Hill, 2014).
NAZE.E3	Bridge Works and Glassworks	0	19	81	Lower Lee Navigation	River Lee (CH2M Hill, 2014).
NAZE.E4	Hillgrove Business Park	0	66	24	Nazeing Drain	River Lee (CH2M Hill, 2014).
NAZE.E6	Millbrook Business Park	89	6	5	Nazeing Brook.	River Lee (CH2M Hill, 2014).
NAZE.E7	Land at Winston Farm	97	0	3	Nazeing Brook	River Lee (CH2M Hill, 2014).
THOR.E4	Weald Hall Lane Industrial Area	18	70	12	Cripsey Brook, tributary of Upper Roding.	Upper Roding (JBA 2016).
HONG.E1	Nash Hall Industrial Estate	98	1	1	Clattersford Brook, tributary of the Upper Roding.	Not included in the Upper Roding model (JBA 2016).
RUR.E17	Brookside Garage	99	0	1	Little London Brook, tributary of Middle Roding	Not included in the Middle Roding model (JBA 2012).
RUR.E20	Land at Stewarts Farm	39.4	60	0.4	Stanford Hall Brook	Upper Roding (JBA 2016).
RUR.E23	Hobbs Cross Business Centre	50	4	46	Brookhouse Brook	Not included in the Middle Roding model (JBA 2012).
WAL.E4	Cartersfield Road / Brooker Road	96	3	1	Cobbin's Brook	River Lee (CH2M Hill, 2014).
WAL.E5	Meridian Business Park and Sainsbury's Distribution Centre	75	19	6	Cobbin's Brook	River Lee (CH2M Hill, 2014).
WAL.E6	Galley Hill Road Industrial Estate	60	38.2	1.8	Cobbin's Brook	River Lee (CH2M Hill, 2014).
WAL.E8	Land north of A121	99.9	0.08	0.01	Quinton Hill Brook	River Lee (CH2M Hill, 2014).

Site Assessment Summary – LOU.E2 Langston Road Industrial Estate

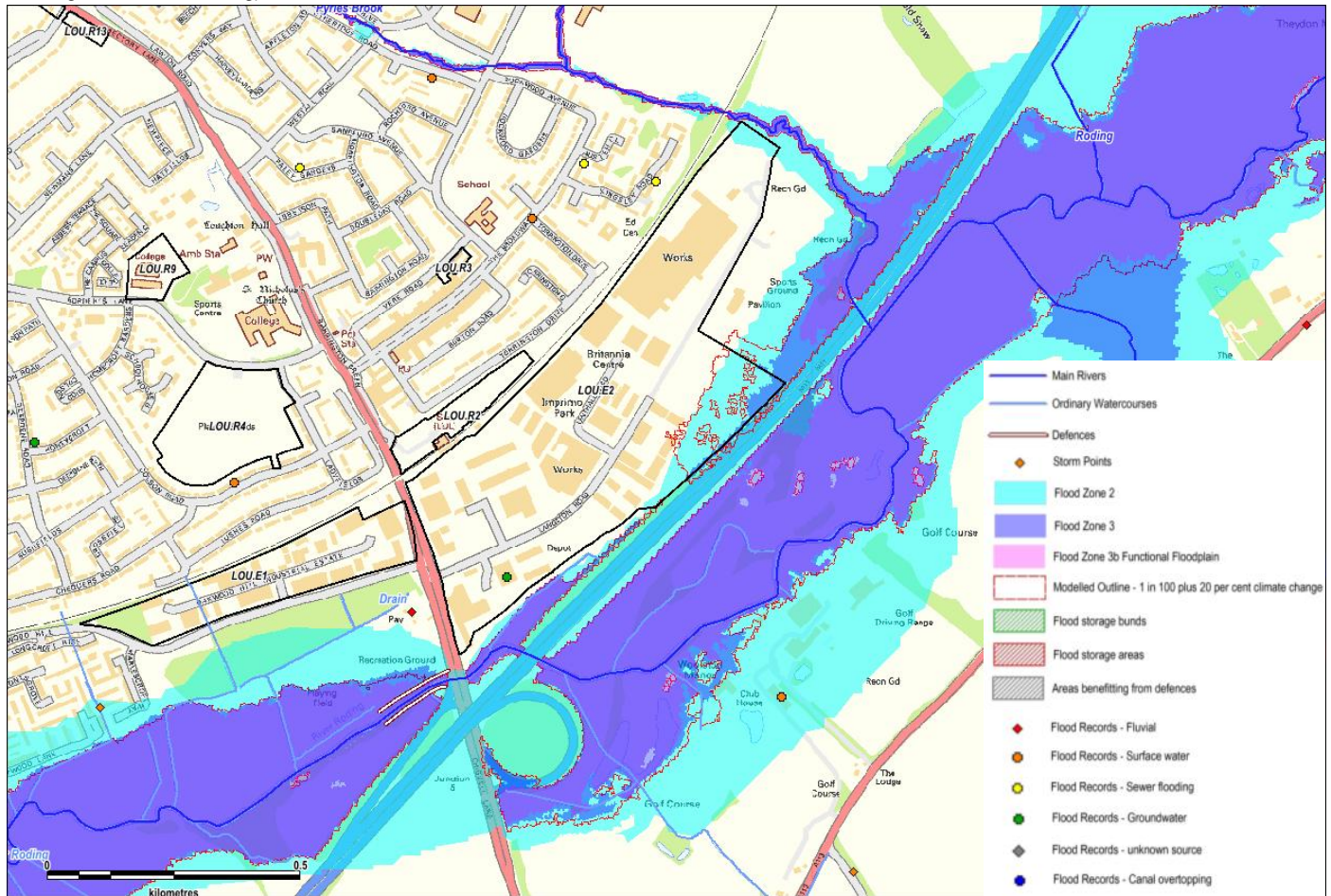
Allocation Reference: LOU.E2	Address: Loughton, IG10 3DQ	Area (ha): 29.78	Proposed Use: Employment	Vulnerability Classification: Less Vulnerable
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Fluvial Flood Risk

Flood Zone 1: 91%	Flood Zone 2: 8%	Flood Zone 3a: 1%	Flood Zone 3b: 0%
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Flood Zones and Flood Defences

The Loughton Hall Farm Ditch runs south-east alongside the northern border of the site. This main river joins the River Roding and then continues to flow south-west approximately 250m south-east of the site, on the other side of the M11. The M11 acts as a barrier to the flooding associated with the Roding River, resulting in the majority of the site (91%) being located in Flood Zone 1. The area does not, however, benefit from any formal flood defences. The areas of Flood Zone 2 are located in the north (associated with Loughton Hall Farm Ditch) and east of the site (linked with the flooding of the River Roding).



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Figure A Flood Map for Planning (Rivers and Sea)

Historic Records

The Environment Agency Historic Flood Map records fluvial flooding in this area during the flood event of September 1968. Within 1km of the site an additional 10 fluvial flooding incidents have been reported.

Climate Change

In accordance with the PPG, for Less Vulnerable development proposed in Flood Zone 3, the Central (25%) and Higher Central (35%) climate change allowances should be considered. Analysis of the stage-discharge relationship along the Loughton Hall Farm Ditch identifies that the 0.1% AEP (1 in 1000 year) flood scenario, which corresponds to Flood Zone 2, is greater than the flood levels calculated for the Central and Higher Central climate change allowances. The outline of Flood Zone 2 is therefore appropriate to use as a proxy when considering the impact of climate change on flood risk for this site and surrounding area.

Site Assessment Summary – LOU.E2 Langston Road Industrial Estate

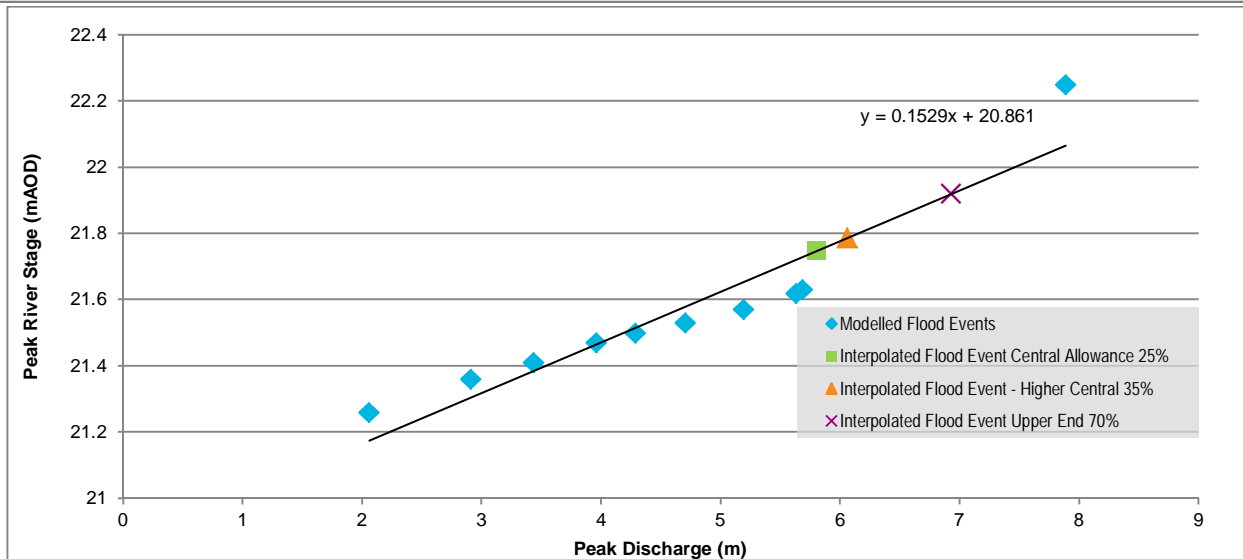


Figure B Stage-Discharge relationship at Node LD1.003 of the Middle Roding Modelling Study 2012

Surface Water Flood Risk

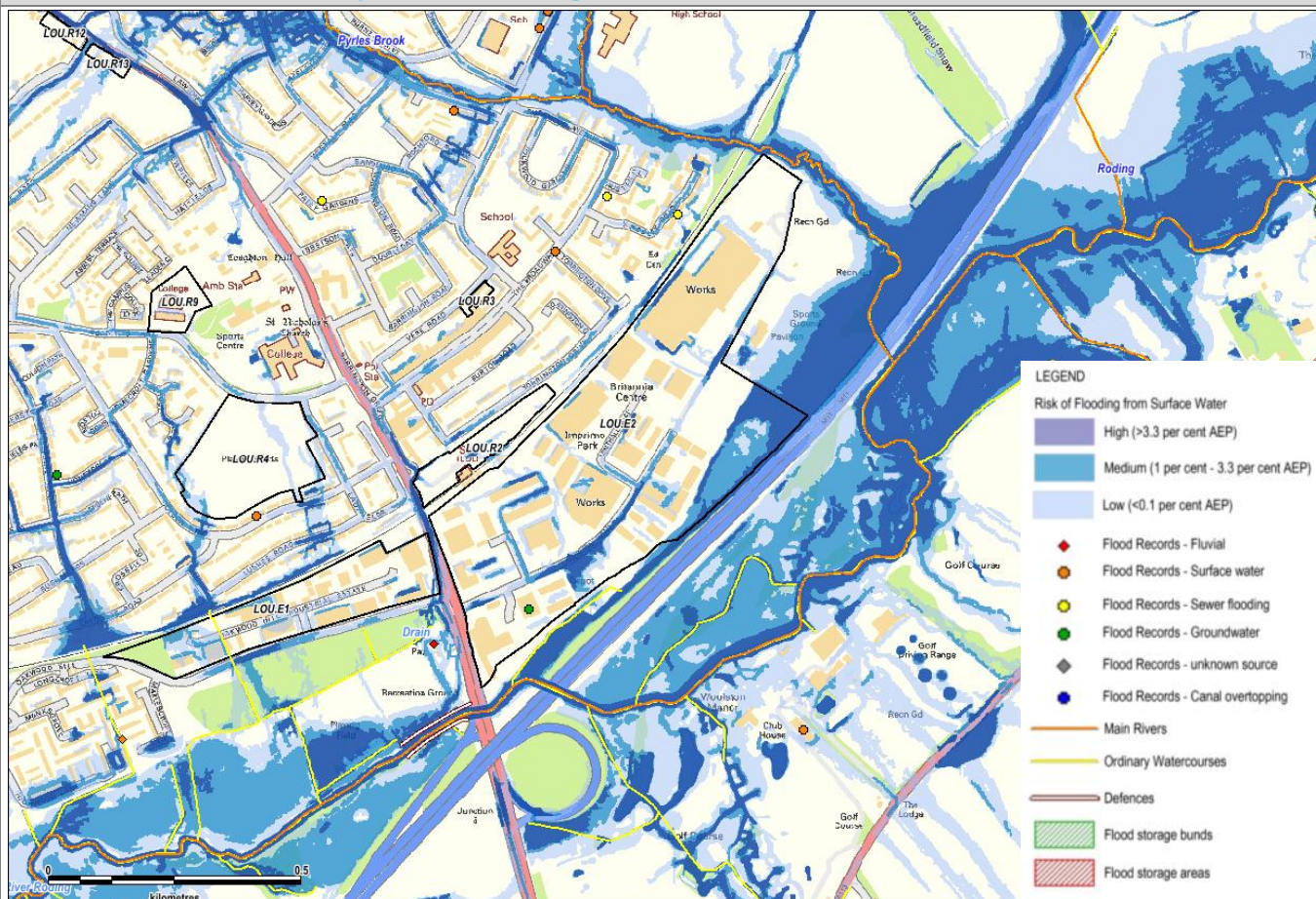
Risk of Flooding from Surface Water (RoFSW)

The RoFSW mapping indicates that the majority of the site is at minimal risk of surface water flooding. There is a large area of ponding in the east of the site, adjacent to the M11, where there is a Medium to High risk of surface water flooding. Located in the centre of this ponding is a small region at low risk of surface water flooding. In this area there is the potential for 'dry islands' to form during times of extensive surface water flooding.

There are also a number of high risk surface water flow paths located within this site, most notably that along Langston Road. This passes through the whole of the site with varying degrees of surface water flood risk, with the highest in the east and west, and the lowest in the centre of the site.

These flow paths should be considered carefully in the development of the site layout to ensure that proposed development is not placed at surface water flood risk, and that the position of any new development does not divert the flow path to a neighbouring area.

Site Assessment Summary – LOU.E2 Langston Road Industrial Estate



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Figure C Risk of Flooding from Surface Water (RoFSW)

Geology:

The underlying geology is London Clay formation. This type of geology comprises clay, silt and sand and is typically not very permeable, resulting in rapid runoff of surface water across the ground surface. Overlying this is a layer of Lowestoft Formation, this also comprises of sands, gravels, silts and clays. In contrast to the bedrock geology, which is typically not very permeable, the superficial deposits of alluvium contains sufficient, saturated permeable material to yield significant quantities of water to wells and springs, reducing the build-up of surface water across the ground surface.

Groundwater Flood Risk

The AS_tGWF mapping (also presented in the Level 1 SFRA, Appendix B Figure 9) indicates that the northern section of the site lies in a region of low susceptibility to groundwater flooding, with the southern region having a medium susceptibility. This will need to be confirmed during site investigation survey.

Historic Records:

There has been one reported groundwater flooding incident within the boundaries of the site, this was located in the south, adjacent to Langstone Road. A further historic groundwater flooding incident has been reported within 1km of the site. This was located east of the site and took place in August 2008.

Other Sources

The Environment Agency ‘Risk of Flooding from Reservoirs’ mapping indicates that the site is at risk of flooding in the event of a failure of a reservoir. However a small area to the north-east of the site, and a much greater area on the opposite side of the M11 are at risk of flooding if a failure were to occur with the reservoir located at Chigwell Row Water Works. If a failure were to occur flood depths in these regions may reach over 2m. Given the regular inspection of these reservoirs in accordance with the Reservoirs Act 1975, flooding from reservoirs is considered to be a managed risk.

Site Specific Recommendations

Fluvial Modelling

As part of a site specific FRA for this site at the planning application stage, additional hydraulic modelling will be required comparing a range of probability events to determine the impact of climate change on the risk of flooding at this location. The 1% AEP (1 in 100 year) flood event including the Central (25%) and Higher Central (35%) allowance are of relevance to the proposed Less Vulnerable development. The modelling will also need

Site Assessment Summary – LOU.E2 Langston Road Industrial Estate

to address any potential impact the proposed development may have on flood risk to the surrounding area.

Set-back Distance

Loughton Hall Farm Ditch is a Main River, and therefore all development should be set back at least 8m from the watercourse. The Environment Agency will need to be consulted and an Environmental Permit obtained for any works within 8m of the watercourse.

Finished Floor Levels

Given the proposed use is Less Vulnerable there is no requirement to raise finished floor levels.

Access / Egress

It will be necessary to consider whether safe dry access to and from the site can be achieved. The site is located north and west of two main rivers (River Roding and Loughton Hall Farm Ditch respectively) and corresponding areas of Flood Zone 2 and 3a. The main access to the site is provided along Chigwell Lane, which passes over the River Roding.

Safe Refuge

Given the proximity to the watercourse and the potential for the access / egress route to be affected by flooding, internal access should be provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. An area of safe refuge should be located above the 1% AEP fluvial flood level including an allowance for climate change. This refuge will have to be permanent and accessible to all occupants and users of the site.

Floodplain Compensation

Land raising and any built development should be avoided within Flood Zone 3. Where alterations to the floodplain are proposed, compensatory floodplain storage will need to be provided on a level-for-level and volume-for-volume basis with respect to the 1% AEP (1 in 100 year) design event, including an allowance for climate change. The land used to provide compensation storage will need to be in hydraulic connectivity with the existing floodplain, but not already part of the floodplain.

Site Layout and Design

The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of SuDS, taking care to consider SuDS features in accordance with the hierarchy of SuDS (i.e. considering infiltration measures first wherever possible). The suitability of locating proposed surface water drainage features within the fluvial floodplain, as they may be rendered ineffective during times of fluvial flooding.

Resilience Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. Guidance on resilience measures can be found in the 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' published by The Department for Communities and Local Government (CLG).

Emergency Planning

The site is shown to be within an Environment Agency Flood Warning Area, the River Roding at Abridge Flood Warning Area. Due to the proximity of the site to the watercourse, Flood Response Plans should be prepared by residents of the site.

LLFA Consultation

It is recommended that potential developers contact Essex County Council (CC) as the LLFA for further information prior to taking forward site specific plans.

Summary

The proposed development is classified as Less Vulnerable and therefore does not require the formal application of the Exception Test in accordance with the NPPF. The site specific recommendations set out above should be considered as part of a site specific FRA for the site, at the planning application stage, to ensure that future development on the site is safe and does not increase flood risk to the site or surrounding area.

Site Assessment Summary – LSHR.E1 The Maltings

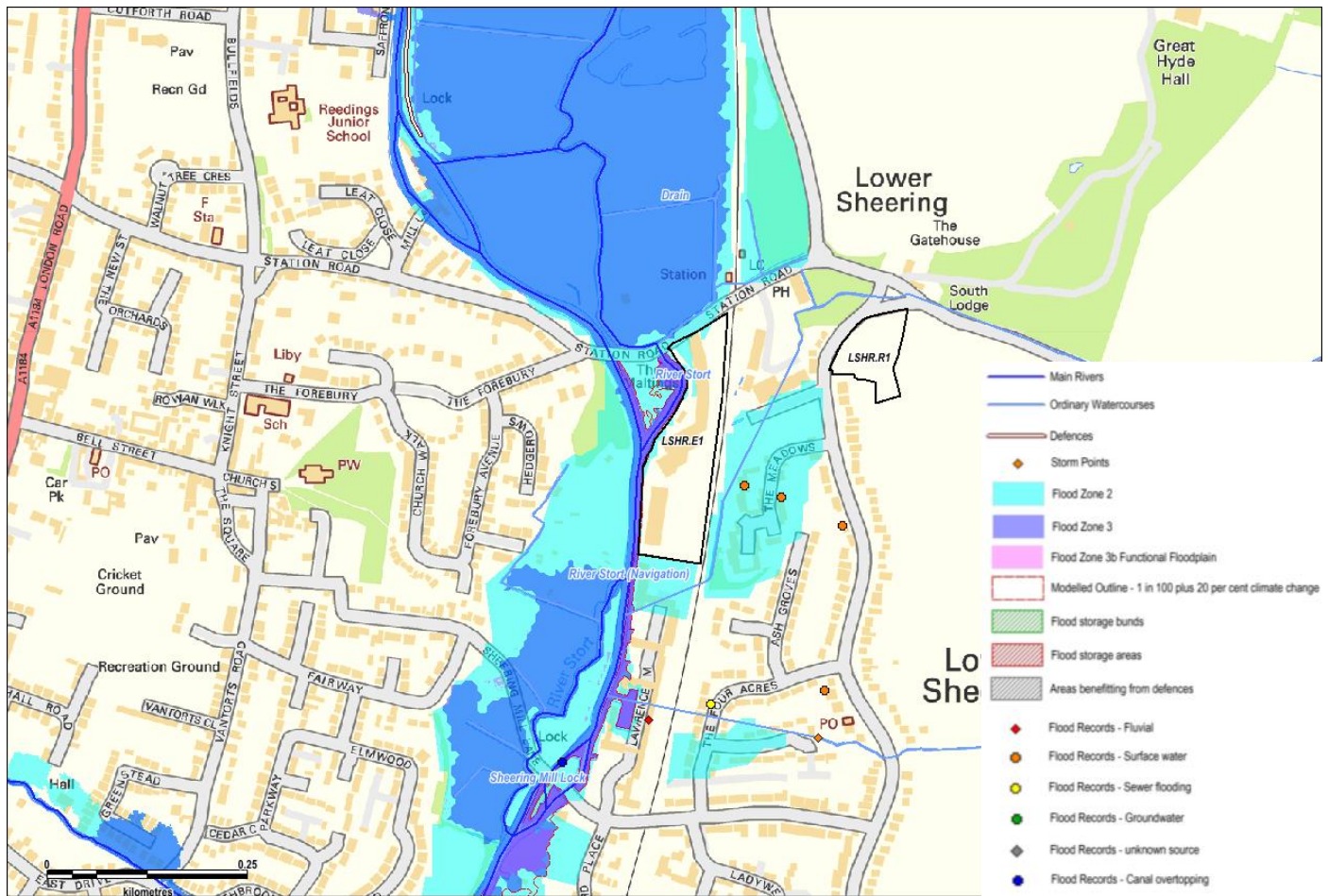
Allocation Reference: LSHR.E1	Address: Station Road, Sawbridgeworth, CM21 9JX	Area (ha): 2.06	Proposed Use: Employment	Vulnerability Classification: Less Vulnerable
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Fluvial Flood Risk

Flood Zone 1: 90%	Flood Zone 2: 9%	Flood Zone 3a: -%	Flood Zone 3b: 1%
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Flood Zones and Flood Defences

The River Stort and River Stort (Navigation) flow along the western boundary of the site. The majority of this site is designated Flood Zone 1, with small areas in the north and west of the site being designated Flood Zone 2 (9%). A thin (no more than 2m wide) band of the site, along the western boundary, lies within Flood Zone 3b. The Flood Zone 3b functional floodplain is defined as land where water has to be stored in times of flood. It is not appropriate to locate development within this area. The site is surrounded by land in both Flood Zones 2 and 3. This site does not benefit from flood defences



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Figure A Flood Map for Planning (Rivers and Sea)

Historic Records

The Environment Agency Historic Flood Map records fluvial flooding in this area during the flood event of October 2000. One additional fluvial flooding event has been recorded within 1km of the site. This was located south of the site and occurred in February 2009.

Climate Change

In accordance with the PPG, for Less Vulnerable development proposed in Flood Zone 3, the Central (25%) and Higher Central (35%) climate change allowances should be considered. Analysis of the stage-discharge relationship along the Lee Navigation identifies that the 0.1% AEP (1 in 1000 year) flood level scenario, which corresponds to Flood Zone 2, is greater than the flood levels calculated for the Central and Higher Central climate change allowances. The outline of Flood Zone 2 is therefore appropriate to use as a proxy when considering the impact of climate change on flood risk for this site and surrounding area.

Site Assessment Summary – LSHR.E1 The Maltings

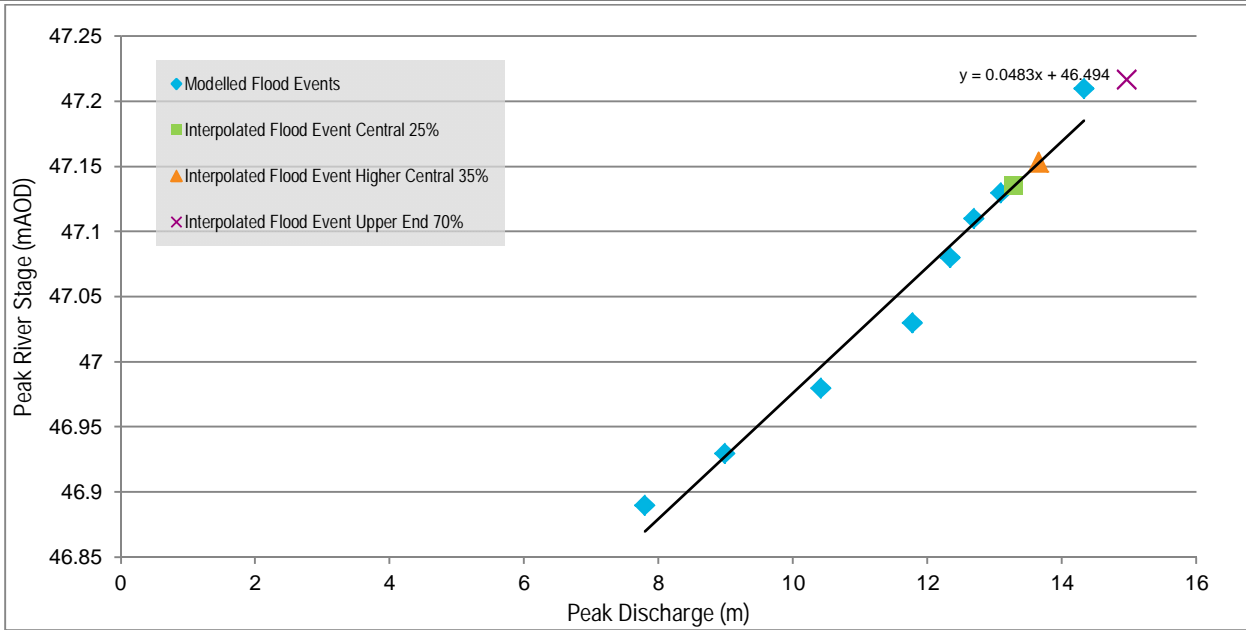


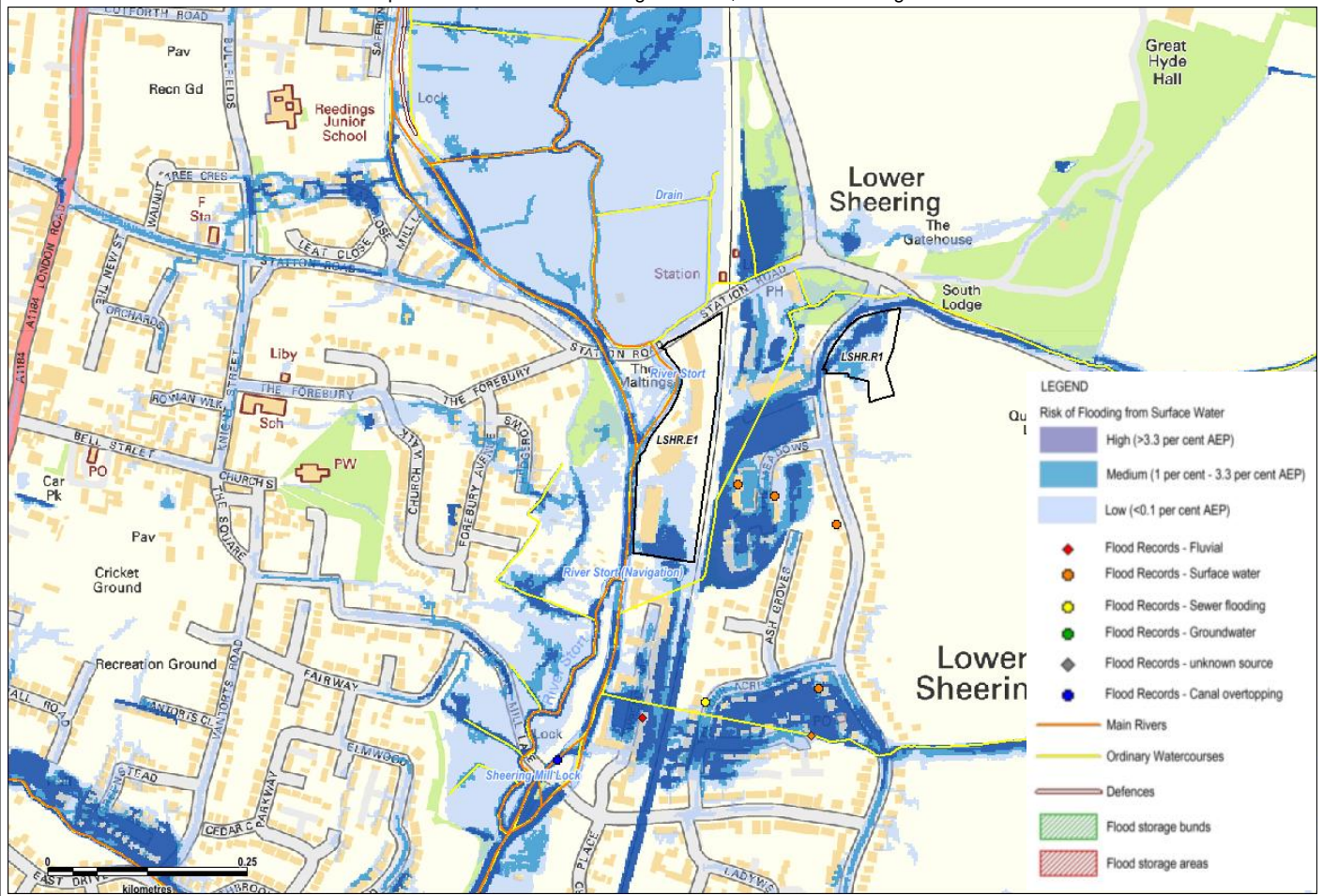
Figure B Stage-Discharge relationship at Node SA001 of the River Stort Modelling Study 2010

Surface Water Flood Risk

Risk of Flooding from Surface Water (RoFSW)

The RoFSW mapping indicates that the southern half of the site is at risk of surface water flooding, largely in the form of ponding, reaching over 900mm in depth in parts. The land surrounding the site is also at risk of surface water flooding, with the largest risk (high) located east of the site. It is not indicated that there are any confined flow paths located within this site.

Within 1km of the site there have been 7 reported surface water flooding incidents, all of which having occurred south-east of the site.



Site Assessment Summary – LSHR.E1 The Maltings

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Figure C Risk of Flooding from Surface Water (RoFSW)

Geology:

The underlying geology is comprised of Lewes Nodular Chalk formation and Seaford Chalk formation (undifferentiated), with superficial alluvium strata overlying this bedrock. The Chalk Group stratum is often very porous. The superficial deposits of alluvium contains sufficient, saturated permeable material to yield significant quantities of water to wells and springs, reducing the build-up of surface water across the ground surface.

Historic Records:

There have been no reported groundwater flooding incidents within 1km of the site.

Groundwater Flood Risk

The ASStGWF mapping (also presented in the Level 1 SFRA, Appendix B Figure 9) indicates that the majority of the site lies within a region which is has a medium susceptibility to groundwater flooding ($\geq 25\%$ $< 50\%$), however the north-eastern tip of the site lies in a region with a low susceptibility ($< 25\%$).

Other Sources

The Environment Agency 'Risk of Flooding from Reservoirs' mapping indicates that the site is not at risk from flooding due to reservoirs. Despite this, along the western boundary of the site lies a region which is at risk. Here the flood depth is expected to be 0.3-2m if a nearby reservoir were to fail. Given the regular inspection of these reservoirs in accordance with the Reservoirs Act 1975, flooding from reservoirs is considered to be a managed risk.

Site Specific Recommendations

Fluvial Modelling

As part of a site specific FRA for this site, additional hydraulic modelling will be required comparing a range of probability events to determine the impact of climate change on the risk of flooding at this location. The 1% AEP (1 in 100 year) flood event including the Central (25%) and Higher Central (35%) allowance are of relevance to the proposed Less Vulnerable development. The modelling will also need to address any potential impact the proposed development may have on flood risk to the surrounding area.

Set-back Distance

The River Stort is a main river, and therefore all development should be set back at least 8m from the watercourse. The Environment Agency will need to be consulted and an Environmental Permit obtained for any works within 8m of the watercourse.

Access / Egress

It will be necessary to consider whether safe dry access to and from the site can be achieved. The site is located east of the River Stort and corresponding areas of Flood Zone 2 and 3. The main access to the site is provided along Station Road, which passes over the River Stort and its associated floodplain.

Safe Refuge

Given the proximity to the watercourse and the potential for the access / egress route to be affected by flooding, internal access should be provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. An area of safe refuge should be located above the 1% AEP fluvial flood level including an allowance for climate change. This refuge will have to be permanent and accessible to all occupants and users of the site.

Floodplain Compensation

Land raising and any built development should be avoided within Flood Zone 3. Where alterations to the floodplain are proposed, compensatory floodplain storage will need to be provided on a level-for-level and volume-for-volume basis with respect to the 1% AEP (1 in 100 year) design event, including an allowance for climate change. The land used to provide compensation storage will need to be in hydraulic connectivity with the existing floodplain, but not already part of the floodplain.

Site Layout and Design

The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of SuDS, taking care to consider SuDS features in accordance with the hierarchy of SuDS (i.e. considering infiltration measures first wherever possible). The suitability of locating proposed surface water drainage features within the fluvial floodplain, as they may be rendered ineffective during times of fluvial flooding.

Finished Floor Levels

Given the proposed use is Less Vulnerable there is no requirement to raise finished floor levels.

Resilience Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. Guidance on resilience measures can be found in the 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' published by The

Site Assessment Summary – LSHR.E1 The Maltings

Department for Communities and Local Government (CLG).

Emergency Planning

The site is shown to be within an Environment Agency Flood Warning Area, the River Stort at Sawbridgeworth Flood Warning Area. Due to the proximity of the site to the watercourse, Flood Response Plans should be prepared by residents of the site.

LLFA Consultation

It is recommended that potential developers contact Essex CC as the LLFA for further information prior to taking forward site specific plans.

Summary

The proposed development is classified as Less Vulnerable and therefore does not require the formal application of the Exception Test in accordance with the NPPF. The site specific recommendations set out above should be considered as part of a site specific FRA for the site at the planning application stage, to ensure that future development on the site is safe and does not increase flood risk to the site or surrounding area.

Site Assessment Summary – NAZE.E1 The Old Waterworks

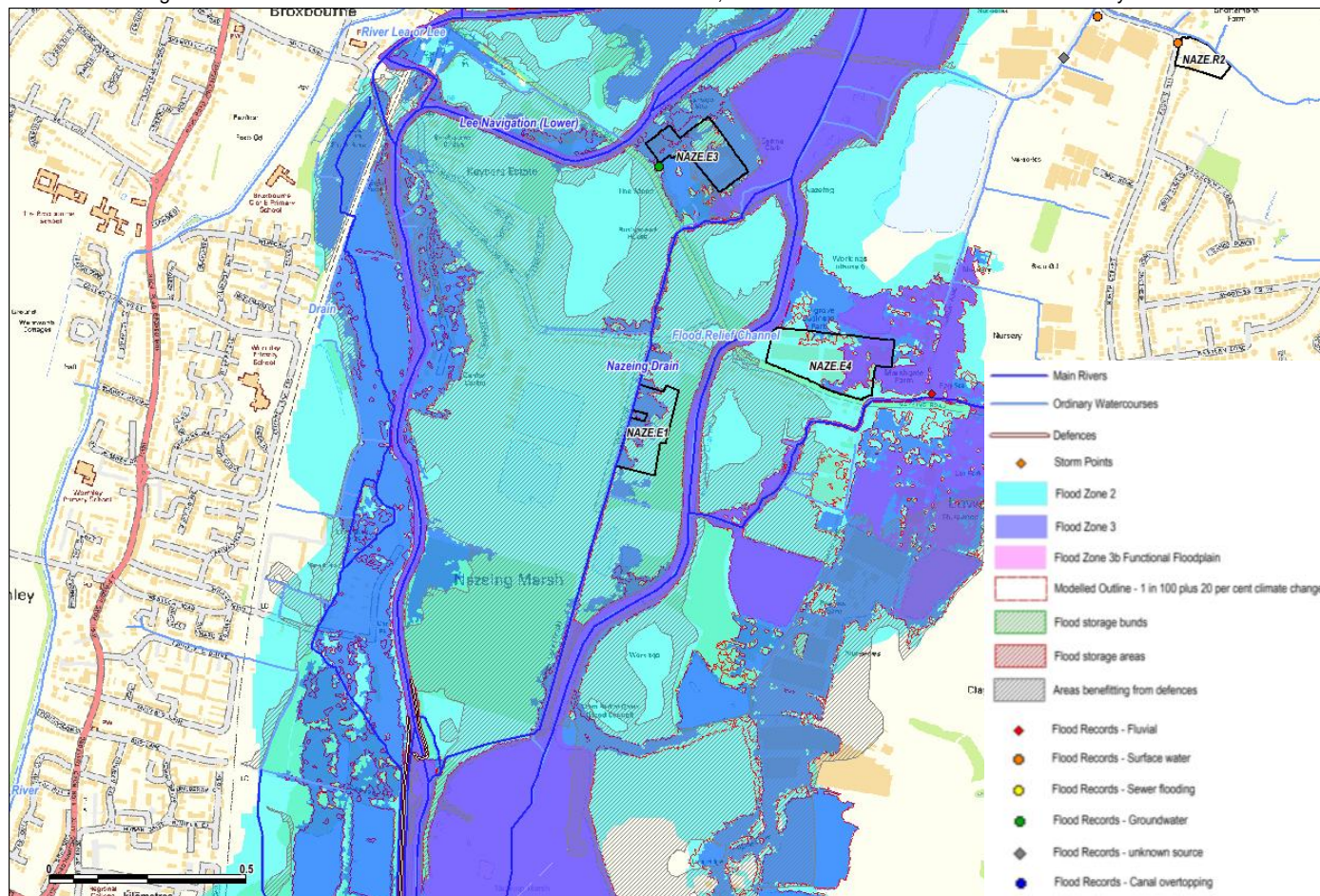
Allocation Reference: NAZE.E1	Address: Nazeing, EN10 6RS	Area (ha): 2.15	Proposed Use: Employment	Vulnerability Classification: Less Vulnerable
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Fluvial Flood Risk

Flood Zone 1: -%	Flood Zone 2: 53%	Flood Zone 3a: 43%	Flood Zone 3b: 4%
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Flood Zones and Flood Defences

The NAZE.E1 site is surrounded by a complex network of channels, with the Nazeing Drain flowing along the western perimeter of the site, in addition to east of the site. Approximately 600m west of the site lies the Lower River Lee (Navigation). The majority of the site is designated as Flood Zone 2 (53%), with the central and western regions of the site being primarily located in Flood Zone 3a (43%). A small area (4%) along the western boundary of the site lies within Flood Zone 3b. Flood Zone 3b is defined as land where water has to be stored in times of flood. It is not appropriate to locate development within this area. The site is shown to benefit from the presence of flood defences, namely the management of flood water through the flood relief channels. The flood risk is therefore residual, in the event of failure of the flood defence system.



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Figure A Flood Map for Planning (Rivers and Sea)

Historic Records

The Environment Agency Historic Flood Map records fluvial flooding in this area during the flood event of March 1947. One additional fluvial flooding event has been recorded within 1km of the site. This occurred west of the site in February 2009.

Climate Change

In accordance with the PPG, for Less Vulnerable development proposed in Flood Zone 3, the Central (25%) and Higher Central (35%) climate change allowances should be considered. Analysis of the stage-discharge relationship along the Nazeing Drain identifies that the 0.1% AEP (1 in 1000 year) flood level for the undefended model scenario, which corresponds to Flood Zone 2, is greater than the flood levels calculated for the Central and Higher Central climate change allowances. The outline of Flood Zone 2 is therefore appropriate to use as a proxy when considering the impact of climate change on flood risk for this site and surrounding area.

Site Assessment Summary – NAZE.E1 The Old Waterworks

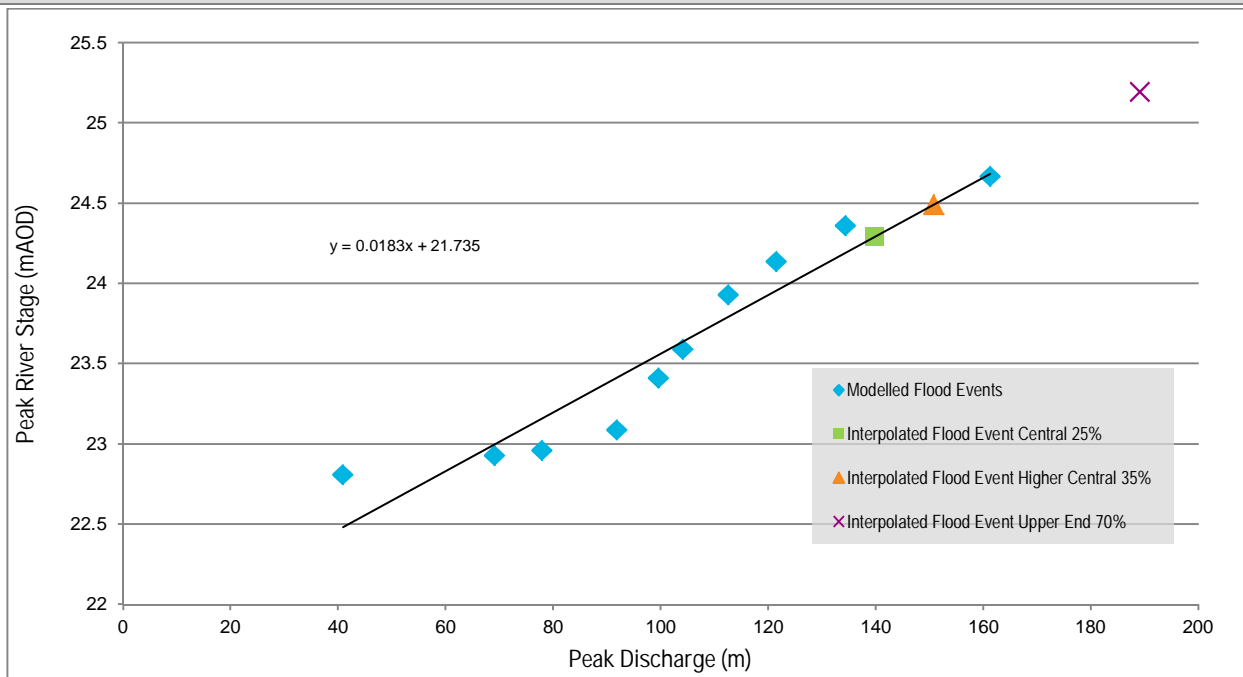


Figure B Stage-Discharge relationship at Node 1.036 of the River Lee Modelling Study 2014

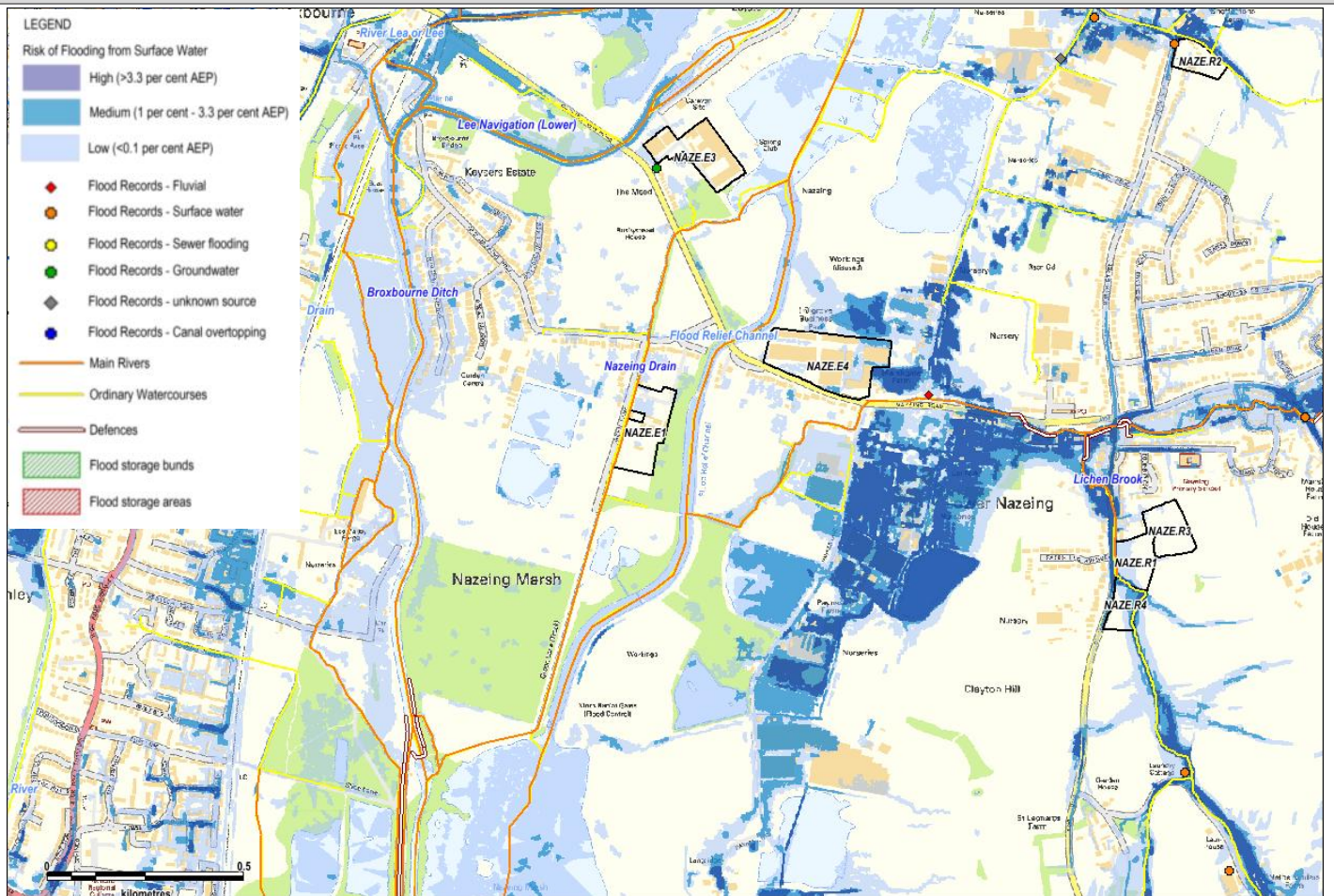
Surface Water Flood Risk

Risk of Flooding from Surface Water (RoFSW)

The RoFSW mapping indicates that the majority of this site is situated in a region which is not at risk of surface water flooding. There is an area which is at low risk of ponding south of an unnamed road (which runs off Old Nazeing Road). Along this road, in the north-west of the site, there is also a low risk surface water flow path, where the velocity of this flow path is not expected to exceed 0.25m/s. These flow paths should be considered carefully in the development of the site layout to ensure that proposed development is not placed at surface water flood risk, and that the position of any new development does not divert the flow path to a neighbouring area.

There are no reported incidents of surface water flooding within 1km of the site.

Site Assessment Summary – NAZE.E1 The Old Waterworks



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Figure C Risk of Flooding from Surface Water (RoFSW)

Geology:

The underlying geology is Lambeth Group, comprising gravels, sands, silts and clays. This bedrock geology is overlain by alluvium. In contrast to the bedrock geology, which is typically not very permeable, the superficial deposits contains sufficient, saturated permeable material to yield significant quantities of water to wells and springs, reducing the build-up of surface water across the ground surface.

Historic Records:

There has been no reported groundwater flooding incidents within 1km of the site.

Groundwater Flood Risk

The ASStGWF mapping (also presented in the Level 1 SFRA, Appendix B Figure 9) indicates that the site lies within a region which is has a very high susceptibility to groundwater flooding ($\geq 75\%$). The risk of groundwater flooding in this area is therefore generally considered to be very high. This will need to be confirmed during site investigation survey.

Other Sources

The Environment Agency ‘Risk of Flooding from Reservoirs’ mapping indicates that the site is not at risk from flooding due to reservoirs.

Site Specific Recommendations

Fluvial Modelling

As part of a site specific FRA for this site at the planning application stage, additional hydraulic modelling will be required comparing a range of probability events to determine the impact of climate change on the risk of flooding at this location. The 1% AEP (1 in 100 year) flood event including the Central (25%) and Higher Central (35%) allowance are of relevance to the proposed Less Vulnerable development. The modelling will also need to address any potential impact the proposed development may have on flood risk to the surrounding area.

Set-back Distance

The River Nazeing Drain is a main river, and therefore all development should be set back at least 8m from the watercourse. The Environment

Site Assessment Summary – NAZE.E1 The Old Waterworks

Agency will need to be consulted and an Environmental Permit obtained for any works within 8m of the watercourse.

Access / Egress

It will be necessary to consider whether safe dry access to and from the site can be achieved. The site is located east of the Nazeing Drain and corresponding areas of Flood Zone 2 and 3. The main access to the site is provided along Green Lane, which passes over the Nazeing Drain and its associated floodplain.

Safe Refuge

Given the proximity to the watercourse and the potential for the access / egress route to be affected by flooding, internal access should be provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. An area of safe refuge should be located above the 1% AEP fluvial flood level including an allowance for climate change. This refuge will have to be permanent and accessible to all occupants and users of the site.

Floodplain Compensation

Land raising and any built development should be avoided within Flood Zone 3. Where alterations to the floodplain are proposed, compensatory floodplain storage will need to be provided on a level-for-level and volume-for-volume basis with respect to the 1% AEP (1 in 100 year) design event, including an allowance for climate change. The land used to provide compensation storage will need to be in hydraulic connectivity with the existing floodplain, but not already part of the floodplain.

Site Layout and Design

The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of SuDS, taking care to consider SuDS features in accordance with the hierarchy of SuDS (i.e. considering infiltration measures first wherever possible). The suitability of locating proposed surface water drainage features within the fluvial floodplain, as they may be rendered ineffective during times of fluvial flooding.

Finished Floor Levels

Given the proposed use is Less Vulnerable there is no requirement to raise finished floor levels.

Resilience Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. Guidance on resilience measures can be found in the 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' published by The Department for Communities and Local Government (CLG).

Emergency Planning

The site is shown to be within an Environment Agency Flood Warning Area, the Lower River Lee at Hoddesdon and Cheshunt Flood Warning Area. Due to the proximity of the site to the watercourse, Flood Response Plans should be prepared by residents of the site.

LLFA Consultation

It is recommended that potential developers contact Essex CC as the LLFA for further information prior to taking forward site specific plans.

Summary

The proposed development is classified as Less Vulnerable and therefore does not require the formal application of the Exception Test in accordance with the NPPF. The site specific recommendations set out above should be considered as part of a site specific FRA for the site at the planning application stage to ensure that future development on the site is safe and does not increase flood risk to the site or surrounding area.

Site Assessment Summary – NAZE.E2 Land west of Sedge Green

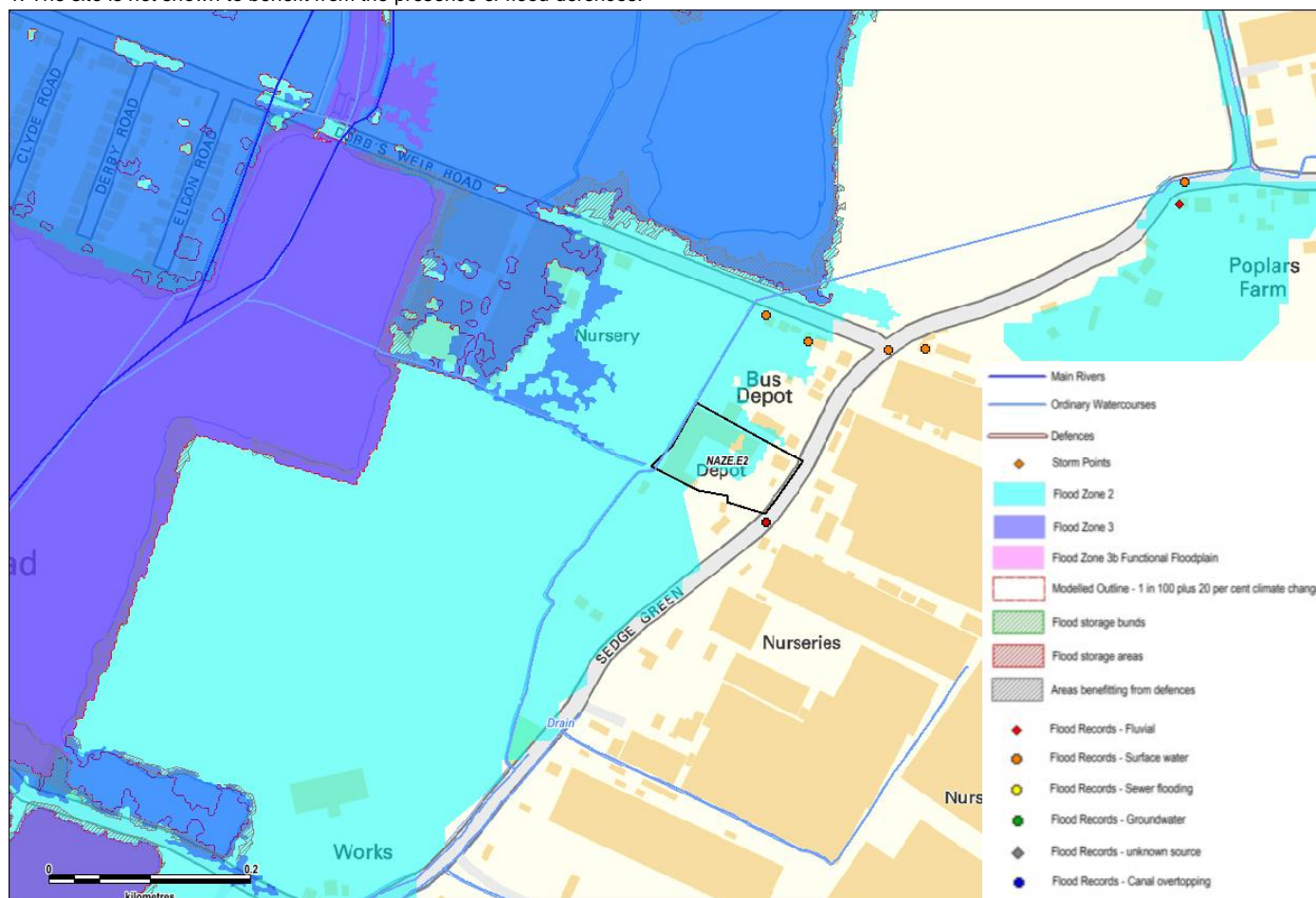
Allocation Reference: NAZE.E2	Address: Nazeing, CM19 5JR	Area (ha): 0.84	Proposed Use: Employment	Vulnerability Classification: Less Vulnerable
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Fluvial Flood Risk

Flood Zone 1: 42%	Flood Zone 2: 58%	Flood Zone 3a: -%	Flood Zone 3b: -%
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Flood Zones and Flood Defences

There are no main rivers within 400m of the site, the closest one being the Nazeing Drain approximately 450m north-west of the site. There is one ordinary watercourse (Drain) which flows along the western boundary of the site. As a result of these two watercourses the majority of the site (58%) is designated as Flood Zone 2, with the surrounding area north-west of the site also being located in Flood Zones 2 and 3. The south-eastern region of the site is in Flood Zone 1, with the area outside the boundaries of the site, east of Sedge Green, also being predominantly in Flood Zone 1. The site is not shown to benefit from the presence of flood defences.



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Figure A Flood Map for Planning (Rivers and Sea)

Historic Records

The Environment Agency Historic Flood Map records fluvial flooding in this area during the flood event of March 1947. Three additional fluvial flooding event have been recorded within 1km of the site, two of which within 10m on the site.

Climate Change

In accordance with the PPG, for Less Vulnerable development proposed in Flood Zone 2, the Central (25%) climate change allowances should be considered. Analysis of the stage-discharge relationship along the Nazeing Drain identifies that the 0.1% AEP (1 in 1000 year) flood level for the undefended model scenario, which corresponds to Flood Zone 2, is greater than the flood levels calculated for the Central climate change allowances. The outline of Flood Zone 2 is therefore appropriate to use as a proxy when considering the impact of climate change on flood risk for this site and surrounding area.

Site Assessment Summary – NAZE.E2 Land west of Sedge Green

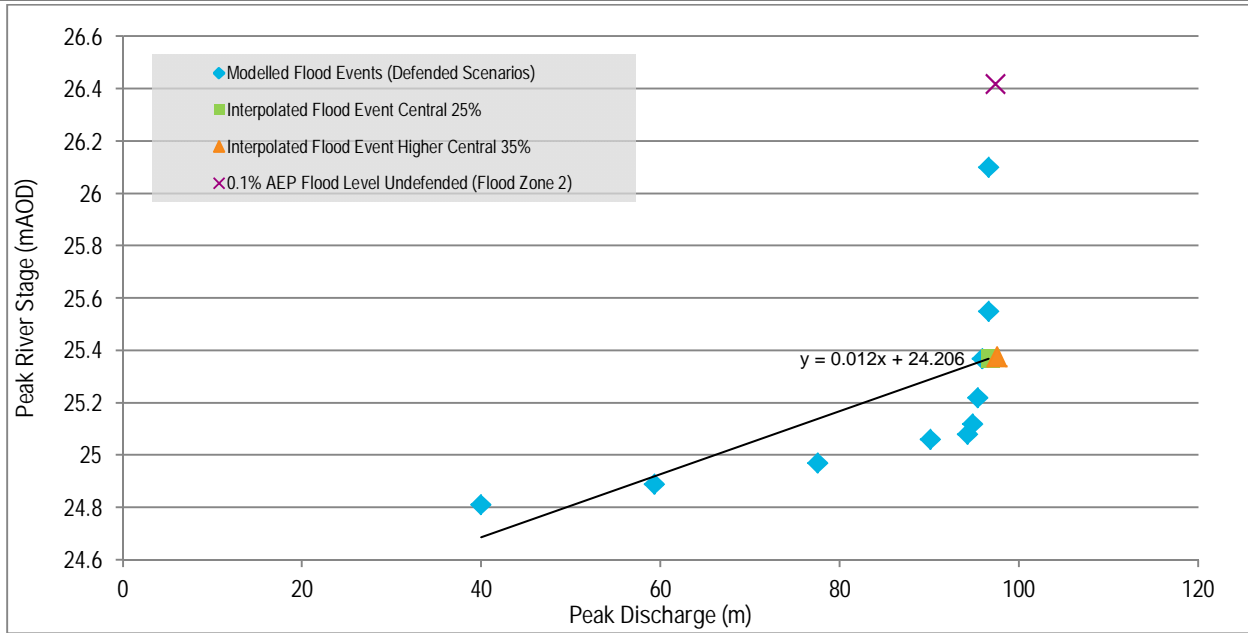


Figure B Stage-Discharge relationship at Node DG1D of the River Lee Modelling Study 2014

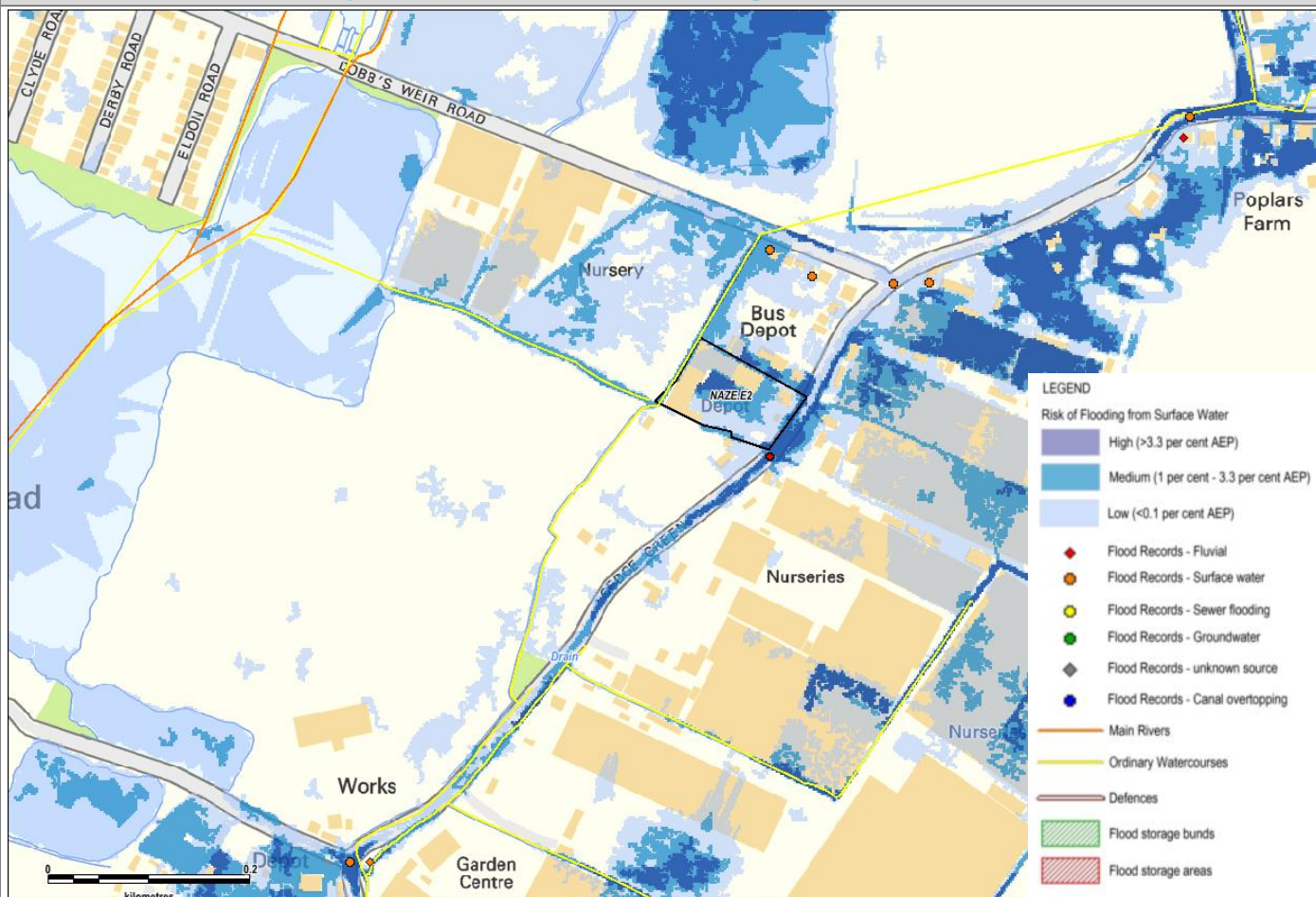
Surface Water Flood Risk

Risk of Flooding from Surface Water (RoFSW)

The RoFSW mapping indicates that the majority of this site is situated in a region which is at risk of surface water flooding. There is an area which is at high risk of ponding within the centre of the site, with this area extending towards the south-east of the site, reducing in the level of flood risk. In the south-eastern and north-eastern corners of the site there are small parcels of land which are not at risk from surface water flooding, however they are surrounded by areas of low risk or higher. During large surface water flooding events there is the potential for these small areas of land to form 'dry islands'. There is an absence of surface water flow paths within the site; however there is a high risk flow path which flows south along Sedge Green, adjacent to the site.

There are 11 reported incidents of surface water flooding within 1km of the site, primarily in the north-east and south-west.

Site Assessment Summary – NAZE.E2 Land west of Sedge Green



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Figure C Risk of Flooding from Surface Water (RoFSW)

Geology:

The underlying geology is Lambeth Group, comprising gravels, sands, silts and clays. This bedrock geology is overlain by Kempton Park Gravel Formation. In contrast to the bedrock geology, which is typically not very permeable, the superficial deposits contains sufficient, saturated permeable material to yield significant quantities of water to wells and springs.

Historic Records:

There has been no reported groundwater flooding incidents within 1km of the site. There is however a reported flooding incident approximately 800m south-west of the site with an unknown origin.

Groundwater Flood Risk

The AS_gWF mapping (also presented in the Level 1 SFRA, Appendix B Figure 9) indicates that the site lies within a region which is has a very high susceptibility to groundwater flooding (>=75%). The risk of groundwater flooding in this area is therefore generally considered to be very high. This will need to be confirmed during site investigation survey.

Other Sources

The Environment Agency ‘Risk of Flooding from Reservoirs’ mapping indicates that the site is not at risk from flooding due to reservoirs. There is a risk of flooding from reservoirs approximately 200m north-west of the site.

Site Specific Recommendations

Fluvial Modelling

As part of a site specific FRA for this site at the planning application stage, additional hydraulic modelling will be required comparing a range of probability events to determine the impact of climate change on the risk of flooding at this location. The 1% AEP (1 in 100 year) flood event including the Central (25%) and Higher Central (35%) allowance are of relevance to the proposed Less Vulnerable development. The modelling will also need to address any potential impact the proposed development may have on flood risk to the surrounding area.

Set-back Distance

Site Assessment Summary – NAZE.E2 Land west of Sedge Green

Due to the close proximity of the drain to the site, development should be set back from this ordinary watercourse. Any work affecting this ordinary watercourse may require consent under Section 23 Land Drainage Act (1991) from Essex County Council as the Lead Local Flood Authority (LLFA). Essex CC should therefore be consulted early in the site planning process.

Access / Egress

It will be necessary to consider whether safe dry access to and from the site can be achieved. The site is located east of a drain and corresponding areas of Flood Zone 2. The main access to the site is provided along Sedge Green, which does not pass over any main watercourses, however it does pass through regions of Flood Zone 2 within 300m of the site. Dobb's Weir Road, which is located approximately 100m north of the site, passes over the Nazeing Drain and associated Flood Zones 2 and 3.

Safe Refuge

Given the proximity to the ordinary watercourse and the potential for the access / egress route to be affected by flooding, internal access should be provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. An area of safe refuge should be located above the 1% AEP fluvial flood level including an allowance for climate change. This refuge will have to be permanent and accessible to all occupants and users of the site. *Site Layout and Design*

The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of SuDS, taking care to consider SuDS features in accordance with the hierarchy of SuDS (i.e. considering infiltration measures first wherever possible). The suitability of locating proposed surface water drainage features within the fluvial floodplain, as they may be rendered ineffective during times of fluvial flooding.

Finished Floor Levels

Given the proposed use is Less Vulnerable there is no requirement to raise finished floor levels.

Floodplain Compensation

Land raising and any built development should be avoided within Flood Zone 3. Where alterations to the floodplain are proposed, compensatory floodplain storage will need to be provided on a level-for-level and volume-for-volume basis with respect to the 1% AEP (1 in 100 year) design event, including an allowance for climate change. The land used to provide compensation storage will need to be in hydraulic connectivity with the existing floodplain, but not already part of the floodplain. *Resilience Measures*

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. Guidance on resilience measures can be found in the 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' published by The Department for Communities and Local Government (CLG).

Emergency Planning

The site is shown to be within an Environment Agency Flood Warning Area, the Lower River Lee at Hoddesdon and Cheshunt Flood Warning Area. Due to the proximity of the site to the watercourse, Flood Response Plans should be prepared by residents of the site.

LLFA Consultation

It is recommended that potential developers contact Essex CC as the LLFA for further information prior to taking forward site specific plans.

Summary

The proposed development is classified as Less Vulnerable and therefore does not require the formal application of the Exception Test in accordance with the NPPF. The site specific recommendations set out above should be considered as part of a site specific FRA for the site at the planning application stage to ensure that future development on the site is safe and does not increase flood risk to the site or surrounding area.

Site Assessment Summary – NAZE.E3 Bridge Works and Glassworks

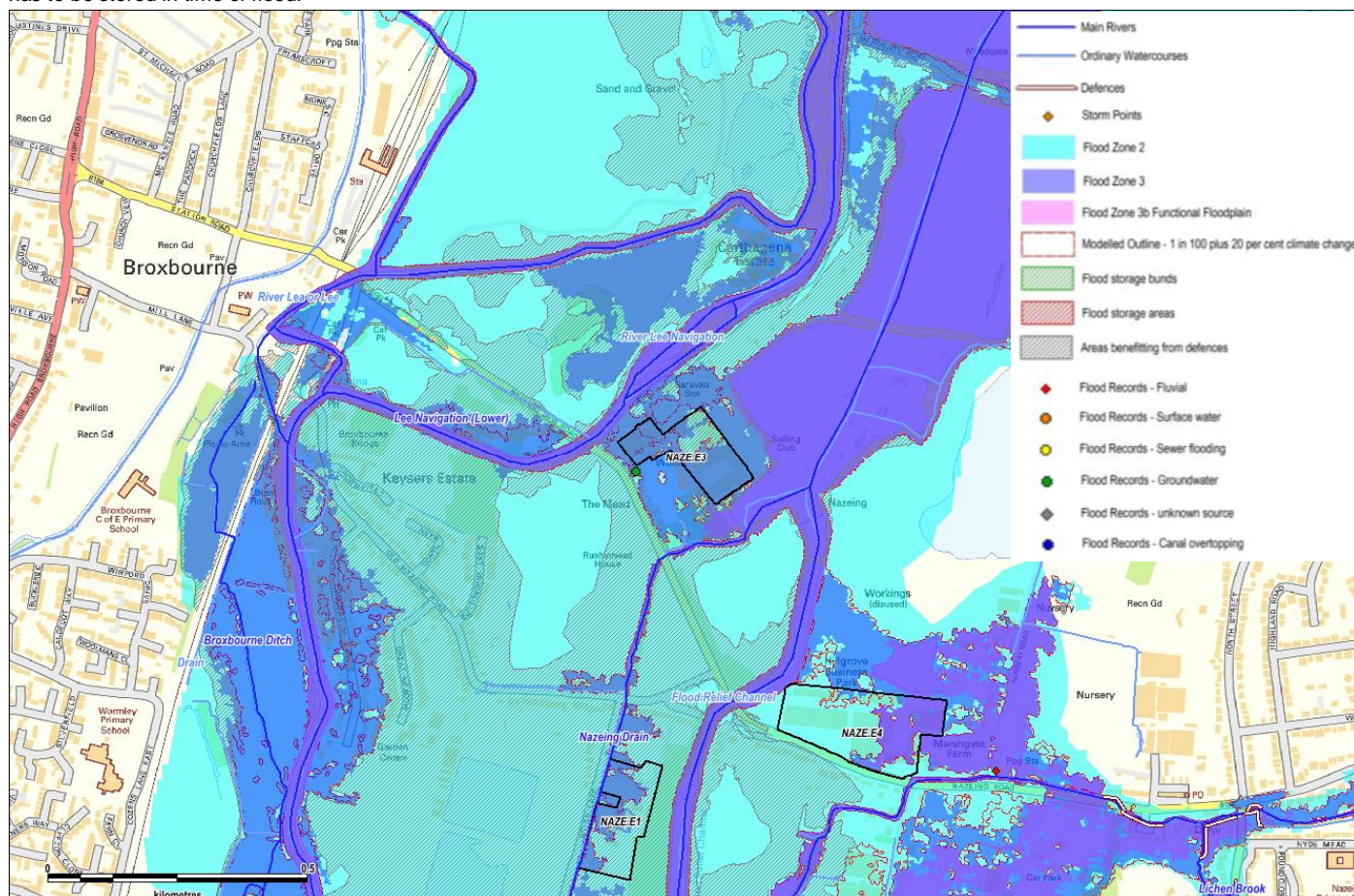
Allocation Reference: NAZE.E3	Address: Nazeing New Road, Broxbourne, EN10 6SY	Area (ha): 2.12	Proposed Use: Employment	Vulnerability Classification: Less Vulnerable
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Fluvial Flood Risk

Flood Zone 1: -	Flood Zone 2: 19%	Flood Zone 3a: 81%	Flood Zone 3b: -
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Flood Zones and Flood Defences

To the west of the site flows a complex network of channels that form the Lower Lee Navigation, Flood Relief Channel and Nazeing Drain. The majority of the site is identified as Flood Zone 3a (81%), with the central part classified as Flood Zone 2 (19%). The site is shown to benefit from the presence of flood defences, namely the management of flood water through the flood relief channels. The flood risk is therefore residual, in the event of failure of the flood defence system. The site is not shown to be located within Flood Zone 3b Functional Floodplain. However the areas to the east of the site, and that adjacent to the Lower Lee Navigation to the west, are defined as such and are therefore identified as land where water has to be stored in time of flood.



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Figure A Flood Map for Planning (Rivers and Sea)

Historic Records

The Environment Agency Historic Flood Map records fluvial flooding in this area during the flood event of March 1947. There have been no reported historical fluvial flooding events within this site, with the only recorded event within 1km of the site having been reported approximately 0.8km south east of the site. This occurred due to the rising of water within the Nazeing Drain.

Climate Change

In accordance with the PPG, for Less Vulnerable development proposed in Flood Zone 3, the Central (25%) and Higher Central (35%) climate change allowances should be considered. Analysis of the stage-discharge relationship along the Lee Navigation identifies that the 0.1% AEP (1 in 1000 year) flood level for the undefended model scenario, which corresponds to Flood Zone 2, is greater than the flood levels calculated for the Central and Higher Central climate change allowances. The outline of Flood Zone 2 is therefore appropriate to use as a proxy when considering the impact of climate change on flood risk for this site and surrounding area.

Site Assessment Summary – NAZE.E3 Bridge Works and Glassworks

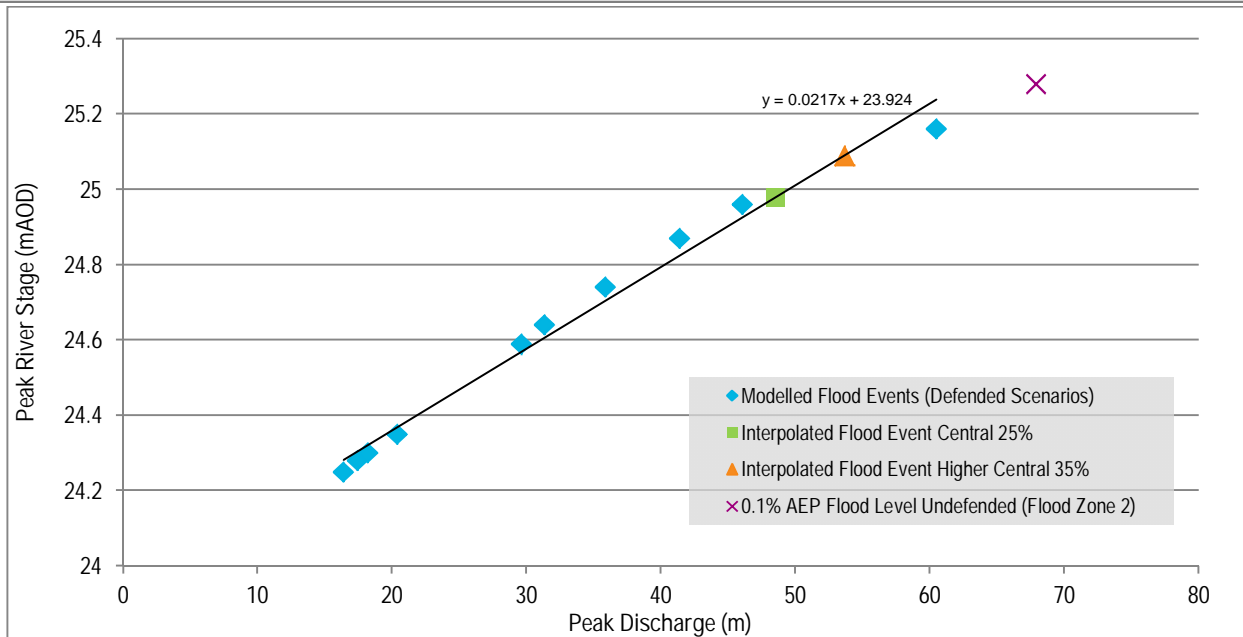
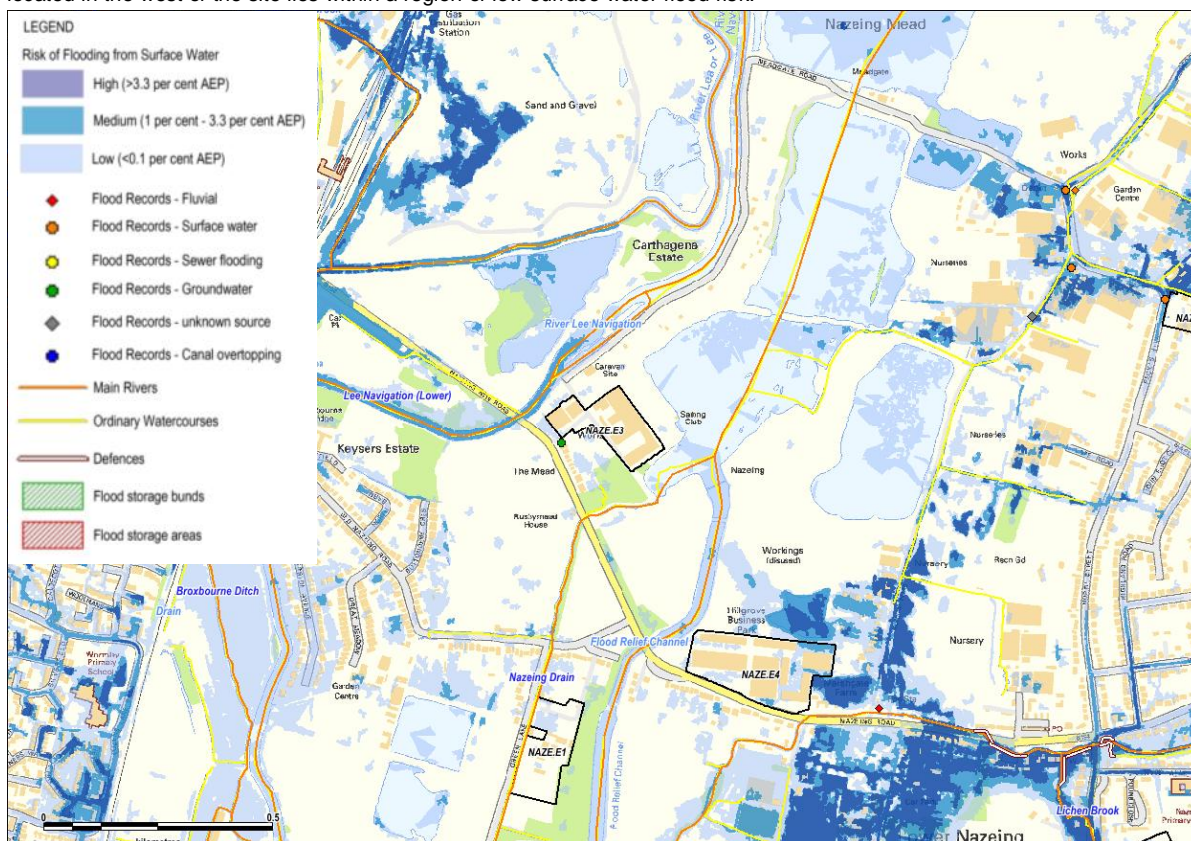


Figure B Stage-Discharge relationship at Node WGA56 of the River Lee Modelling Study 2014

Surface Water Flood Risk

Risk of Flooding from Surface Water (RoFSW)

The RoFSW mapping indicates that the majority of the site is not at risk from surface water flooding. However, a small region (approximately 5m²) located in the west of the site lies within a region of low surface water flood risk.



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Figure C Risk of Flooding from Surface Water (RoFSW)

Geology:

The underlying geology is Lambeth Group, comprising gravels, sands, silts and clays. This bedrock geology is overlain by alluvium. In contrast to the bedrock geology, which is typically not very permeable, the superficial deposits contains sufficient, saturated permeable material to yield significant

Site Assessment Summary – NAZE.E3 Bridge Works and Glassworks

quantities of water to wells and springs, reducing the build-up of surface water across the ground surface, as illustrated by the RoFSW mapping.

Groundwater Flood Risk

The AStGWF mapping (also presented in the Level 1 SFRA, Appendix B Figure 9) shows that the site is located within a 1km square of which $\geq 75\%$ is susceptible to groundwater emergence. The risk of groundwater flooding in this area is therefore generally considered to be high. This will need to be confirmed during site investigation survey.

Historic Records:

There have been three reported groundwater flooding incidents approximately 10m from the south western boundary of the site, all groundwater seepages occurred in 2007.

Other Sources

The Environment Agency 'Risk of Flooding from Reservoirs' mapping indicates that the site is not at risk of flooding in the event of a failure of a reservoir.

Site Specific Recommendations

Fluvial Modelling

As part of a site specific FRA for this site at the planning application stage, additional hydraulic modelling will be required comparing a range of probability events to determine the impact of climate change on the risk of flooding at this location. The 1% AEP (1 in 100 year) flood event including the Central (25%) and Higher Central (35%) allowance are of relevance to the proposed Less Vulnerable development. The modelling will also need to address any potential impact the proposed development may have on flood risk to the surrounding area.

Site Layout and Design

The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of SuDS, taking care to consider SuDS features in accordance with the hierarchy of SuDS (i.e. considering infiltration measures first wherever possible). The suitability of locating proposed surface water drainage features within the fluvial floodplain, as they may be rendered ineffective during times of fluvial flooding.

Finished Floor Levels

Given the proposed use is Less Vulnerable there is no requirement to raise finished floor levels.

Floodplain Compensation

Land raising and any built development should be avoided within Flood Zone 3. Where alterations to the floodplain are proposed, compensatory floodplain storage will need to be provided on a level-for-level and volume-for-volume basis with respect to the 1% AEP (1 in 100 year) design event, including an allowance for climate change. The land used to provide compensation storage will need to be in hydraulic connectivity with the existing floodplain, but not already part of the floodplain.

Access / Egress

It will be necessary to consider whether safe dry access to and from the site can be achieved. The site is located between two watercourses and corresponding areas of Flood Zone 3a. The main access to the site is provided along Nazeing New Road, which passes over the watercourses.

Safe Refuge

Given the proximity to the watercourses and the potential for the access / egress route to be affected by flooding, internal access should be provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. An area of safe refuge should be located above the 1% AEP fluvial flood level including an allowance for climate change. This refuge will have to be permanent and accessible to all occupants and users of the site.

Emergency Planning

The site is shown to be within an Environment Agency Flood Warning Area for the Lower River Lee at Hoddesdon and Cheshunt. Site occupants should register to receive the warning service. Due to the proximity of the site to the watercourse, Flood Response Plans should be prepared by residents of the site.

Resilience Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. Guidance on resilience measures can be found in the 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' published by The Department for Communities and Local Government (CLG).

Resilience Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. Guidance on resilience measures can be found in the 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' published by The Department for Communities and Local Government (CLG).

Site Assessment Summary – NAZE.E3 Bridge Works and Glassworks*LLFA Consultation*

It is recommended that potential developers contact Essex CC as the LLFA for further information prior to taking forward site specific plans.

Summary

The proposed development is classified as Less Vulnerable and therefore does not require the formal application of the Exception Test in accordance with the NPPF. The site specific recommendations set out above should be considered as part of a site specific FRA for the site at the planning application stage to ensure that future development on the site is safe and does not increase flood risk to the site or surrounding area.

Site Assessment Summary – NAZE.E4 Hillgrove Business Park

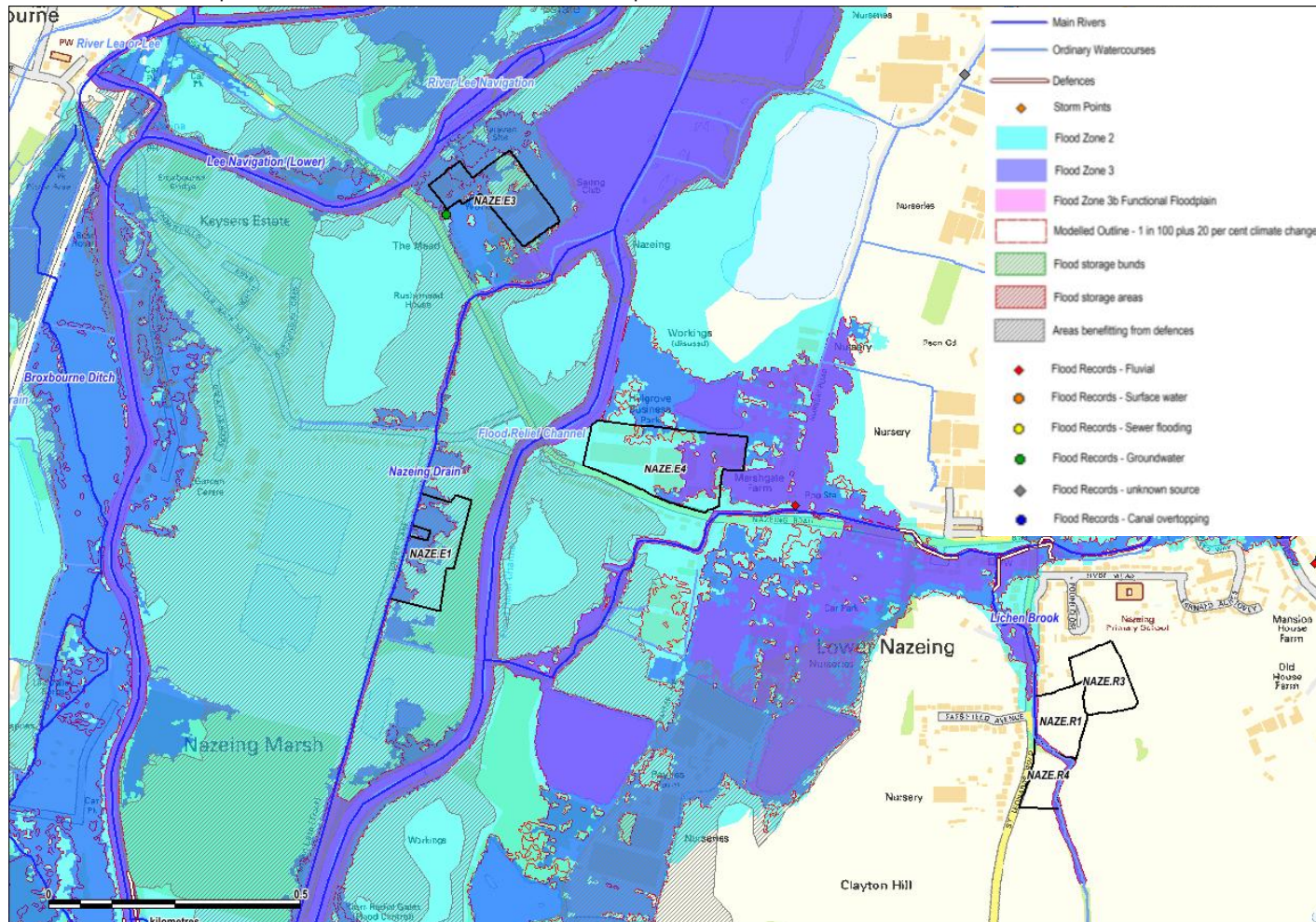
Allocation Reference: NAZE.E4	Address: Nazeing Road, Nazeing, EN9 2HB	Area (ha): 3.85	Proposed Use: Employment	Vulnerability Classification: Less Vulnerable
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Fluvial Flood Risk

Flood Zone 1: -	Flood Zone 2: 66%	Flood Zone 3a: 5%	Flood Zone 3b: 29%
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Flood Zones and Flood Defences

The Flood Relief Channel forms the north-westernmost boundary of the NAZE.E4 site, with Nazeing Brook encroaching the site from the south east, whilst not entering the site. The majority of the site is identified as Flood Zone 2 (66%), with 29% in the eastern part of the site defined as Flood Zone 3b functional floodplain. This site is not shown to benefit from the presence of flood defences.



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Figure A Flood Map for Planning (Rivers and Sea)

Historic Records

The Environment Agency Historic Flood Map records fluvial flooding in this area during December 2000. There is a reported incident of fluvial flooding approximately 150m east of the site, adjacent to the Nazeing Brook. This event arose through rising water levels of the Nazeing Brook.

Climate Change

In accordance with the PPG, for Less Vulnerable development proposed in Flood Zone 3, the Central (25%) and Higher Central (35%) climate change allowances should be considered. Analysis of the stage-discharge relationship along the Nazeing Drain identifies that the 0.1% AEP (1 in 1000 year) flood level for the undefended model scenario, which corresponds to Flood Zone 2, is greater than the flood levels calculated for the Central and Higher Central climate change allowances. The outline of Flood Zone 2 is therefore appropriate to use as a proxy when considering the impact of climate change on flood risk for this site and surrounding area.

Site Assessment Summary – NAZE.E4 Hillgrove Business Park

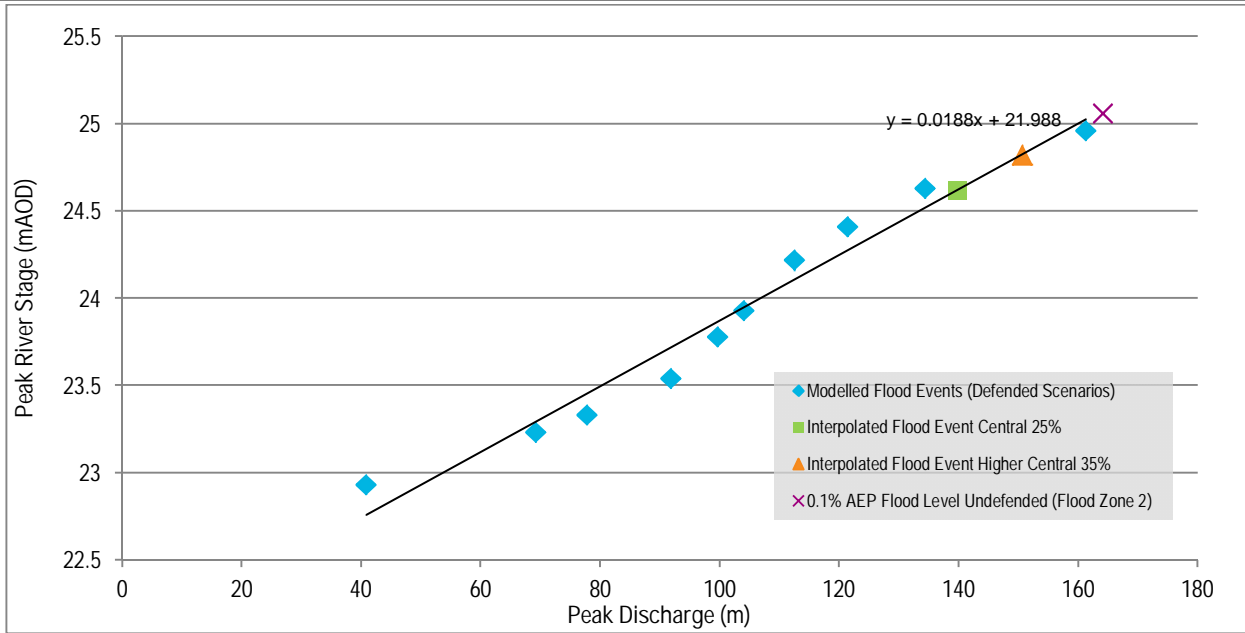


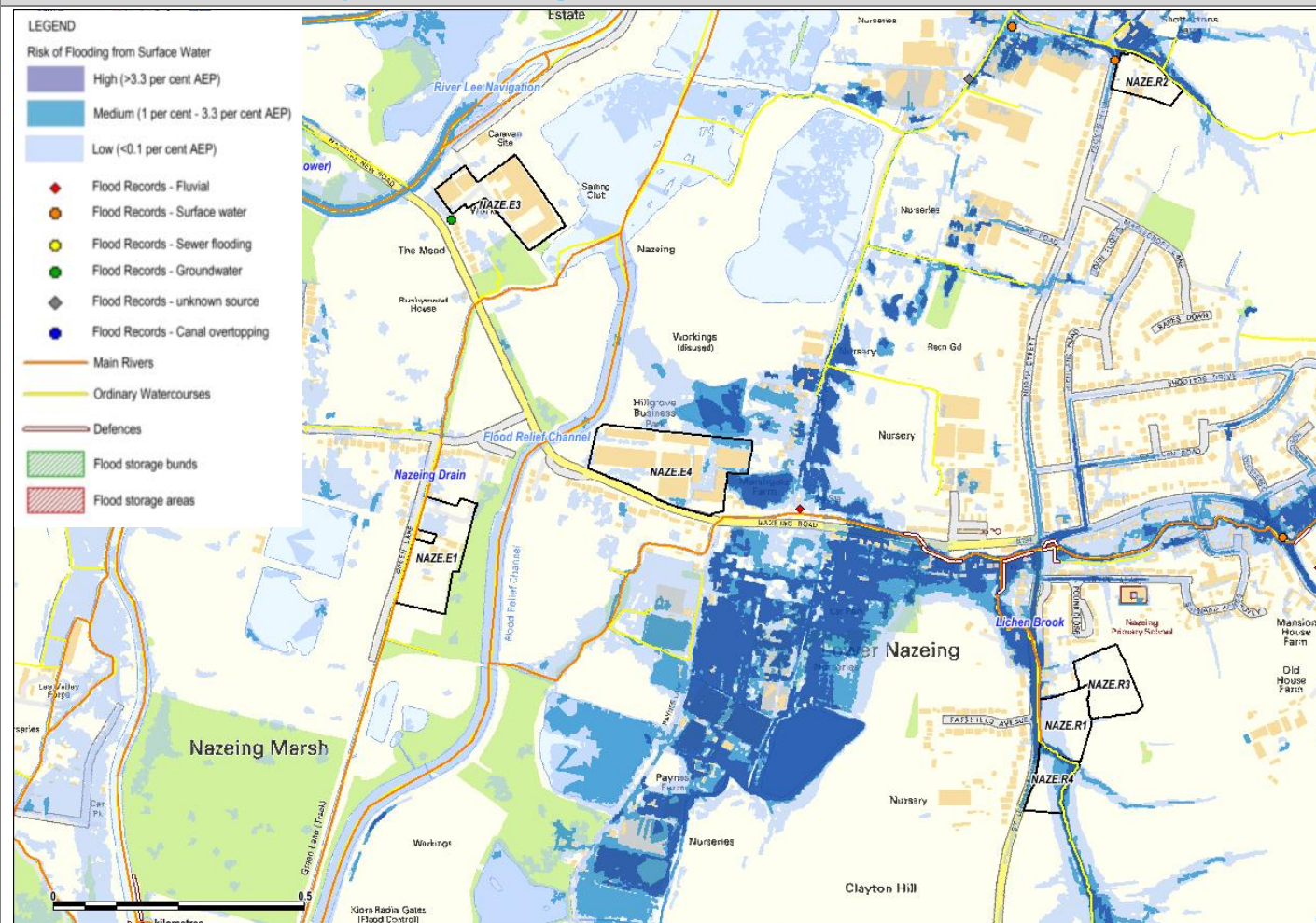
Figure B Stage-Discharge relationship at Node NM16 of the River Lee Modelling Study 2014

Surface Water Flood Risk

Risk of Flooding from Surface Water (RoFSW)

The RoFSW mapping indicates that there are several locations within the site where there is a risk of surface water flooding. The areas at highest risk (medium) are located in the eastern half of the site, with the largest area of medium risk situated in the north east. This region contributes to a low risk flow path which runs from this area south, through the car park of the industrial state. This flow path should be considered carefully in the development of the site layout to ensure that new development is not placed at surface water flood risk, and that the position of any new development does not divert the flow path to a neighbouring area. It should also be noted that outside the boundaries of the site, in the south east, lies an extensive area which has a high risk of surface water flooding. Despite this, there have been no reported incidents of flooding from surface water within 1km of the site.

Site Assessment Summary – NAZE.E4 Hillgrove Business Park



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Figure C Risk of Flooding from Surface Water (RoFSW)

Geology:

The underlying geology is Lambeth Group, comprising gravels, sands, silts and clays. This bedrock geology is overlain by alluvium. In contrast to the bedrock geology, which is typically not very permeable, the superficial deposits contains sufficient, saturated permeable material to yield significant quantities of water to wells and springs, reducing the build-up of surface water across the ground surface, as illustrated by the RoFSW mapping.

Historic Records:

There have been no incidents of groundwater flooding within this site. Three groundwater flooding incidents, however, were reported in 2007, approximately 0.5km north west of the site.

Groundwater Flood Risk

The ASStGWF mapping (also presented in the Level 1 SFRA, Appendix B Figure 9) shows that the site is located within a 1km square of which >=75% is susceptible to groundwater emergence. The risk of groundwater flooding in this area is therefore generally considered to be high. This will need to be confirmed during site investigation survey.

Other Sources

The Environment Agency 'Risk of Flooding from Reservoirs' mapping indicates that the site is at not risk of flooding in the event of a failure of a reservoir.

Site Specific Recommendations

Site Layout and Design

Flood Zone 3b is defined as land where water has to be stored in times of flood. It is not appropriate to locate development within this area. The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of SuDS, taking care to consider SuDS features in accordance with the hierarchy of SuDS (i.e. considering infiltration measures first wherever possible). The suitability of locating proposed surface water drainage features within the fluvial floodplain, as they may be rendered ineffective during times of fluvial flooding.

Site Assessment Summary – NAZE.E4 Hillgrove Business Park

Set-back Distance

All development should be set back at least 8m from the Navigation Channel and Nazeing Brook watercourses. The Environment Agency will need to be consulted and an Environmental Permit obtained for any works within 8m of the watercourse.

Fluvial Modelling

As part of a site specific FRA for this site at the planning application stage, additional hydraulic modelling will be required comparing a range of probability events to determine the impact of climate change on the risk of flooding at this location. The 1% AEP (1 in 100 year) flood event including the Central (25%) and Higher Central (35%) allowance are of relevance to the proposed Less Vulnerable development. The modelling will also need to address any potential impact the proposed development may have on flood risk to the surrounding area.

Finished Floor Levels

Given the proposed use is Less Vulnerable there is no requirement to raise finished floor levels.

Floodplain Compensation

Land raising and any built development should be avoided within Flood Zone 3. Where alterations to the floodplain are proposed, compensatory floodplain storage will need to be provided on a level-for-level and volume-for-volume basis with respect to the 1% AEP (1 in 100 year) design event, including an allowance for climate change. The land used to provide compensation storage will need to be in hydraulic connectivity with the existing floodplain, but not already part of the floodplain.

Resilience Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. Guidance on resilience measures can be found in the 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' published by The Department for Communities and Local Government (CLG).

Access / Egress

It will be necessary to consider whether safe dry access to and from the site can be achieved. The site is located between two watercourses and corresponding areas of Flood Zone 3a and 3b. The main access to the site is provided along Nazeing Road, which is also at risk of flooding.

Safe Refuge

Given the proximity to the watercourses and the potential for the access / egress route to be affected by flooding, internal access should be provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. An area of safe refuge should be located above the 1% AEP fluvial flood level including an allowance for climate change. This refuge will have to be permanent and accessible to all occupants and users of the site.

Emergency Planning

The site is shown to be within an Environment Agency Flood Warning Area for the Lower River Lee at Hoddesdon and Cheshunt. Site occupants should register to receive the warning service. Due to the proximity of the site to the watercourse, Flood Response Plans should be prepared by residents of the site.

LLFA Consultation

It is recommended that potential developers contact Essex CC as the LLFA for further information prior to taking forward site specific plans.

Summary

The proposed development is classified as Less Vulnerable and therefore does not require the formal application of the Exception Test in accordance with the NPPF. The site specific recommendations set out above should be considered as part of a site specific FRA for the site at the planning application stage to ensure that future development on the site is safe and does not increase flood risk to the site or surrounding area.

Site Assessment Summary – NAZE.E6 Millbrook Business Park

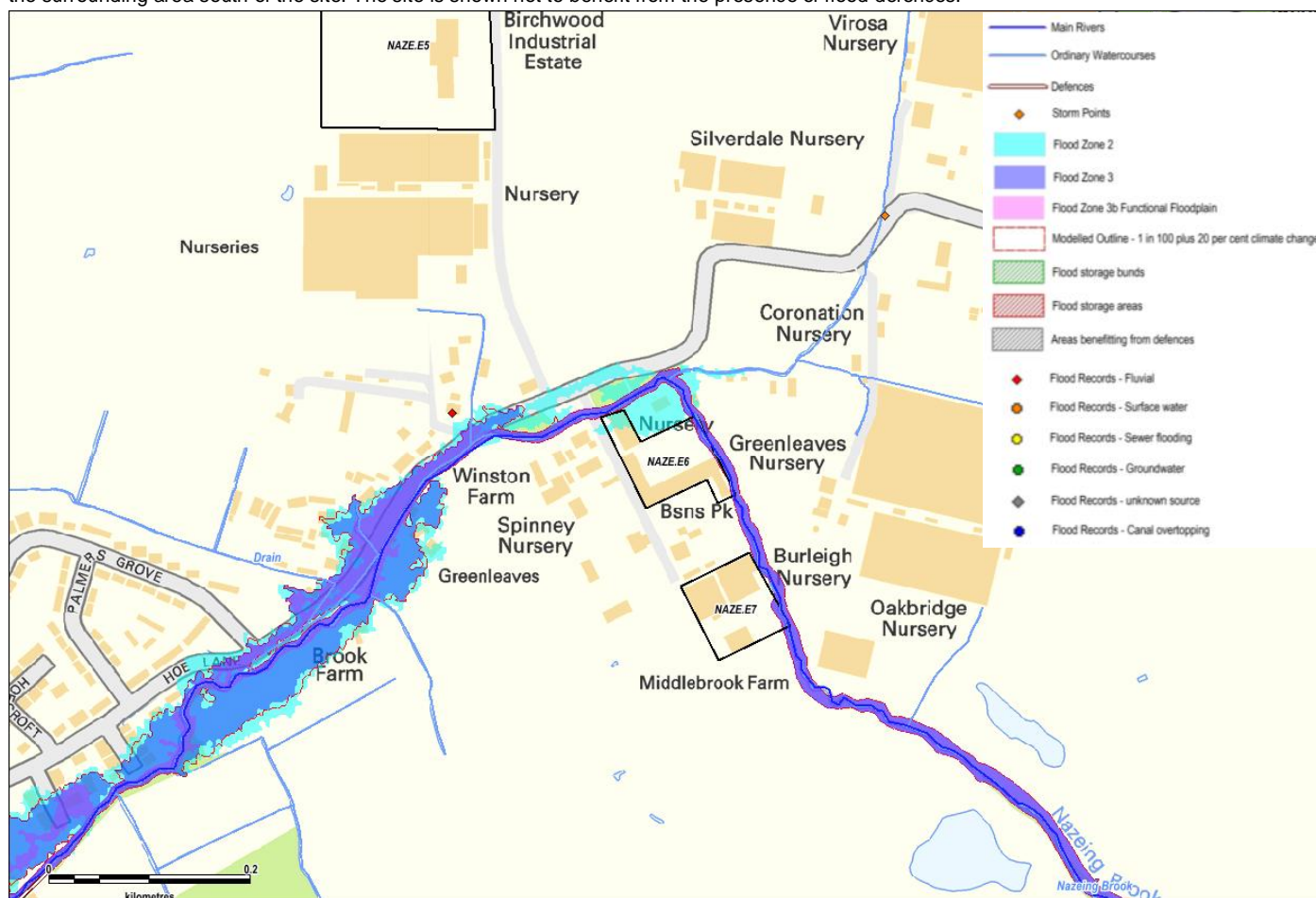
Allocation Reference: NAZE.E6	Address: Nazeing, Waltham Abbey, EN9 2RJ	Area (ha): 0.68	Proposed Use: Employment	Vulnerability Classification: Less Vulnerable
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Fluvial Flood Risk

Flood Zone 1: 89%	Flood Zone 2: 6%	Flood Zone 3a: -%	Flood Zone 3b: 5%
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Flood Zones and Flood Defences

Nazeing Brook wraps around the northern and eastern borders of the site, encroaching into the site along the eastern perimeter. Small areas of Flood Zones 2 (6%) and 3b (5%) within this site are associated with this main river. Flood Zone 3b is defined as land where water has to be stored in times of flood. It is not appropriate to locate development within this area. The majority of the site, however, is situated within Flood Zone 1, as is the surrounding area south of the site. The site is shown not to benefit from the presence of flood defences.



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Figure A Flood Map for Planning (Rivers and Sea)

Historic Records

The Environment Agency Historic Flood Map does not record any incidents of fluvial flooding within this area. There have however, been three reported fluvial flooding events within 1km of the site.

Climate Change

In accordance with the PPG, for Less Vulnerable development proposed in Flood Zone 3, the Central (25%) and Higher Central (35%) climate change allowances should be considered. Analysis of the stage-discharge relationship along the Nazeing Brook identifies that the 0.1% AEP (1 in 1000 year) flood level for the undefended model scenario, which corresponds to Flood Zone 2, is greater than the flood levels calculated for the Central and Higher Central climate change allowances. The outline of Flood Zone 2 is therefore appropriate to use as a proxy when considering the impact of climate change on flood risk for this site and surrounding area.

Site Assessment Summary – NAZE.E6 Millbrook Business Park

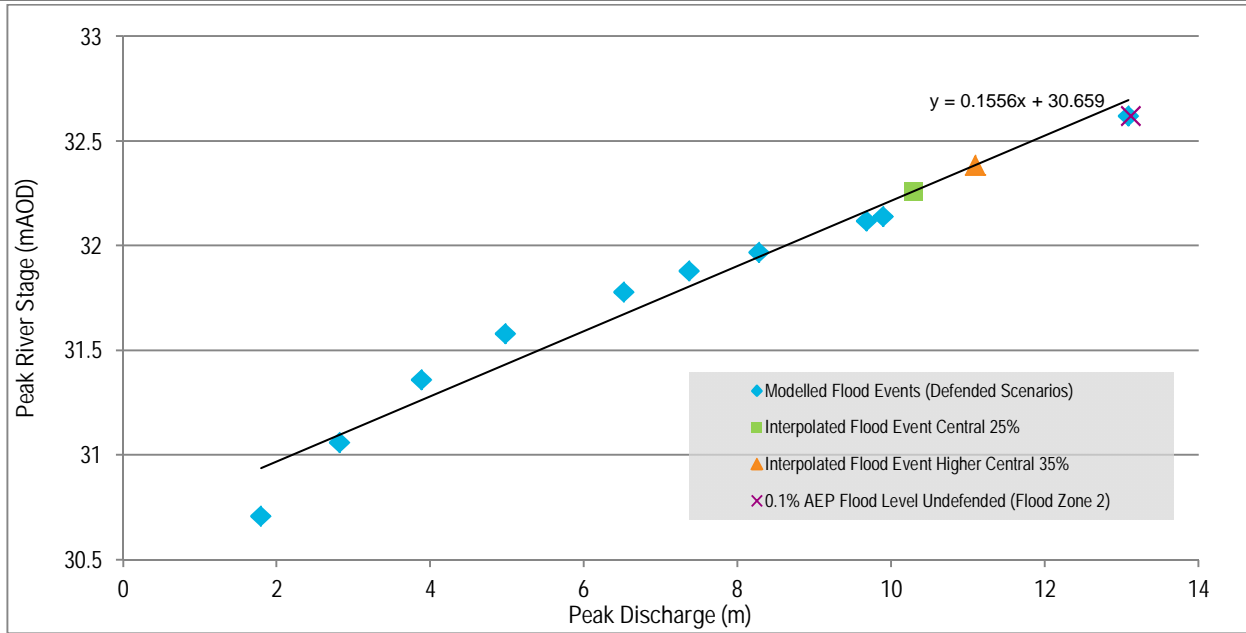


Figure B Stage-Discharge relationship at Node NZ.074u of the River Lee Modelling Study 2014

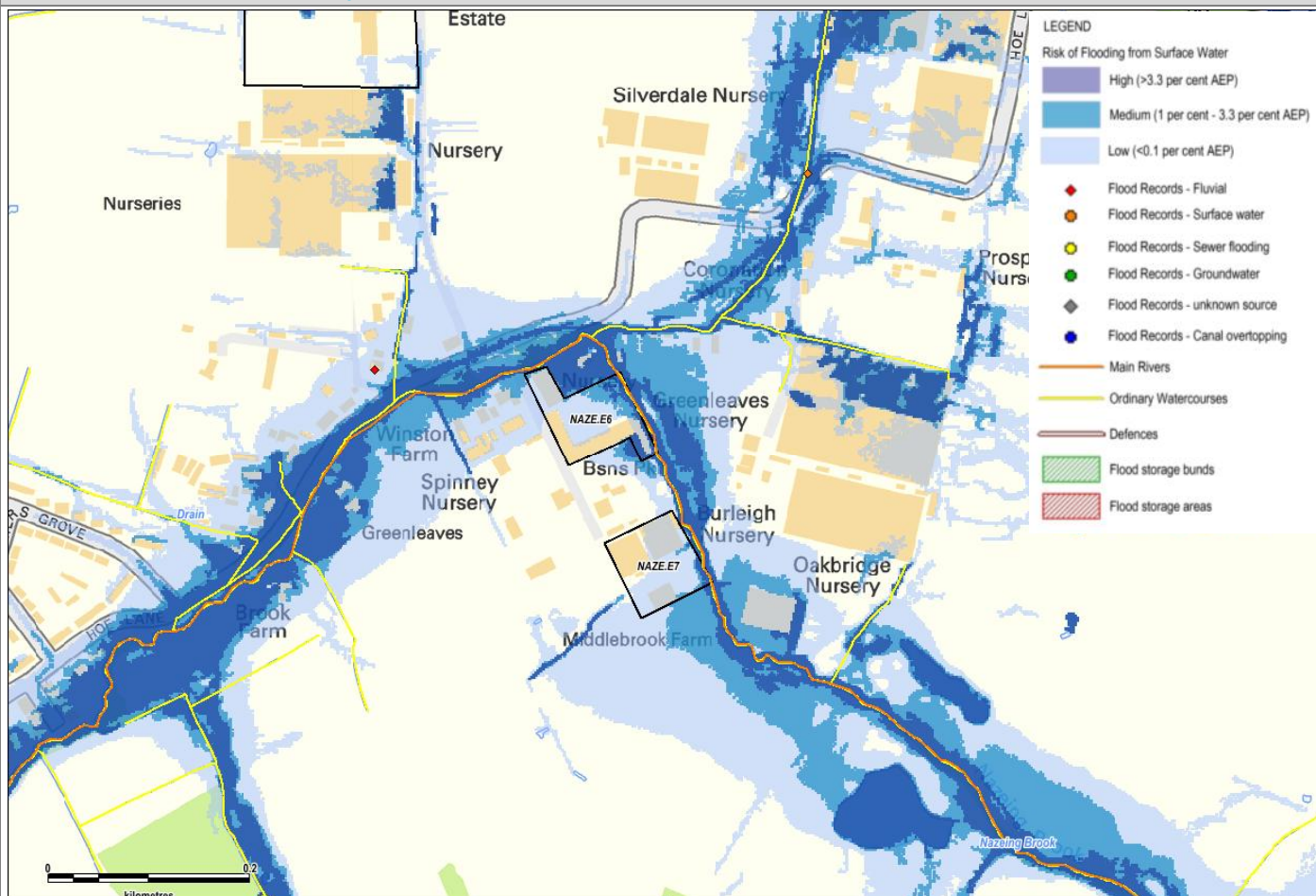
Surface Water Flood Risk

Risk of Flooding from Surface Water (RoFSW)

The RoFSW mapping indicates that the majority of this site is situated within an area of low surface water flood risk, with the north-east of the site being at the highest (medium to high) risk. The site is surrounded in the north and east by high risk surface water flow paths, with flood water here having the potential to exceed 900mm in depth. These flow paths are located along key access/egress routes.

There are 7 reported incidents of surface water flooding within 1km of the site, with the majority located in the south along Middle Street.

Site Assessment Summary – NAZE.E6 Millbrook Business Park



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Figure C Risk of Flooding from Surface Water (RoFSW)

Geology:

The underlying geology is London Clay formation. This type of geology comprises clay, silt and sand and is typically not very permeable, resulting in rapid runoff of surface water across the ground surface. Overlying this is a polymict deposit layer of Head. This also comprises of poorly sorted and poorly stratified deposits of sands, gravels, silts and clays. In contrast to the bedrock geology, which is typically not very permeable, the superficial deposits, due to their poorly sorted structure are permeable.

Historic Records:

There has been no reported groundwater flooding incidents within 1km of the site.

Groundwater Flood Risk

The AStGWF mapping (also presented in the Level 1 SFRA, Appendix B Figure 9) indicates that the site lies within a region which is has a high susceptibility to groundwater flooding (>=50% <75%). The risk of groundwater flooding in this area is therefore generally considered to be high. This will need to be confirmed during site investigation survey.

Other Sources

The Environment Agency ‘Risk of Flooding from Reservoirs’ mapping indicates that the site is not at risk from flooding due to reservoirs.

Site Specific Recommendations

Fluvial Modelling

As part of a site specific FRA for this site, additional hydraulic modelling will be required comparing a range of probability events to determine the impact of climate change on the risk of flooding at this location. The 1% AEP (1 in 100 year) flood event including the Central (25%) and Higher Central (35%) allowance are of relevance to the proposed Less Vulnerable development. The modelling will also need to address any potential impact the proposed development may have on flood risk to the surrounding area.

Set-back Distance

Due to the close proximity of the Nazeing Brook, a main river, to the site, development should be set back at least 8m from the watercourse. The

Site Assessment Summary – NAZE.E6 Millbrook Business Park

Environment Agency will need to be consulted and an Environmental Permit obtained for any works within 8m of the watercourse.

Access / Egress

It will be necessary to consider whether safe dry access to and from the site can be achieved. The site is located south of Nazeing Brook and corresponding areas of Flood Zone 2 and 3b. The main access to the site is provided along Hoe Lane, which does not pass over Nazeing Brook, however it does pass through associated regions of Flood Zones 2 and 3.

Safe Refuge

Given the proximity to the ordinary watercourse and the potential for the access / egress route to be affected by flooding, internal access should be provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. An area of safe refuge should be located above the 1% AEP fluvial flood level including an allowance for climate change. This refuge will have to be permanent and accessible to all occupants and users of the site.

Site Layout and Design

The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of SuDS, taking care to consider SuDS features in accordance with the hierarchy of SuDS (i.e. considering infiltration measures first wherever possible). The suitability of locating proposed surface water drainage features within the fluvial floodplain, as they may be rendered ineffective during times of fluvial flooding.

Finished Floor Levels

Given the proposed use is Less Vulnerable there is no requirement to raise finished floor levels.

Floodplain Compensation

Land raising and any built development should be avoided within Flood Zone 3. Where alterations to the floodplain are proposed, compensatory floodplain storage will need to be provided on a level-for-level and volume-for-volume basis with respect to the 1% AEP (1 in 100 year) design event, including an allowance for climate change. The land used to provide compensation storage will need to be in hydraulic connectivity with the existing floodplain, but not already part of the floodplain.

Resilience Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. Guidance on resilience measures can be found in the 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' published by The Department for Communities and Local Government (CLG).

Emergency Planning

The site is shown to be within an Environment Agency Flood Warning Area, the Nazeing Brook at Lower Nazing Flood Warning Area. Due to the proximity of the site to the watercourse, Flood Response Plans should be prepared by residents of the site.

LLFA Consultation

It is recommended that potential developers contact Essex CC as the LLFA for further information prior to taking forward site specific plans.

Summary

The proposed development is classified as Less Vulnerable and therefore does not require the formal application of the Exception Test in accordance with the NPPF. The site specific recommendations set out above should be considered as part of a site specific FRA for the site at the planning application stage to ensure that future development on the site is safe and does not increase flood risk to the site or surrounding area.

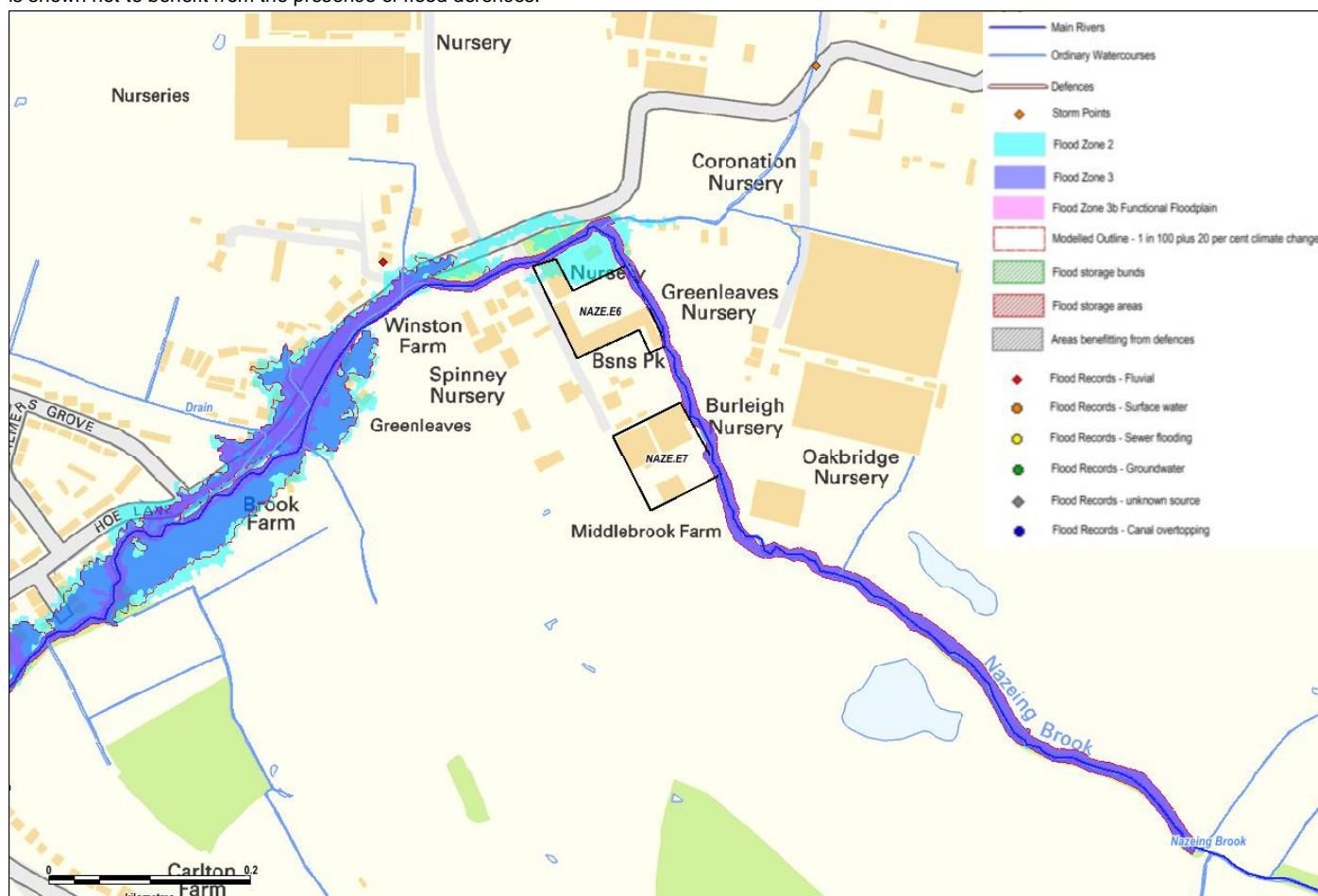
Site Assessment Summary – NAZE.E7 Land at Winston Farm

Allocation Reference: NAZE.E7	Address: Hoe Lane Nazeing, Waltham Abbey, EN9 2RJ	Area (ha): 0.63	Proposed Use: Employment	Vulnerability Classification: Less Vulnerable
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Fluvial Flood Risk			
Flood Zone 1: 97%	Flood Zone 2: -%	Flood Zone 3a: -%	Flood Zone 3b: 3%

Flood Zones and Flood Defences

Nazeing Brook flows along the eastern border of the site. There is a small portion of land within the site, associated with Nazeing Brook, which is designated as Flood Zone 3b (3%). Flood Zone 3b is defined as land where water has to be stored in times of flood. It is not appropriate to locate development within this area. The majority of the site, however, is situated within Flood Zone 1, as is the surrounding area south of the site. The site is shown not to benefit from the presence of flood defences.



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Figure A Flood Map for Planning (Rivers and Sea)

Historic Records

The Environment Agency Historic Flood Map does not record any incidents of fluvial flooding within this area. There have however, been three reported fluvial flooding events within 1km of the site.

Climate Change

In accordance with the PPG, for Less Vulnerable development proposed in Flood Zone 3, the Central (25%) and Higher Central (35%) climate change allowances should be considered. Analysis of the stage-discharge relationship along Nazeing Brook identifies that the 0.1% AEP (1 in 1000 year) flood level for the undefended model scenario, which corresponds to Flood Zone 2, is greater than the flood levels calculated for the Central and Higher Central climate change allowances. The outline of Flood Zone 2 is therefore appropriate to use as a proxy when considering the impact of climate change on flood risk for this site and surrounding area.

Site Assessment Summary – NAZE.E7 Land at Winston Farm

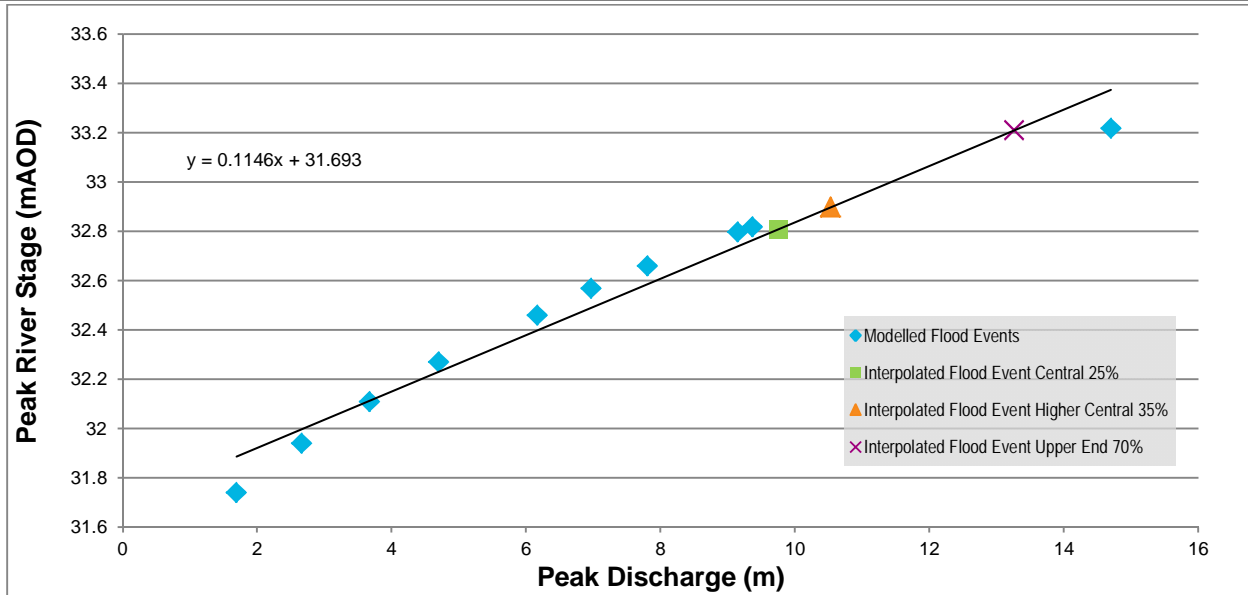


Figure B Stage-Discharge relationship at Node NZ.076 of the River Lee Modelling Study 2014

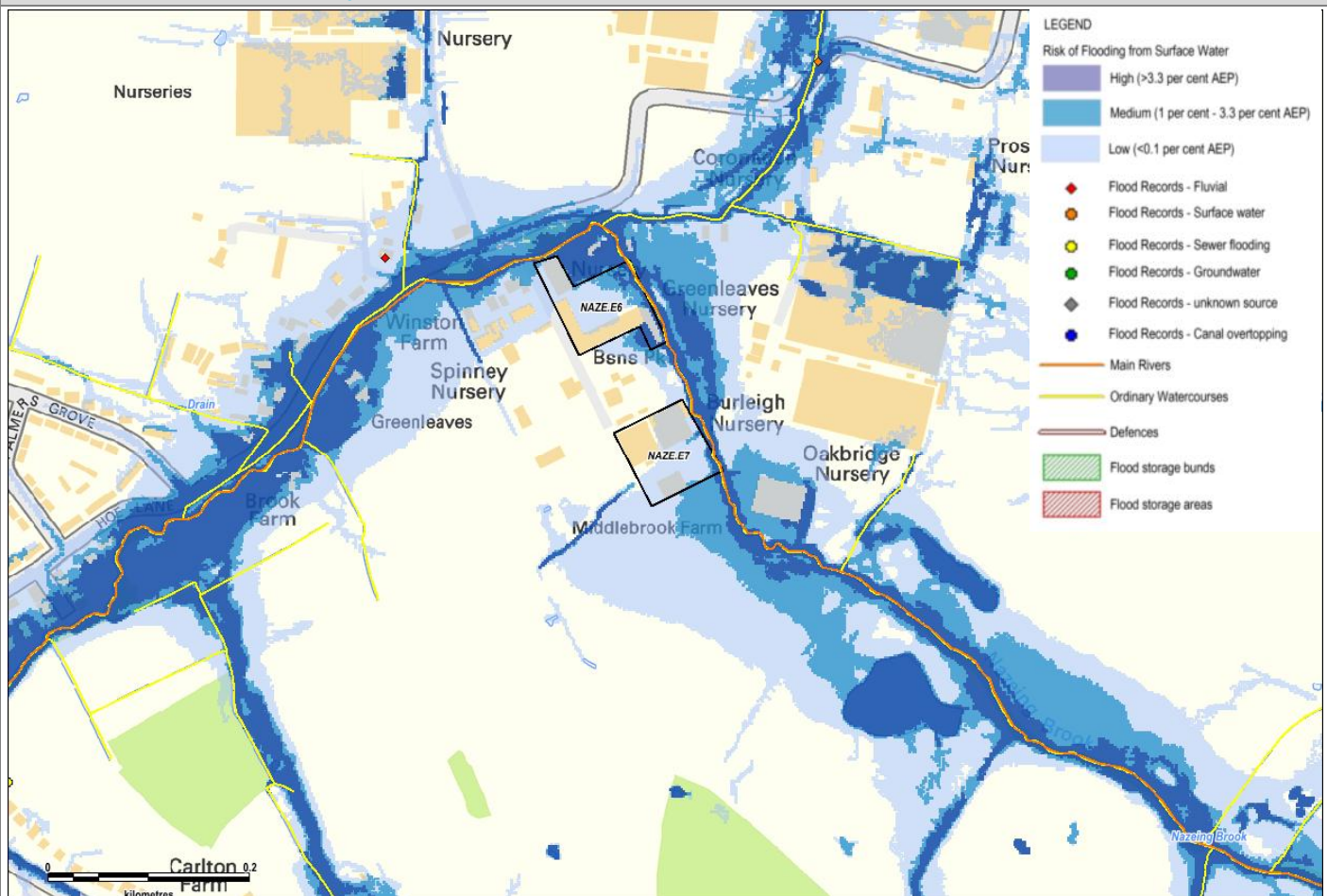
Surface Water Flood Risk

Risk of Flooding from Surface Water (RoFSW)

The RoFSW mapping indicates that the majority of this site is situated within an area of low surface water flood risk, with a small area in the south-east of the site located in an area of medium to high risk. Along the eastern boundary of the site is a high risk flow path which flows north along Winston Farm. This flow path is located along a key access/egress route.

There are 7 reported incidents of surface water flooding within 1km of the site, with the majority located in the south along Middle Street.

Site Assessment Summary – NAZE.E7 Land at Winston Farm



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Figure C Risk of Flooding from Surface Water (RoFSW)

Geology:

The underlying geology is London Clay formation. This type of geology comprises clay, silt and sand and is typically not very permeable, resulting in rapid runoff of surface water across the ground surface. Overlying this is a polymict deposit layer of Head. This also comprises of poorly sorted and poorly stratified deposits of sands, gravels, silts and clays. In contrast to the bedrock geology, which is typically not very permeable, the superficial deposits, due to their poorly sorted structure are permeable.

Historic Records:

There have been no reported groundwater flooding incidents within 1km of the site.

Groundwater Flood Risk

The AStGWF mapping (also presented in the Level 1 SFRA, Appendix B Figure 9) indicates that the site lies within a region which is has a high susceptibility to groundwater flooding (>=50% <75%). The risk of groundwater flooding in this area is therefore generally considered to be high. This will need to be confirmed during site investigation survey.

Other Sources

The Environment Agency ‘Risk of Flooding from Reservoirs’ mapping indicates that the site is not at risk from flooding due to reservoirs.

Site Specific Recommendations

Fluvial Modelling

As part of a site specific FRA for this site, additional hydraulic modelling will be required comparing a range of probability events to determine the impact of climate change on the risk of flooding at this location. The 1% AEP (1 in 100 year) flood event including the Central (25%) and Higher Central (35%) allowance are of relevance to the proposed Less Vulnerable development. The modelling will also need to address any potential impact the proposed development may have on flood risk to the surrounding area.

Set-back Distance

Due to the close proximity of the Nazeing Brook, a main river, to the site, development should be set back at least 8m from the watercourse. The

Site Assessment Summary – NAZE.E7 Land at Winston Farm

Environment Agency will need to be consulted and an Environmental Permit obtained for any works within 8m of the watercourse.

Access / Egress

It will be necessary to consider whether safe dry access to and from the site can be achieved. The site is located west of Nazeing Brook and corresponding areas of Flood Zone 2 and 3b. The main access to the site is provided along Hoe Lane, which does not pass over Nazeing Brook, however it does pass through associated regions of Flood Zones 2 and 3.

Safe Refuge

Given the proximity to the ordinary watercourse and the potential for the access / egress route to be affected by flooding, internal access should be provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. An area of safe refuge should be located above the 1% AEP fluvial flood level including an allowance for climate change. This refuge will have to be permanent and accessible to all occupants and users of the site.

Site Layout and Design

The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of SuDS, taking care to consider SuDS features in accordance with the hierarchy of SuDS (i.e. considering infiltration measures first wherever possible). The suitability of locating proposed surface water drainage features within the fluvial floodplain, as they may be rendered ineffective during times of fluvial flooding.

Finished Floor Levels

Given the proposed use is Less Vulnerable there is no requirement to raise finished floor levels.

Floodplain Compensation

Land raising and any built development should be avoided within Flood Zone 3. Where alterations to the floodplain are proposed, compensatory floodplain storage will need to be provided on a level-for-level and volume-for-volume basis with respect to the 1% AEP (1 in 100 year) design event, including an allowance for climate change. The land used to provide compensation storage will need to be in hydraulic connectivity with the existing floodplain, but not already part of the floodplain.

Resilience Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. Guidance on resilience measures can be found in the 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' published by The Department for Communities and Local Government (CLG).

Emergency Planning

The site is shown to be within an Environment Agency Flood Warning Area, the Nazeing Brook at Lower Nazing Flood Warning Area. Due to the proximity of the site to the watercourse, Flood Response Plans should be prepared by residents of the site.

LLFA Consultation

It is recommended that potential developers contact Essex CC as the LLFA for further information prior to taking forward site specific plans.

Summary

The proposed development is classified as Less Vulnerable and therefore does not require the formal application of the Exception Test in accordance with the NPPF. The site specific recommendations set out above should be considered as part of a site specific FRA for the site to ensure that future development on the site is safe and does not increase flood risk to the site or surrounding area.

Site Assessment Summary – THOR.E4 Weald Hall Lane Industrial Area

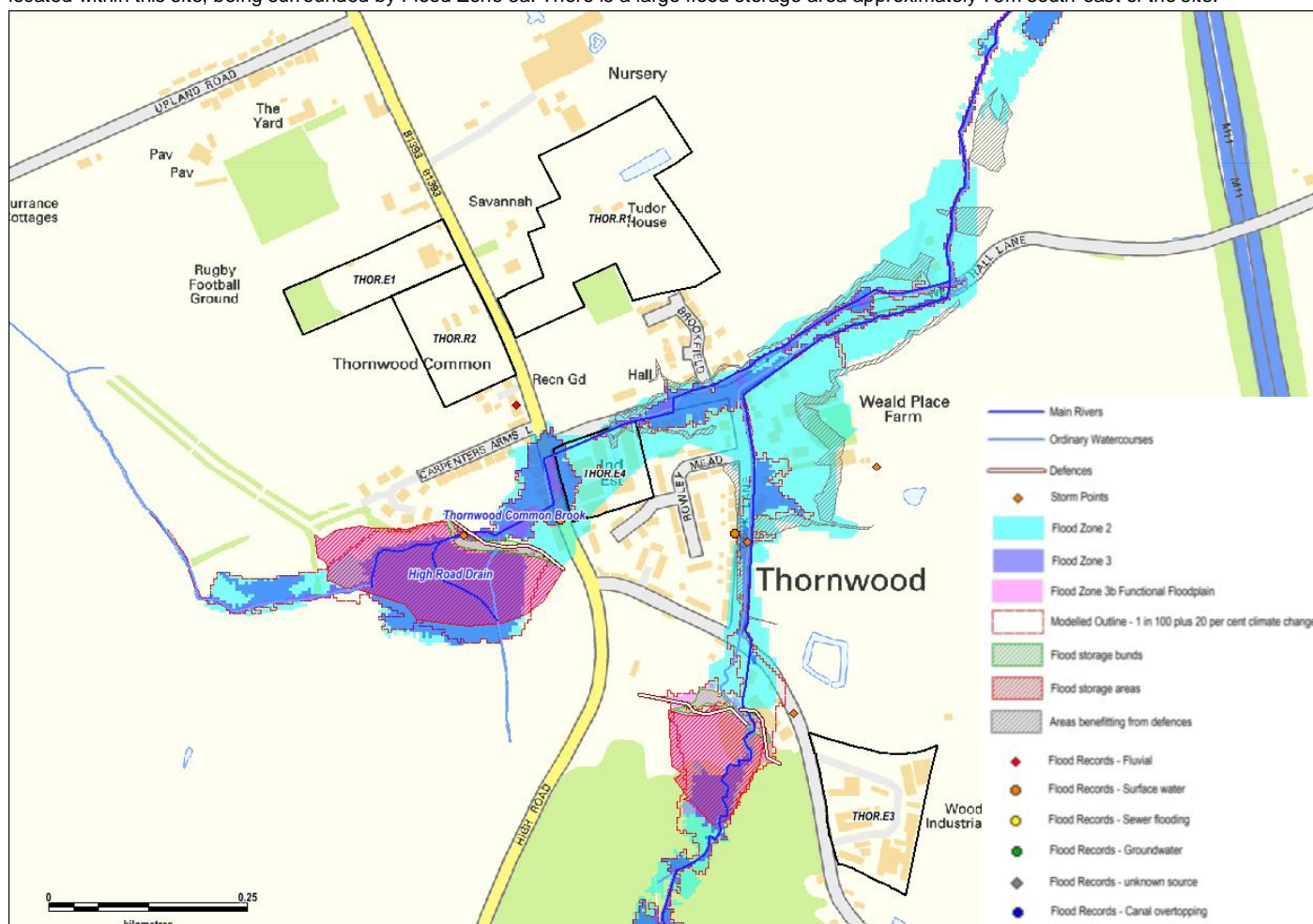
Allocation Reference: THOR.E4	Address: Thornwood, Epping, CM16 6NB	Area (ha): 1.09	Proposed Use: Employment	Vulnerability Classification: Less Vulnerable
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Fluvial Flood Risk

Flood Zone 1: 18%	Flood Zone 2: 70%	Flood Zone 3a: 11%	Flood Zone 3b: 1%
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Flood Zones and Flood Defences

Thornwood Common Brook flows along the northern edge of the site and the Cripsey Brook flows northwards approximately 150m east of the site. These form tributaries of the Upper Roding. The majority of the site is identified as Flood Zone 2 (70%), with the western edge of the site classified as Flood Zone 3 (11%). The site is not shown to benefit from the presence of flood defences. An area of Flood Zone 3b, less than 10m² in size, is located within this site, being surrounded by Flood Zone 3a. There is a large flood storage area approximately 75m south-east of the site.



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Figure A Flood Map for Planning (Rivers and Sea)

Historic Records

The Environment Agency Historic Flood Map records fluvial flooding in this area in December 1981. Approximately 75m north-west of the site there have been 2 reported incidents of fluvial flooding.

Climate Change

In accordance with the PPG, for Less Vulnerable development proposed in Flood Zone 3, the Central (25%) and Higher Central (35%) climate change allowances should be considered. Analysis of the stage-discharge relationship along the Thornwood Brook identifies that the 0.1% AEP (1 in 1000 year) flood level scenario, which corresponds to Flood Zone 2, is greater than the flood levels calculated for the Central climate change allowance, and a close match to the Higher Central scenario. The outline of Flood Zone 2 is therefore appropriate to use as a proxy when considering the impact of climate change on flood risk for this site and surrounding area.

Site Assessment Summary – THOR.E4 Weald Hall Lane Industrial Area

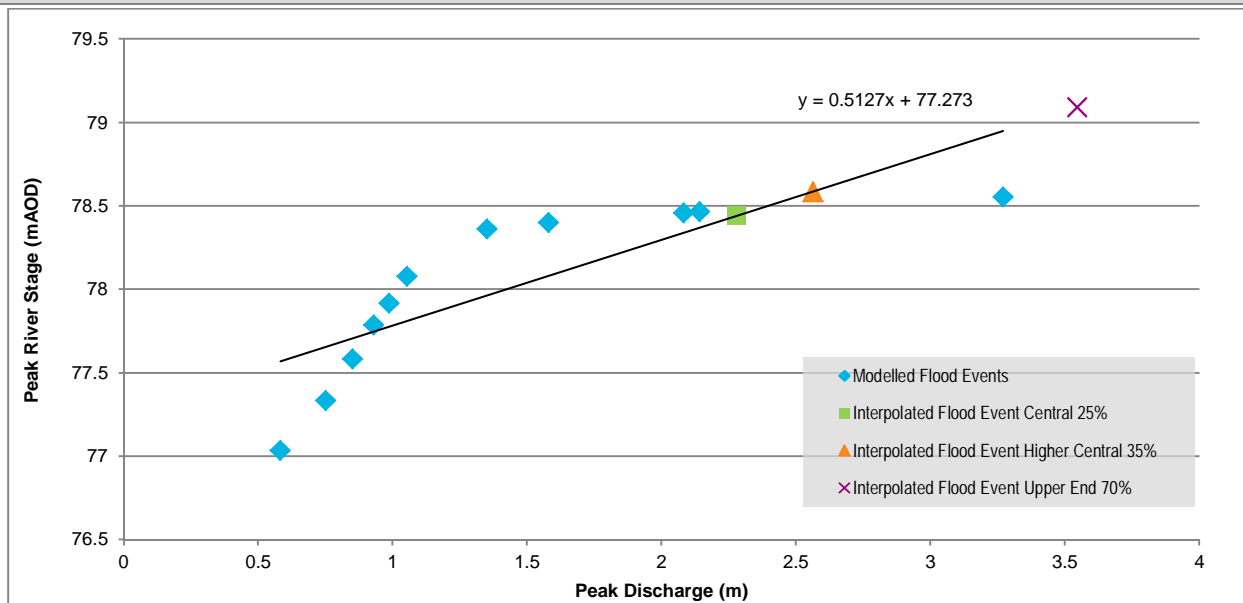


Figure B Stage-Discharge relationship at Node 1035 of the Upper Roding Study 2016

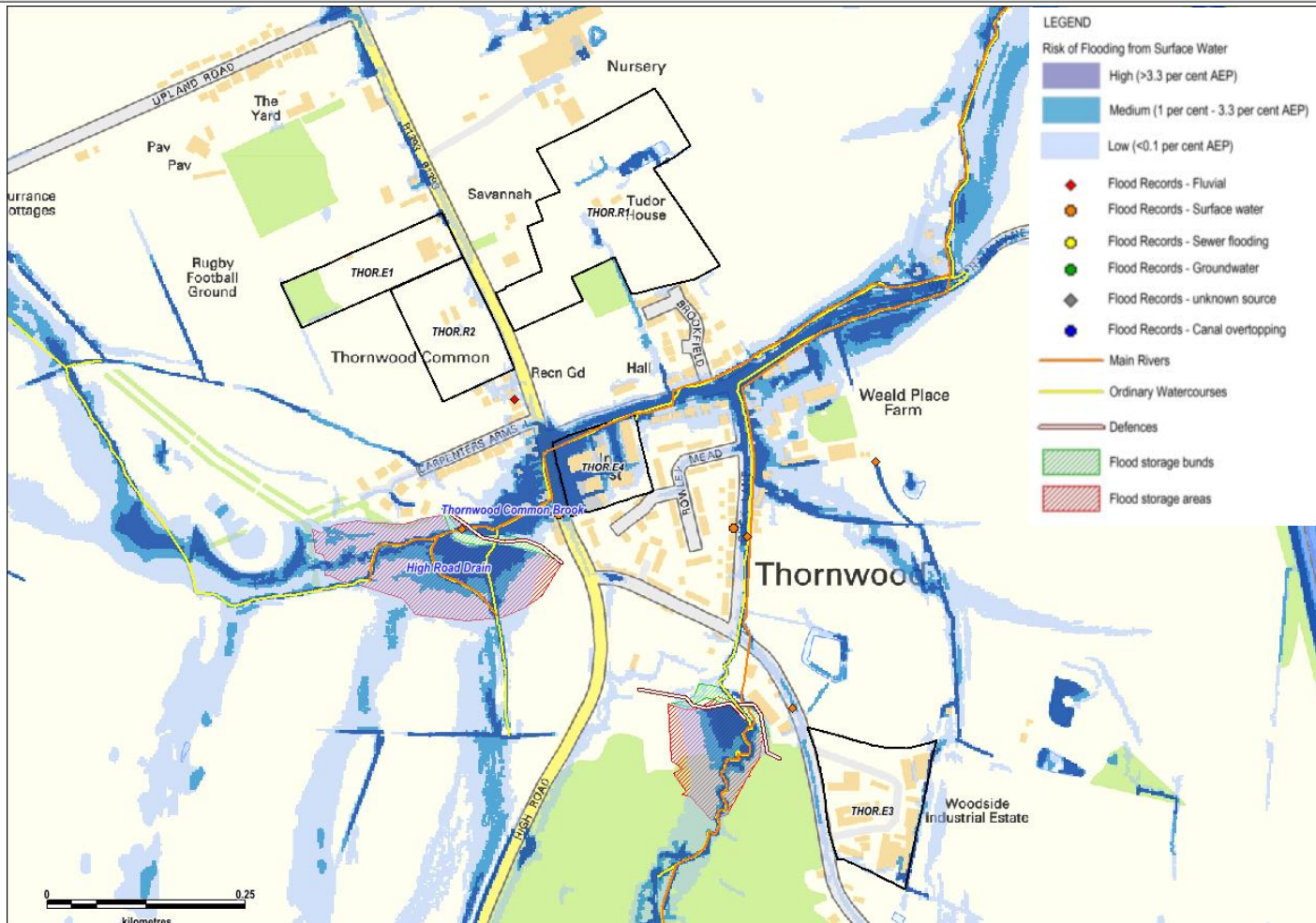
Surface Water Flood Risk

Risk of Flooding from Surface Water (RoFSW)

The RoFSW mapping indicates that the majority of this site is at risk of surface water flooding, with the south-eastern corner of the site being the only region not at risk of surface water flooding. Several high risk surface water flow paths pass through this site, most originating from high risk flow paths along the B1393 and Weald Hall Lane. The majority of the flow pathways flowing through the site have a flood velocity of over 0.25m/s. These flow paths should be considered carefully in the development of the site layout to ensure that proposed development is not placed at surface water flood risk, and that the position of any new development does not divert the flow path to a neighbouring area.

There are 7 reported incidents of surface water flooding within 1km of the site, with the majority south-east of the site.

Site Assessment Summary – THOR.E4 Weald Hall Lane Industrial Area



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Figure C Risk of Flooding from Surface Water (RoFSW)

Geology:

The underlying geology is London Clay formation. This type of geology comprises clay, silt and sand and is typically not very permeable, resulting in rapid runoff of surface water across the ground surface. Overlying this is a layer of Lowestoft Formation, this also comprises of sands, gravels, silts and clays.

Groundwater Flood Risk

The AStGWF mapping (also presented in the Level 1 SFRA, Appendix B Figure 9) indicates that the site is not located in an area that is susceptible to groundwater flooding. This will need to be confirmed during site investigation survey.

Other Sources

The Environment Agency 'Risk of Flooding from Reservoirs' mapping indicates that the site is at not risk of flooding in the event of a failure of a reservoir.

Site Specific Recommendations

Site Assessment Summary – THOR.E4 Weald Hall Lane Industrial Area

Fluvial Modelling

As part of a site specific FRA for this site, additional hydraulic modelling will be required comparing a range of probability events to determine the impact of climate change on the risk of flooding at this location. The 1% AEP (1 in 100 year) flood event including the Central (25%) and Higher Central (35%) allowance are of relevance to the proposed Less Vulnerable development. The modelling will also need to address any potential impact the proposed development may have on flood risk to the surrounding area.

Set-back Distance

Thornwood Common Brook is a main river, and therefore all development should be set back at least 8m from the watercourse. The Environment Agency will need to be consulted and an Environmental Permit obtained for any works within 8m of the watercourse. *Floodplain Compensation*

Land raising and any built development should be avoided within Flood Zone 3. Where alterations to the floodplain are proposed, compensatory floodplain storage will need to be provided on a level-for-level and volume-for-volume basis. The land used to provide compensation storage will need to be in hydraulic connectivity with the existing floodplain, but not already part of the floodplain.

Site Layout and Design

The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of SuDS, taking care to consider SuDS features in accordance with the hierarchy of SuDS (i.e. considering infiltration measures first wherever possible). The suitability of locating proposed surface water drainage features within the fluvial floodplain, as they may be rendered ineffective during times of fluvial flooding.

Finished Floor Levels

Given the proposed use is Less Vulnerable there is no requirement to raise finished floor levels.

Floodplain Compensation

Land raising and any built development should be avoided within Flood Zone 3. Where alterations to the floodplain are proposed, compensatory floodplain storage will need to be provided on a level-for-level and volume-for-volume basis with respect to the 1% AEP (1 in 100 year) design event, including an allowance for climate change. The land used to provide compensation storage will need to be in hydraulic connectivity with the existing floodplain, but not already part of the floodplain.

Resilience Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. Guidance on resilience measures can be found in the 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' published by The Department for Communities and Local Government (CLG).

Access / Egress

It will be necessary to consider whether safe dry access to and from the site can be achieved. The site is located between two watercourses and corresponding areas of Flood Zone 3a. The main access to the site is provided along Nazeing New Road, which passes over the watercourses.

Safe Refuge

Given the proximity to the watercourses and the potential for the access / egress route to be affected by flooding, internal access should be provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. An area of safe refuge should be located above the 1% AEP fluvial flood level including an allowance for climate change. This refuge will have to be permanent and accessible to all occupants and users of the site.

Emergency Planning

The site is not shown to be within an Environment Agency Flood Warning Area. Site occupants should register to receive the warning service. Due to the proximity of the site to the watercourse, Flood Response Plans should be prepared by residents of the site.

LLFA Consultation

It is recommended that potential developers contact Essex CC as the LLFA for further information prior to taking forward site specific plans.

Summary

The proposed development is classified as Less Vulnerable and therefore does not require the formal application of the Exception Test in accordance with the NPPF. The site specific recommendations set out above should be considered as part of a site specific FRA for the site to ensure that future development on the site is safe and does not increase flood risk to the site or surrounding area.

Site Assessment Summary – HONG.E1 Nash Hall Industrial Estate

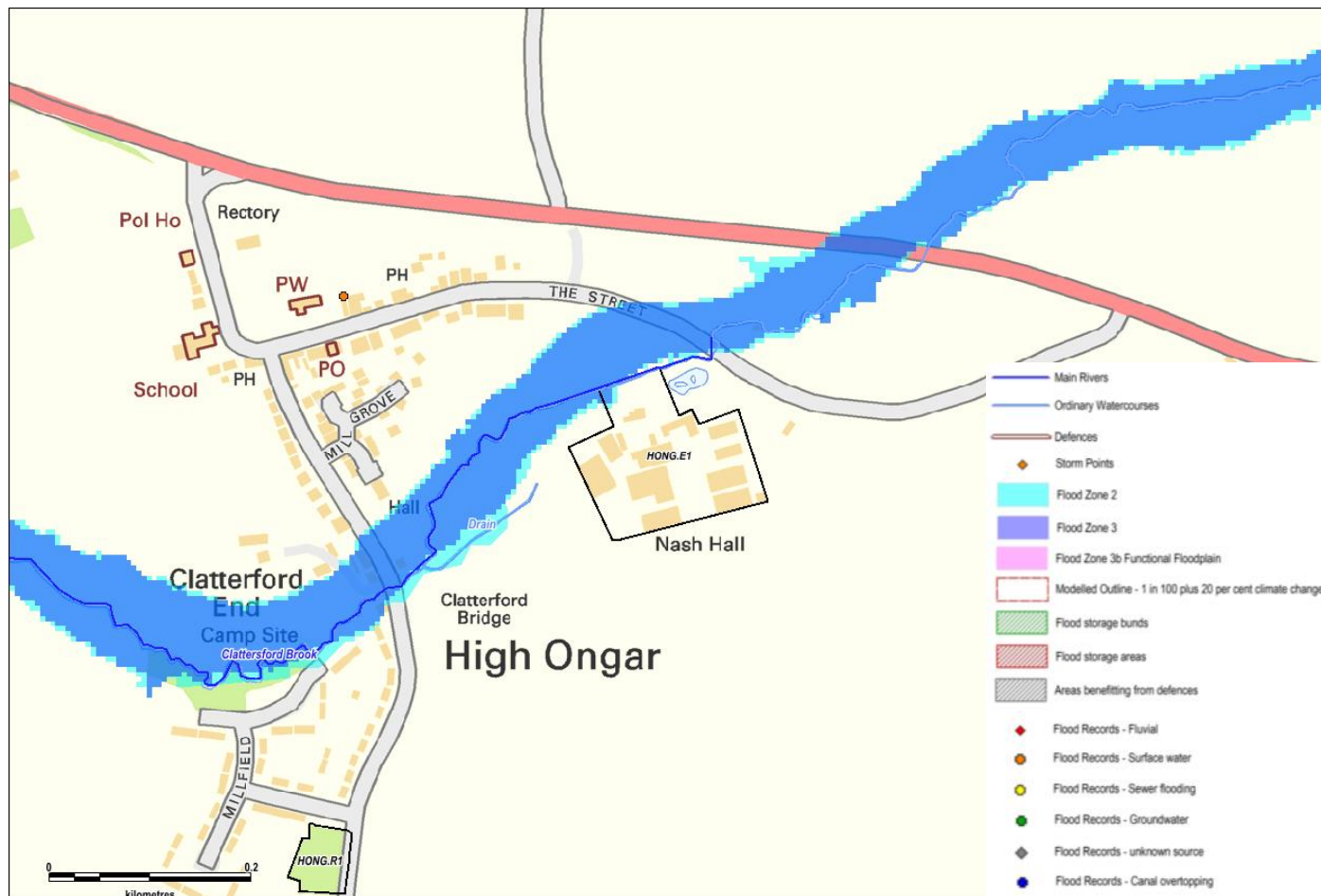
Allocation Reference: HONG.E1	Address: High Ongar, CM5 9NL	Area (ha): 2.00	Proposed Use: Employment	Vulnerability Classification: Less Vulnerable
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Fluvial Flood Risk

Flood Zone 1: 98%	Flood Zone 2: 1%	Flood Zone 3a: 1%	Flood Zone 3b: 0%
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Flood Zones and Flood Defences

Clattersford Brook runs along the northern edge of the site. The majority of the site lies within Flood Zone 1 (98%), with a small area of land in the north, adjacent to Clattersford Brook, being located in Flood Zone 2 (1%) or 3 (1%). This site is not shown to benefit from the presence of flood defences.



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Figure A Flood Map for Planning (Rivers and Sea)

Historic Records

The Environment Agency Historic Flood Map does not record any incidents of fluvial flooding within this area.

Climate Change

In accordance with the PPG, for Less Vulnerable development proposed in Flood Zone 3, the Central (25%) and Higher Central (35%) climate change allowances should be considered. No detailed hydraulic modelling of the Clattersford Brook has been undertaken (it is not included in the model for the Upper Roding of which it is a tributary). It is assumed that the outline presented above is generated from broad scale JFLOW modelling.

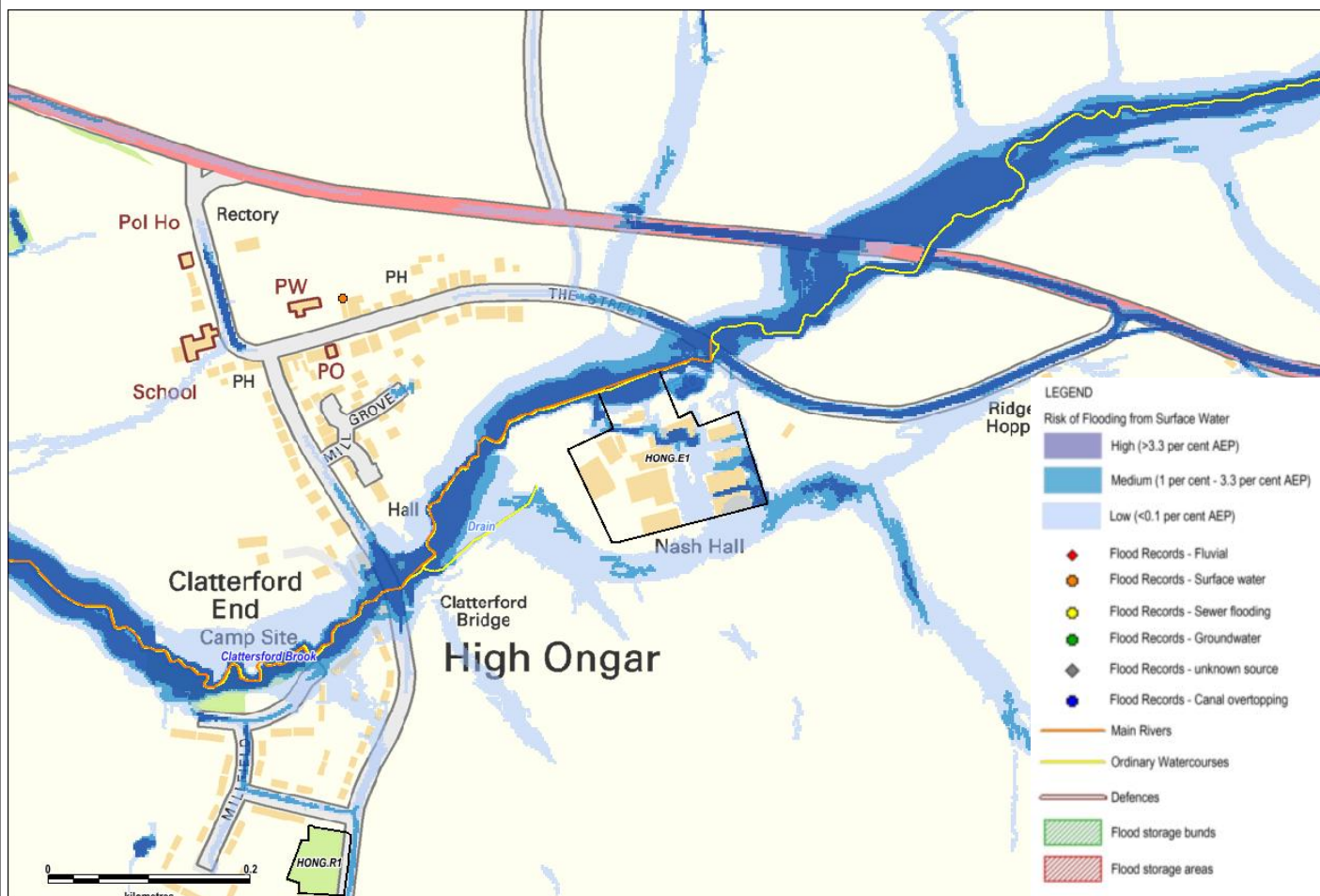
Surface Water Flood Risk

Risk of Flooding from Surface Water (RoFSW)

The RoFSW mapping indicates that the northern and eastern regions of this site are at the greatest risk of surface water flooding. Several high risk surface water flow paths are situated within this site, with the majority of these having a flood velocity of over 0.25m/s and a depth of between 300 and 900mm. These flow paths should be considered carefully in the development of the site layout to ensure that proposed development is not placed at surface water flood risk, and that the position of any new development does not divert the flow path to a neighbouring area.

Site Assessment Summary – HONG.E1 Nash Hall Industrial Estate

The site is also completely surrounded by surface water flow paths, those of high flood risk in the north (notably those adjacent to Clattersford Brook and along The Street), and of low to medium risk in the south around Nash Hill.



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Figure B Risk of Flooding from Surface Water (RoFSW)

Geology:

The bedrock geology of this site is comprised of London Clay Formation, overlying which is a layer of alluvium. Both strata are typically not very permeable, the superficial deposits contains sufficient, saturated permeable material to yield significant quantities of water to wells and springs, reducing the build-up of surface water across the ground surface

Groundwater Flood Risk

The ASStGWF mapping (also presented in the Level 1 SFRA, Appendix B Figure 9) indicates that the northern section of the site lies in a region of medium ($\geq 25\%$ $< 50\%$) susceptibility to groundwater flooding. This will need to be confirmed during site investigation survey.

Other Sources

The Environment Agency 'Risk of Flooding from Reservoirs' mapping indicates that the site is at not risk of flooding in the event of a failure of a reservoir.

Site Specific Recommendations

Fluvial Modelling

As part of a site specific FRA for this site at the planning application stage, a hydraulic model will need to be developed to determine in more detail the risk of flooding from the Clattersford Brook including the impact of climate change. The 1% AEP (1 in 100 year) flood event including the Central (25%) and Higher Central (35%) allowance are of relevance to the proposed Less Vulnerable development. The modelling will also need to address any potential impact the proposed development may have on flood risk to the surrounding area.

Set-back Distance

Clattersford Brook is a Main River, and therefore all development should be set back at least 8m from the watercourse. The Environment Agency will

Site Assessment Summary – HONG.E1 Nash Hall Industrial Estate

need to be consulted and an Environmental Permit obtained for any works within 8m of the watercourse.

Access / Egress

It will be necessary to consider whether safe dry access to and from the site can be achieved. The site is located south of a main river (Clattersford Brook) and corresponding areas of Flood Zone 3a. The main access to the site is provided along The Street via Chelmsford Road, which passes over the watercourses. In addition to this, during a large surface water flooding incident the site may become completely surrounded by flood water, providing little opportunity to safe dry access to and from the site.

Safe Refuge

Given the proximity to the watercourse and the potential for the access / egress route to be affected by flooding, internal access should be provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. An area of safe refuge should be located above the 1% AEP fluvial flood level including an allowance for climate change. This refuge will have to be permanent and accessible to all occupants and users of the site.

Site Layout and Design

The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of SuDS, taking care to consider SuDS features in accordance with the hierarchy of SuDS (i.e. considering infiltration measures first wherever possible). The suitability of locating proposed surface water drainage features within the fluvial floodplain, as they may be rendered ineffective during times of fluvial flooding.

Finished Floor Levels

Given the proposed use is Less Vulnerable there is no requirement to raise finished floor levels.

Floodplain Compensation

Land raising and any built development should be avoided within Flood Zone 3. Where alterations to the floodplain are proposed, compensatory floodplain storage will need to be provided on a level-for-level and volume-for-volume basis with respect to the 1% AEP (1 in 100 year) design event, including an allowance for climate change. The land used to provide compensation storage will need to be in hydraulic connectivity with the existing floodplain, but not already part of the floodplain.

Resilience Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. Guidance on resilience measures can be found in the 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' published by The Department for Communities and Local Government (CLG).

Emergency Planning

The site is not shown to be within an Environment Agency Flood Warning Area. Site occupants should register to receive the Upper River Roding Flood Alert warning service. Due to the proximity of the site to the watercourse, Flood Response Plans should be prepared by residents of the site.

LLFA Consultation

It is recommended that potential developers contact Essex CC as the LLFA for further information prior to taking forward site specific plans.

Summary

The proposed development is classified as Less Vulnerable and therefore does not require the formal application of the Exception Test in accordance with the NPPF. The site specific recommendations set out above should be considered as part of a site specific FRA for the site at the plannign application stage to ensure that future development on the site is safe and does not increase flood risk to the site or surrounding area.

Site Assessment Summary – RUR.E17 Brookside Garage

Allocation Reference: RUR.E17	Address: Gravel Lane, IG7 6DQ	Area (ha): 0.34	Proposed Use: Employment	Vulnerability Classification: Less Vulnerable
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Fluvial Flood Risk

Flood Zone 1: 99%	Flood Zone 2: -%	Flood Zone 3a: 1%	Flood Zone 3b: -%
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Flood Zones and Flood Defences

Little London Brook cuts through the site. Associated with this main river is a small area (1%) of Flood Zone 3, locate in the north of the RUR.E17 site. The rest of the site is designated as Flood Zone 1 (99%). The majority of the area within 2km of the site also is designated as Flood Zone 1. This site is shown not to benefit from the presence of flood defences.



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Figure A Flood Map for Planning (Rivers and Sea)

Historic Records

The Environment Agency Historic Flood Map does not record any incidents of fluvial flooding within this area. In addition to this, there have not been any reported incidents of fluvial flooding within 1km of the site.

Climate Change

In accordance with the PPG, for Less Vulnerable development proposed in Flood Zone 3, the Central (25%) and Higher Central (35%) climate change allowances should be considered. Little London Brook is a tributary of the Roding, however there is no modelling currently available on this watercourse.

Surface Water Flood Risk

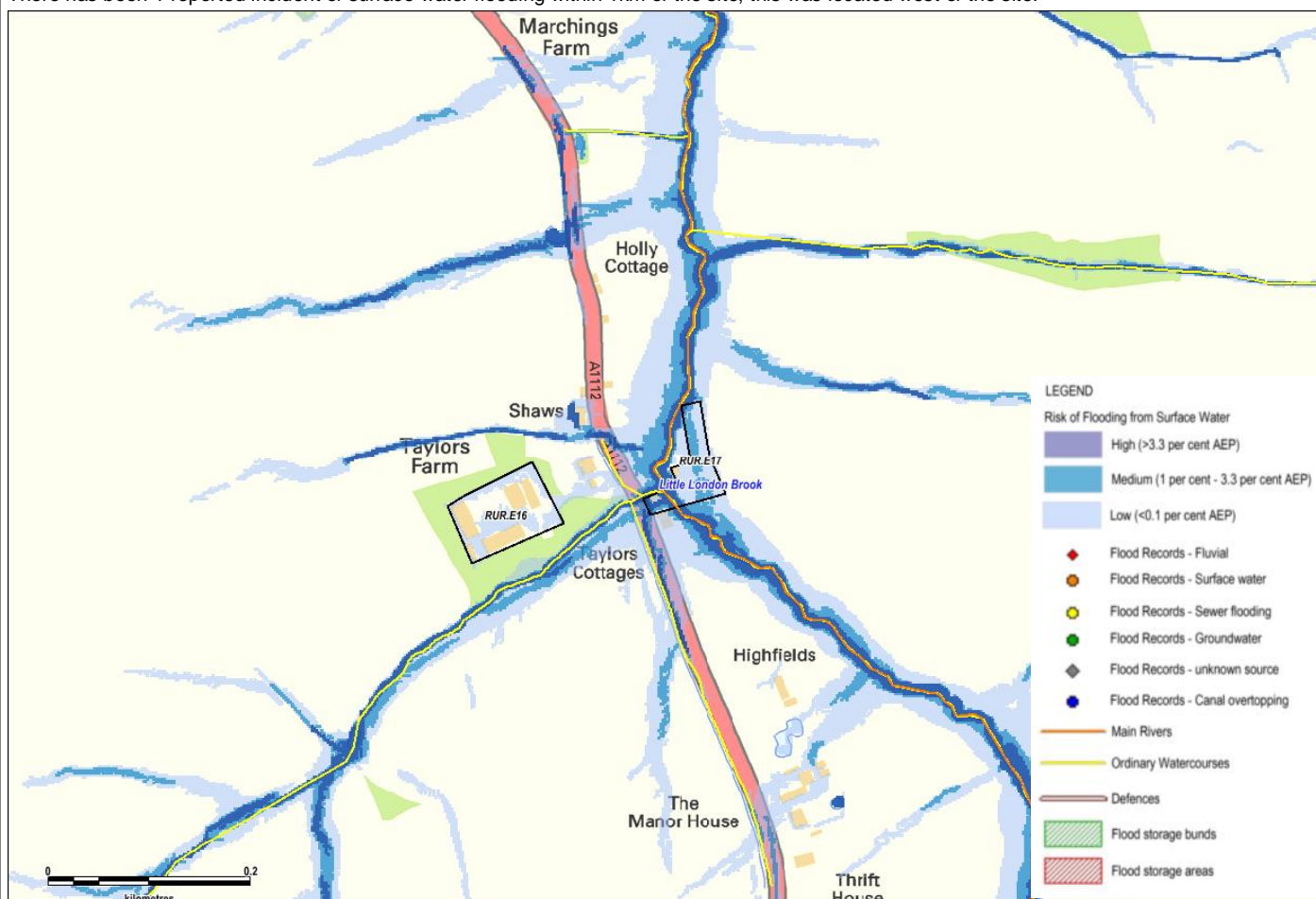
Risk of Flooding from Surface Water (RoFSW)

In contrast to the low fluvial flood risk present within this site, the RoFSW mapping indicates that almost all of this site is at risk from surface water flooding, with large proportions of the site located in high risk regions, most notably in the south-east of the site where three high risk flow pathways

Site Assessment Summary – RUR.E17 Brookside Garage

converge and flow northwards. There is also a medium risk flow path which runs through the centre of the site. These flow paths should be considered carefully in the development of the site layout to ensure that new development is not placed at surface water flood risk, and that the position of any new development does not divert the flow path to a neighbouring area.

There has been 1 reported incident of surface water flooding within 1km of the site, this was located west of the site.



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Figure B Risk of Flooding from Surface Water (RoFSW)

Geology:

The underlying geology is London Clay formation. This type of geology comprises clay, silt and sand and is typically not very permeable, resulting in rapid runoff of surface water across the ground surface.

Groundwater Flood Risk

The ASGWf mapping (also presented in the Level 1 SFRA, Appendix B Figure 9) indicates that the site lies within a region which has a low susceptibility to groundwater flooding (<25%). The risk of groundwater flooding in this area is therefore generally considered to be low. This will need to be confirmed during site investigation survey.

Other Sources

The Environment Agency 'Risk of Flooding from Reservoirs' mapping indicates that the site is at risk from flooding due to reservoir failure, notably the reservoir located at Chigwell Water Works. If this reservoir were to fail the flood depth within the central region of this site may exceed 2m. Given the regular inspection of these reservoirs in accordance with the Reservoirs Act 1975, flooding from reservoirs is considered to be a managed risk.

Site Specific Recommendations

Fluvial Modelling

As part of a site specific FRA for this site at the planning application stage, additional hydraulic modelling will be required comparing a range of probability events to determine the impact of climate change on the risk of flooding at this location. The 1% AEP (1 in 100 year) flood event including the Central (25%) and Higher Central (35%) allowance are of relevance to the proposed Less Vulnerable development. The modelling will also need to address any potential impact the proposed development may have on flood risk to the surrounding area.

Site Assessment Summary – RUR.E17 Brookside Garage

Set-back Distance

Due to the close proximity of the Little London Brook, a main river, to the site, development should be set back at least 8m from the watercourse. The Environment Agency will need to be consulted and an Environmental Permit obtained for any works within 8m of the watercourse.

Access / Egress

It will be necessary to consider whether safe dry access to and from the site can be achieved. The main access to the site is provided along the A1112. This road passes over Little London Brook approximately 1km south of the site, and is located within Flood Zone 3 approximately 1km north of the site.

Safe Refuge

Given the proximity to the ordinary watercourse and the potential for the access / egress route to be affected by flooding, internal access should be provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. An area of safe refuge should be located above the 1% AEP fluvial flood level including an allowance for climate change. This refuge will have to be permanent and accessible to all occupants and users of the site.

Site Layout and Design

The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of SuDS, taking care to consider SuDS features in accordance with the hierarchy of SuDS (i.e. considering infiltration measures first wherever possible). The suitability of locating proposed surface water drainage features within the fluvial floodplain, as they may be rendered ineffective during times of fluvial flooding.

Finished Floor Levels

Given the proposed use is Less Vulnerable there is no requirement to raise finished floor levels.

Floodplain Compensation

Land raising and any built development should be avoided within Flood Zone 3. Where alterations to the floodplain are proposed, compensatory floodplain storage will need to be provided on a level-for-level and volume-for-volume basis with respect to the 1% AEP (1 in 100 year) design event, including an allowance for climate change. The land used to provide compensation storage will need to be in hydraulic connectivity with the existing floodplain, but not already part of the floodplain.

Resilience Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. Guidance on resilience measures can be found in the 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' published by The Department for Communities and Local Government (CLG).

Emergency Planning

The site is not shown to be within an Environment Agency Flood Warning Area. Site occupants should register to receive the warning service further down the catchment for the FWA for River Roding at Abridge. Due to the proximity of the site to the watercourse, Flood Response Plans should be prepared by residents of the site.

LLFA Consultation

It is recommended that potential developers contact Essex CC as the LLFA for further information prior to taking forward site specific plans.

Summary

The proposed development is classified as Less Vulnerable and therefore does not require the formal application of the Exception Test in accordance with the NPPF. The site specific recommendations set out above should be considered as part of a site specific FRA at the planning application stage for the site to ensure that future development on the site is safe and does not increase flood risk to the site or surrounding area.

Site Assessment Summary – RUR.E20 Land at Stewarts Farm

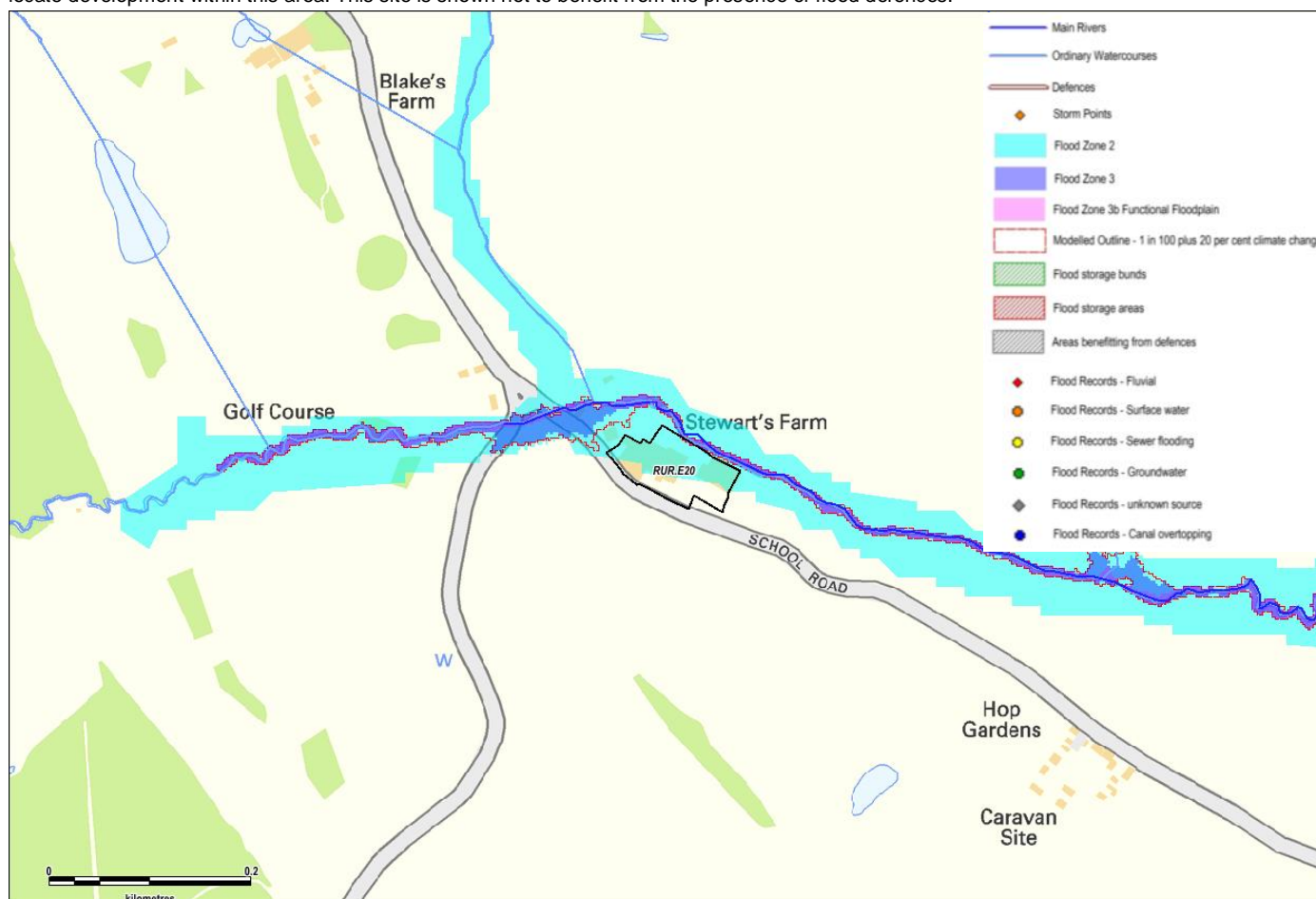
Allocation Reference: RUR.E20	Address: School Road, Stanford Rivers, Ongar, Essex, CM5 9PT	Area (ha): 0.60	Proposed Use: Employment	Vulnerability Classification: Less Vulnerable
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Fluvial Flood Risk

Flood Zone 1: 39.6%	Flood Zone 2: 60%	Flood Zone 3a: -%	Flood Zone 3b: 0.4%
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Flood Zones and Flood Defences

Stanford Hall Brook flows eastwards north of the site. The majority of the site is designated as Flood Zone 2 (60%), with a very small area in the north of the site located in Flood Zone 3b. Flood Zone 3b is defined as land where water has to be stored in times of flood. It is not appropriate to locate development within this area. This site is shown not to benefit from the presence of flood defences.



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Figure A Flood Map for Planning (Rivers and Sea)

Historic Records

The Environment Agency Historic Flood Map records one incident of fluvial flooding within this area, this event occurred in December 1981. There have been no further reported incidents of fluvial flooding within 1km of the site.

Climate Change

In accordance with the PPG, for Less Vulnerable development proposed in Flood Zone 3, the Central (25%) and Higher Central (35%) climate change allowances should be considered. Analysis of the stage-discharge relationship along the Stanford Hall Brook identifies that the 0.1% AEP (1 in 1000 year) flood level for the undefended model scenario, which corresponds to Flood Zone 2, is greater than the flood levels calculated for the Central and Higher Central climate change allowances. The outline of Flood Zone 2 is therefore appropriate to use as a proxy when considering the impact of climate change on flood risk for this site and surrounding area.

Site Assessment Summary – RUR.E20 Land at Stewarts Farm

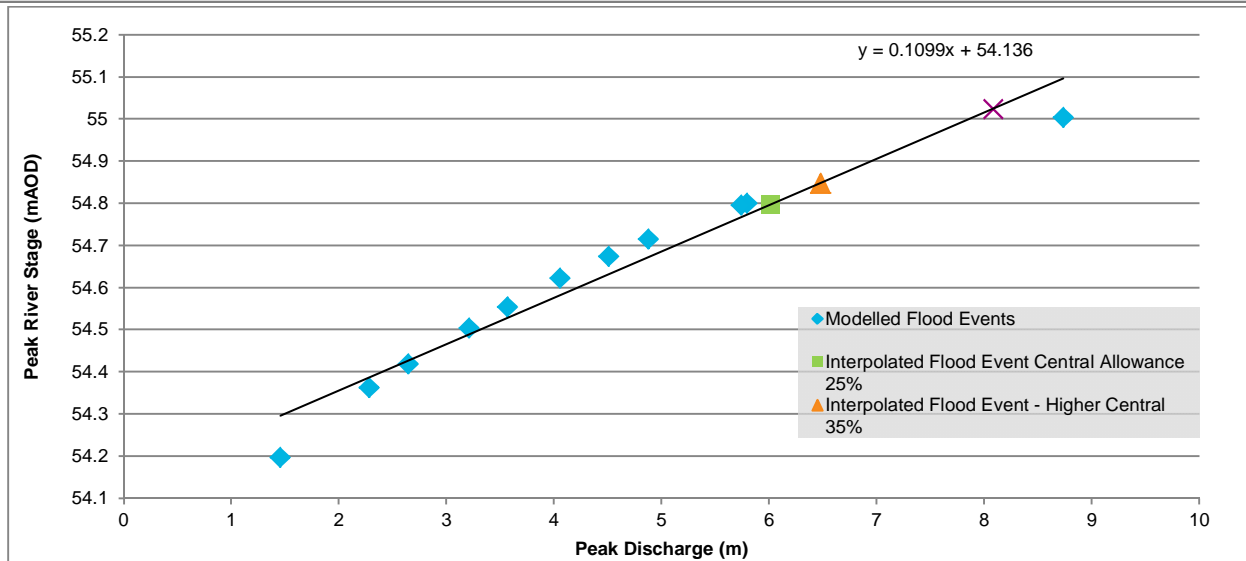


Figure B Stage-Discharge relationship at Node SH.102 of the Upper Roding Modelling Study 2016

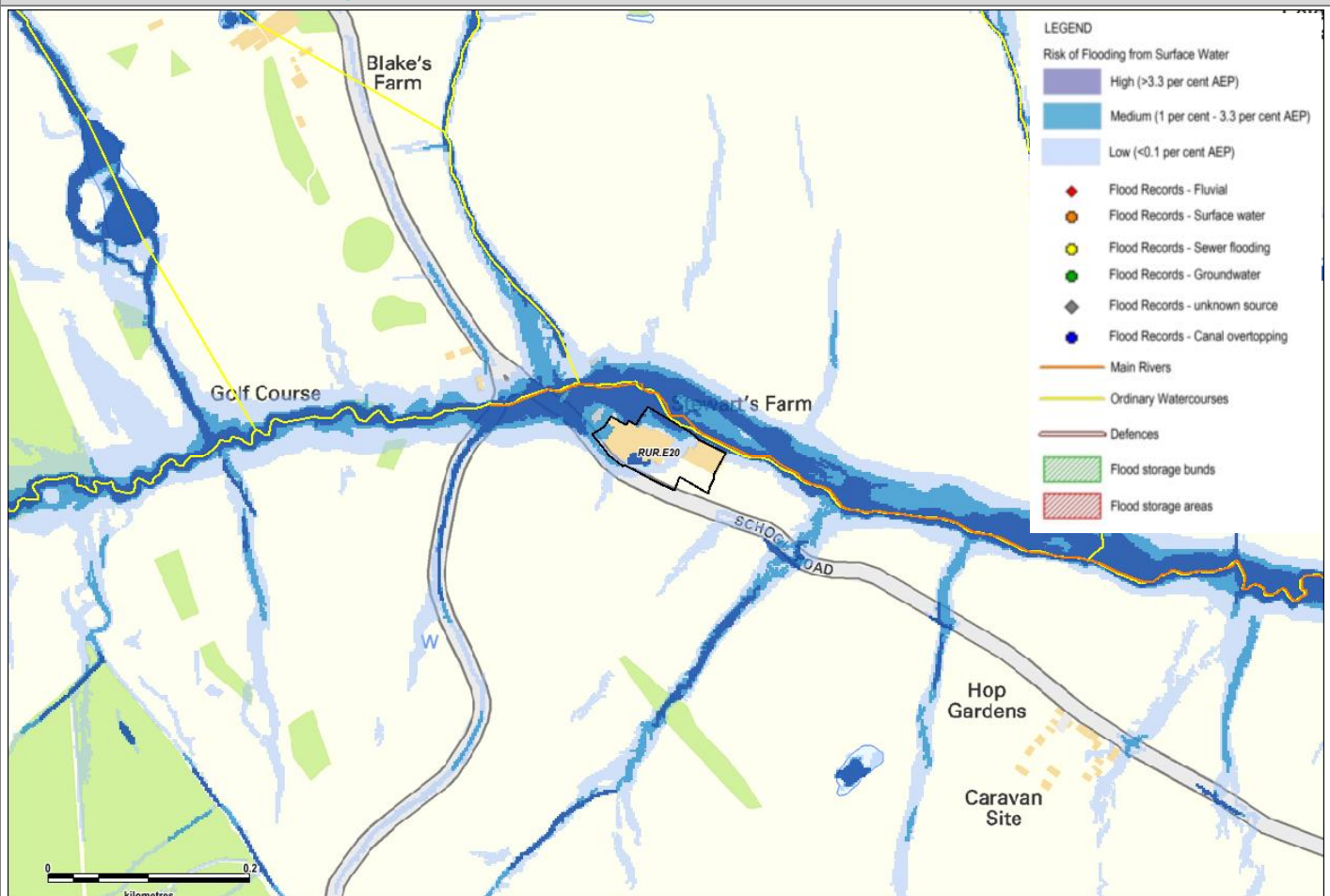
Surface Water Flood Risk

Risk of Flooding from Surface Water (RoFSW)

The RoFSW mapping suggests that this site is situated just south of a wide (approximately 40m) high risk, eastern travelling flow path. Small areas in the north have a high risk of surface water flooding; these areas correspond with the aforementioned high risk flow path. This flow path should be considered carefully in the development of the site layout to ensure that new development is not placed at surface water flood risk, and that the position of any new development does not divert the flow path to a neighbouring area. There is a small region in the centre in which there is a high susceptibility to ponding. A larger area of land in the north-west of the site is suggested to not be at risk of surface water flooding, however it is surrounded on all sides by regions of low to high risk of flooding from surface water.

There have been 2 reported incidents of surface water flooding within 1km of the site, both located north of the site.

Site Assessment Summary – RUR.E20 Land at Stewarts Farm



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Figure C Risk of Flooding from Surface Water (RoFSW)

Geology:

The underlying geology is London Clay formation. This type of geology comprises clay, silt and sand and is typically not very permeable, resulting in rapid runoff of surface water across the ground surface.

Groundwater Flood Risk

The ASTGWF mapping (also presented in the Level 1 SFRA, Appendix B Figure 9) indicates that the site lies within a region which has a low susceptibility to groundwater flooding (<25%). The risk of groundwater flooding in this area is therefore generally considered to be low. This will need to be confirmed during site investigation survey.

Other Sources

The Environment Agency ‘Risk of Flooding from Reservoirs’ mapping indicates that the site is not at risk from flooding due to reservoir failure.

Site Specific Recommendations

Fluvial Modelling

As part of a site specific FRA for this site at the planning application stage, additional hydraulic modelling will be required comparing a range of probability events to determine the impact of climate change on the risk of flooding at this location. The 1% AEP (1 in 100 year) flood event including the Central (25%) and Higher Central (35%) allowance are of relevance to the proposed Less Vulnerable development. The modelling will also need to address any potential impact the proposed development may have on flood risk to the surrounding area.

Set-back Distance

Due to the close proximity of Stanford Hall Brook, a main river, to the site, development should be set back at least 8m from the watercourse. The Environment Agency will need to be consulted and an Environmental Permit obtained for any works within 8m of the watercourse.

Access / Egress

It will be necessary to consider whether safe dry access to and from the site can be achieved. The main access to the site is provided along School

Site Assessment Summary – RUR.E20 Land at Stewarts Farm

Road. This road passes over Stanford Hall Brook.

Safe Refuge

Given the proximity to the ordinary watercourse and the potential for the access / egress route to be affected by flooding, internal access should be provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. An area of safe refuge should be located above the 1% AEP fluvial flood level including an allowance for climate change. This refuge will have to be permanent and accessible to all occupants and users of the site.

Site Layout and Design

The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of SuDS, taking care to consider SuDS features in accordance with the hierarchy of SuDS (i.e. considering infiltration measures first wherever possible). The suitability of locating proposed surface water drainage features within the fluvial floodplain, as they may be rendered ineffective during times of fluvial flooding.

Finished Floor Levels

Given the proposed use is Less Vulnerable there is no requirement to raise finished floor levels.

Floodplain Compensation

Land raising and any built development should be avoided within Flood Zone 3. Where alterations to the floodplain are proposed, compensatory floodplain storage will need to be provided on a level-for-level and volume-for-volume basis with respect to the 1% AEP (1 in 100 year) design event, including an allowance for climate change. The land used to provide compensation storage will need to be in hydraulic connectivity with the existing floodplain, but not already part of the floodplain.

Resilience Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. Guidance on resilience measures can be found in the 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' published by The Department for Communities and Local Government (CLG).

Emergency Planning

The site is not shown to be within an Environment Agency Flood Warning Area. Site occupants should register to receive the warning service further down the catchment for the River Roding from Ongar to Stapleford. Due to the proximity of the site to the watercourse, Flood Response Plans should be prepared by residents of the site.

LLFA Consultation

It is recommended that potential developers contact Essex CC as the LLFA for further information prior to taking forward site specific plans.

Summary

The proposed development is classified as Less Vulnerable and therefore does not require the formal application of the Exception Test in accordance with the NPPF. The site specific recommendations set out above should be considered as part of a site specific FRA for the site at the planning application stage, to ensure that future development on the site is safe and does not increase flood risk to the site or surrounding area.

Site Assessment Summary – RUR.E23 Hobbs Cross Business Centre

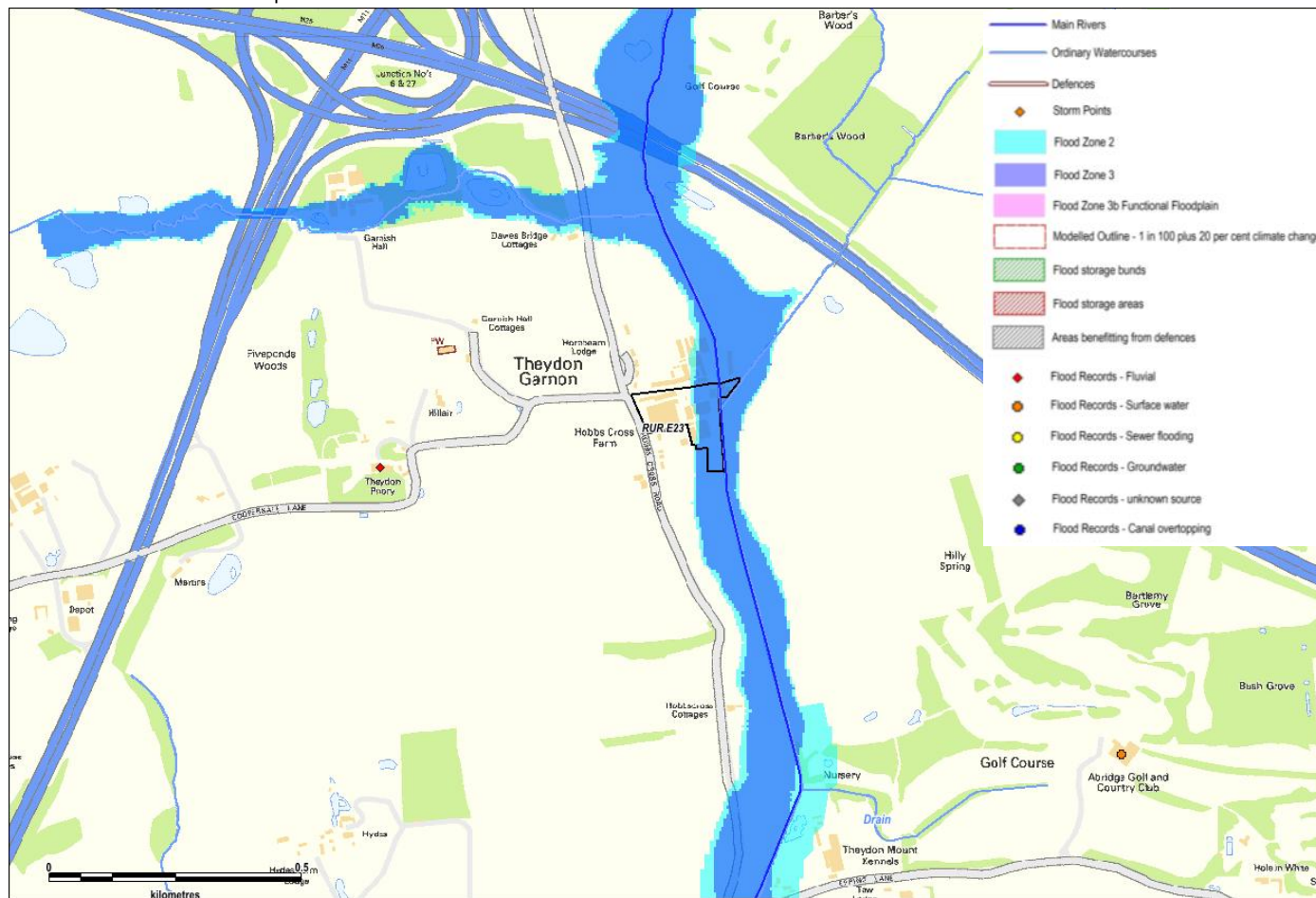
Allocation Reference: RUR.E23	Address: Theydon Garnon, CM16 7NY	Area (ha): 1.76	Proposed Use: Employment	Vulnerability Classification: Less Vulnerable
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Fluvial Flood Risk

Flood Zone 1: 50%	Flood Zone 2: 4%	Flood Zone 3a: 46%	Flood Zone 3b: -%
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Flood Zones and Flood Defences

Brookhouse Brook flows northwards along the eastern boundary of the site, entering the site in the north-east. As a result of this, a large portion of the site is designated as Flood Zone 3a (46%). In contrast to this, the western half of the site is located within Flood Zone 1 (50%). This site is shown not to benefit from the presence of flood defences.



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Figure A Flood Map for Planning (Rivers and Sea)

Historic Records

The Environment Agency Historic Flood Map records no incidents of fluvial flooding within this area. One incident of fluvial flooding has been reported within 1km of the site, this was located approximately 500m west of the site.

Climate Change

In accordance with the PPG, for Less Vulnerable development proposed in Flood Zone 3, the Central (25%) and Higher Central (35%) climate change allowances should be considered. Brookhouse Brook is a tributary of the Middle Roding, however there is no modelling currently available for this watercourse.

Surface Water Flood Risk

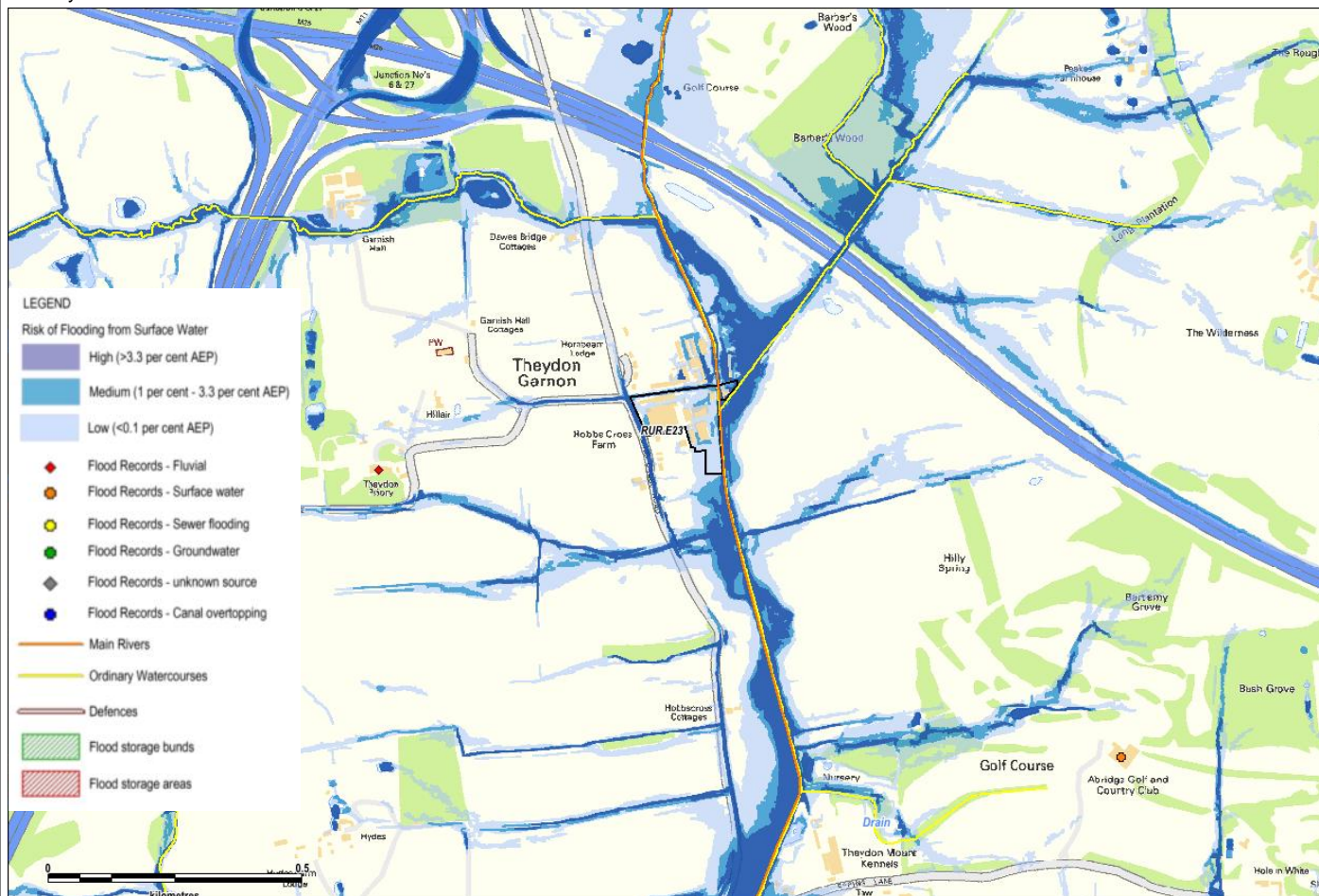
Risk of Flooding from Surface Water (RoFSW)

The RoFSW mapping indicates that the majority of this site lies within a region which has a low risk of flooding from surface water. Most of these regions of low risk are in the form of flow paths travelling throughout the industrial estate. The site is bookended in the east and west by tow high risk flow paths, both flowing southbound. A small section of the eastern flow path encroaches into the site, increasing the surface water flood risk of

Site Assessment Summary – RUR.E23 Hobbs Cross Business Centre

certain areas. The western flow path, despite not passing into the site, is important as it flows along Hobbs Cross Road, an important access/egress route to and from the site. These flow paths should be considered carefully in the development of the site layout to ensure that new development is not placed at surface water flood risk, and that the position of any new development does not divert the flow path to a neighbouring area.

There has been 1 reported incident of surface water flooding within 1km of the site, the was located south-east of the site, close to Abridge Golf and Country Club.



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Figure B Risk of Flooding from Surface Water (RoFSW)

Geology:

The underlying geology is London Clay formation. This type of geology comprises clay, silt and sand and is typically not very permeable, resulting in rapid runoff of surface water across the ground surface. Overlying this bedrock geology is a superficial layer of impermeable alluvium.

Historic Records:

There have been no reported groundwater flooding incidents within 1km of the site.

Groundwater Flood Risk

The AS_tGWF mapping (also presented in the Level 1 SFRA, Appendix B Figure 9) indicates that the site lies within a region which is has a high susceptibility to groundwater flooding (>50% <75%). The risk of groundwater flooding in this area is therefore generally considered to be high. This will need to be confirmed during site investigation survey.

Other Sources

The Environment Agency ‘Risk of Flooding from Reservoirs’ mapping indicates that the site is not at risk from flooding due to reservoir failure.

Site Specific Recommendations

Fluvial Modelling

As part of a site specific FRA for this site at the planning application stage, additional hydraulic modelling will be required comparing a range of probability events to determine the impact of climate change on the risk of flooding at this location. The 1% AEP (1 in 100 year) flood event including the Central (25%) and Higher Central (35%) allowance are of relevance to the proposed Less Vulnerable development. The modelling will also need

Site Assessment Summary – RUR.E23 Hobbs Cross Business Centre

to address any potential impact the proposed development may have on flood risk to the surrounding area.

Set-back Distance

Due to the close proximity of Brookhouse Brook, a main river, to the site, development should be set back at least 8m from the watercourse. The Environment Agency will need to be consulted and an Environmental Permit obtained for any works within 8m of the watercourse.

Access / Egress

It will be necessary to consider whether safe dry access to and from the site can be achieved. The main access to the site is provided along Hobbs Cross Road. Whilst this road does not cross Brookhouse Brook, it does pass through the corresponding Flood Zone 3a.

Safe Refuge

Given the proximity to the ordinary watercourse and the potential for the access / egress route to be affected by flooding, internal access should be provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. An area of safe refuge should be located above the 1% AEP fluvial flood level including an allowance for climate change. This refuge will have to be permanent and accessible to all occupants and users of the site.

Site Layout and Design

The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of SuDS, taking care to consider SuDS features in accordance with the hierarchy of SuDS (i.e. considering infiltration measures first wherever possible). The suitability of locating proposed surface water drainage features within the fluvial floodplain, as they may be rendered ineffective during times of fluvial flooding.

Floodplain Compensation

Land raising and any built development should be avoided within Flood Zone 3. Where alterations to the floodplain are proposed, compensatory floodplain storage will need to be provided on a level-for-level and volume-for-volume basis with respect to the 1% AEP (1 in 100 year) design event, including an allowance for climate change. The land used to provide compensation storage will need to be in hydraulic connectivity with the existing floodplain, but not already part of the floodplain.

Finished Floor Levels

Given the proposed use is Less Vulnerable there is no requirement to raise finished floor levels.

Resilience Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. Guidance on resilience measures can be found in the 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' published by The Department for Communities and Local Government (CLG).

Emergency Planning

The site is not shown to be within an Environment Agency Flood Warning Area. Site occupants should register to receive the warning service for the wider catchment for River Roding from Ongar to Stapleford. Due to the proximity of the site to the watercourse, Flood Response Plans should be prepared by residents of the site.

LLFA Consultation

It is recommended that potential developers contact Essex CC as the LLFA for further information prior to taking forward site specific plans.

Summary

The proposed development is classified as Less Vulnerable and therefore does not require the formal application of the Exception Test in accordance with the NPPF. The site specific recommendations set out above should be considered as part of a site specific FRA for the site at the planning application stage, to ensure that future development on the site is safe and does not increase flood risk to the site or surrounding area.

Site Assessment Summary – WAL.E4 Cartersfield Road/Brooker Road

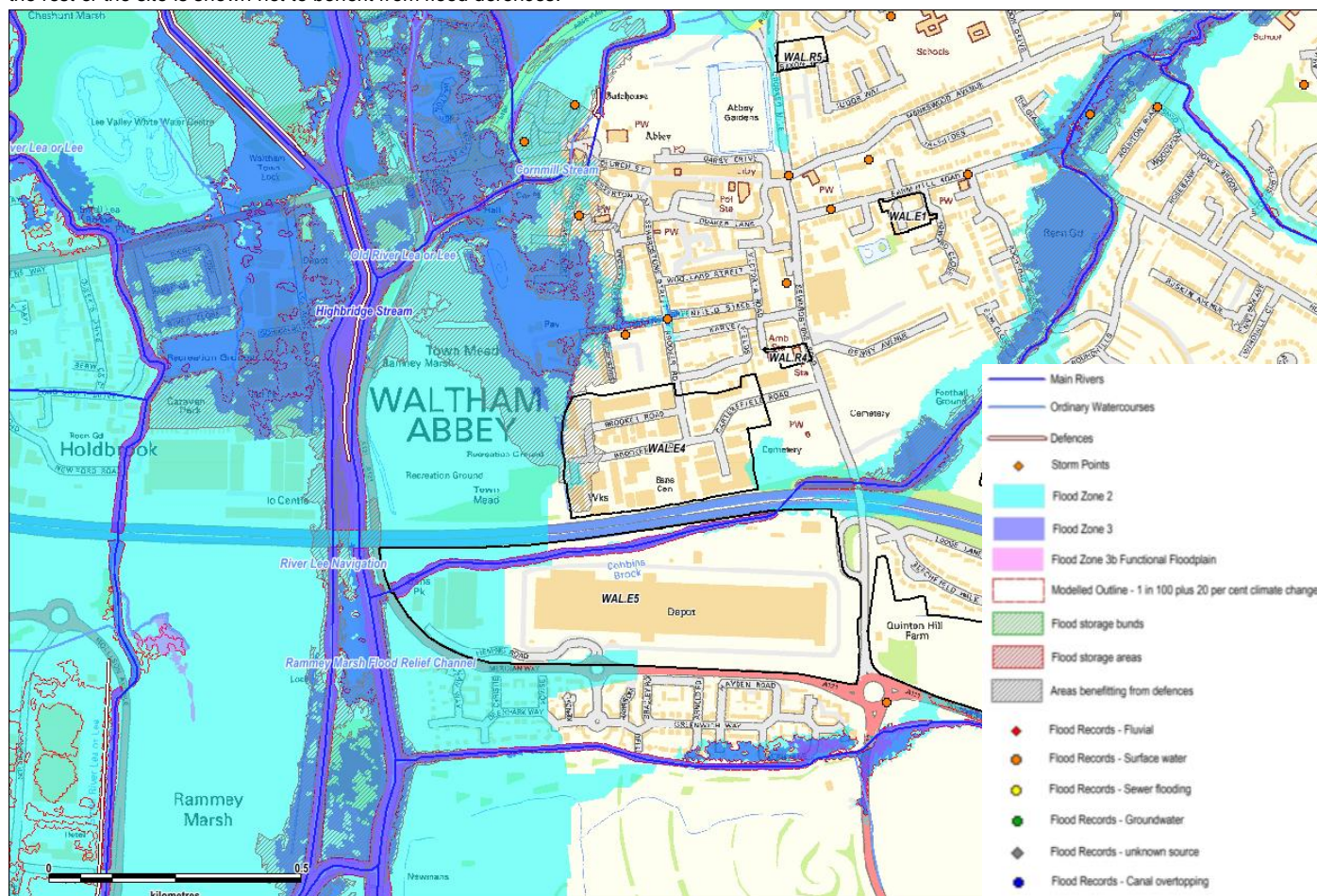
Allocation Reference: WAL.E4	Address: Waltham Abbey, EN9 1J	Area (ha): 8.69	Proposed Use: Employment	Vulnerability Classification: Less Vulnerable
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Fluvial Flood Risk

Flood Zone 1: 96%	Flood Zone 2: 3%	Flood Zone 3a: 1%	Flood Zone 3b: -%
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Flood Zones and Flood Defences

Cobbin's Brook flow westwards and is located approximately 60m south of the site. To the north-east of the site lies a complex network of channels. It is these watercourses that pose a flood risk for the WAL.E4 site. The small area of Flood Zone 2 in the south-east of the site arises from Cobbin's Brook, whilst the areas of Flood Zone 2 and 3 in the west of the site are associated with the complex network of channels in the north-east. The majority of the site is located with Flood Zone 1. The westernmost 75m is shown to benefit from flood defences, notably flood relief channels, whilst the rest of the site is shown not to benefit from flood defences.



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Figure A Flood Map for Planning (Rivers and Sea)

Historic Records

The Environment Agency Historic Flood Map records one incident of fluvial flooding within this area, this took place in March 1947.

Climate Change

In accordance with the PPG, for Less Vulnerable development proposed in Flood Zone 3, the Central (25%) and Higher Central (35%) climate change allowances should be considered. Analysis of the stage-discharge relationship along Cobbin's Brook identifies that the 0.1% AEP (1 in 1000 year) flood level for the undefended model scenario, which corresponds to Flood Zone 2, is greater than the flood levels calculated for the Central and Higher Central climate change allowances. The outline of Flood Zone 2 is therefore appropriate to use as a proxy when considering the impact of climate change on flood risk for this site and surrounding area.

Site Assessment Summary – WAL.E4 Cartersfield Road/Brooker Road

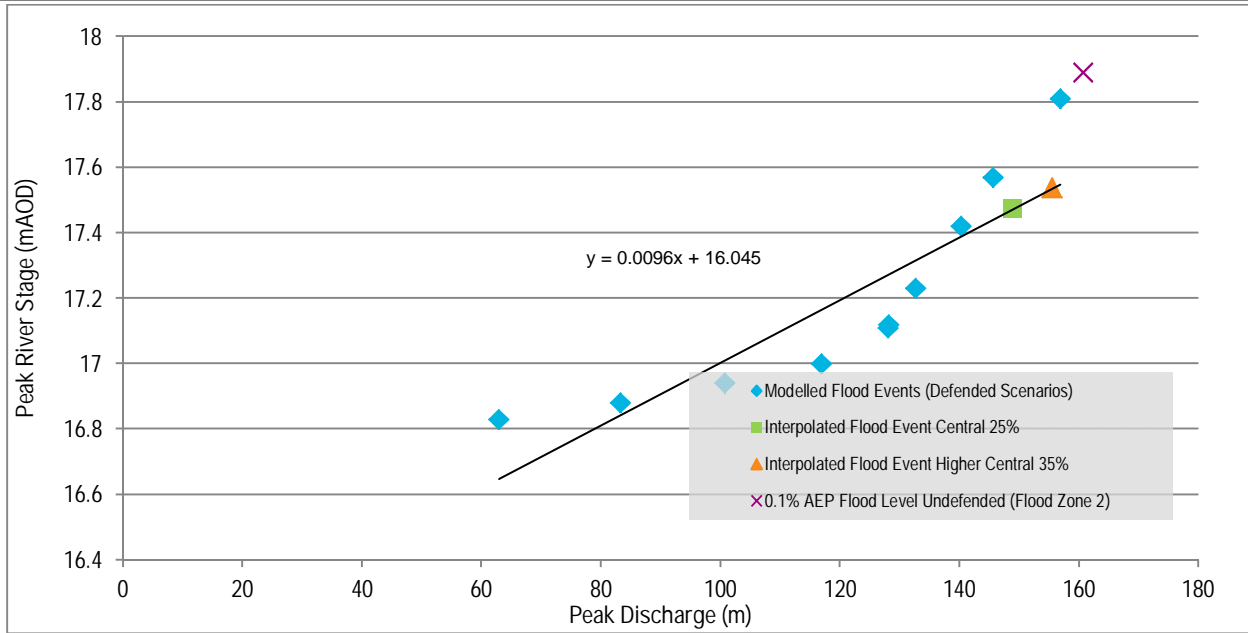


Figure B Stage-Discharge relationship at Node HC49 of the River Lee Modelling Study 2014

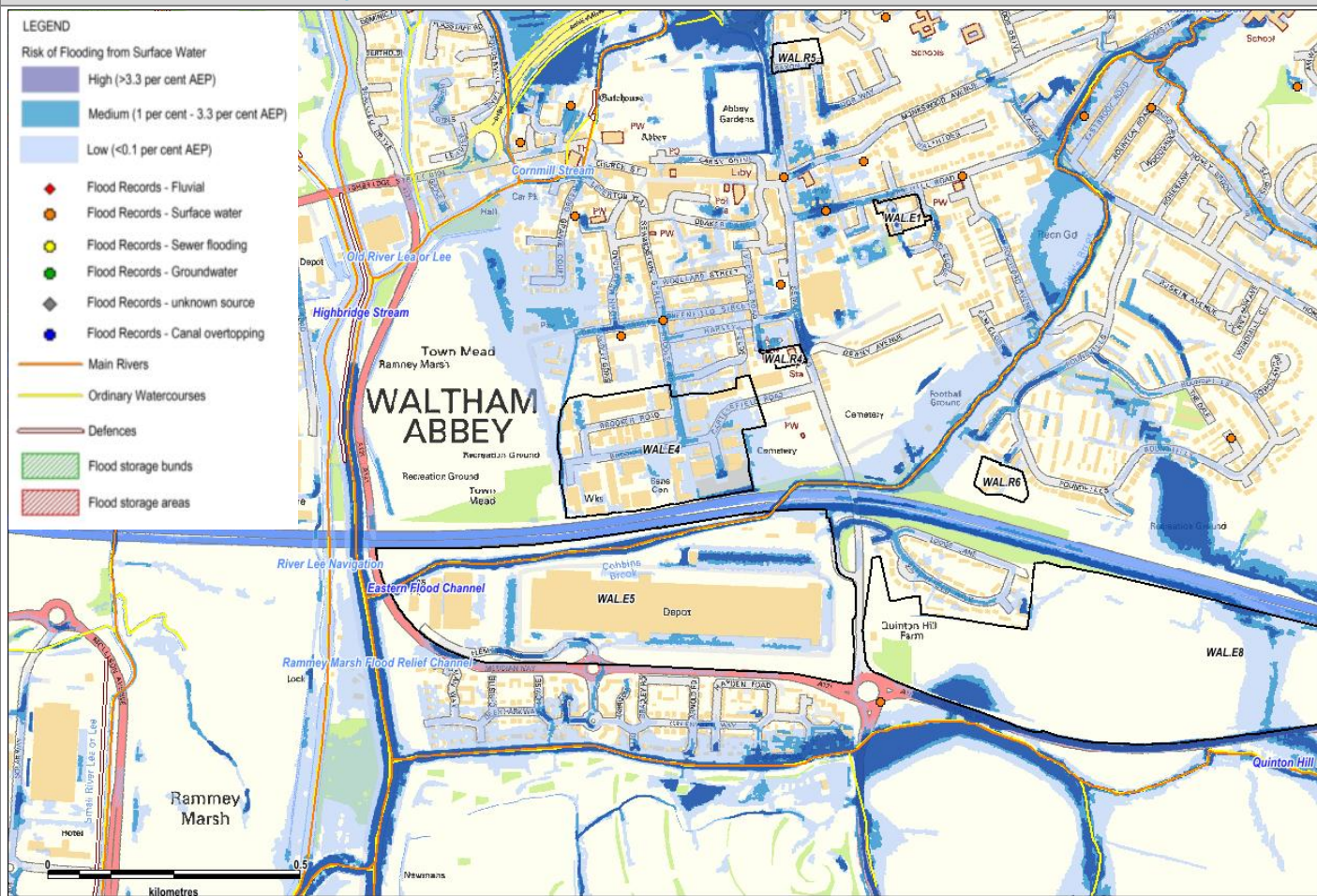
Surface Water Flood Risk

Risk of Flooding from Surface Water (RoFSW)

The RoFSW mapping indicates that there are several low to medium risk flow pathways flowing along Brooker Road and Cartersfield Road within this site, with associate lower risk pathways diverging from these. All these flow paths should be considered carefully in the development of the site layout to ensure that new development is not placed at surface water flood risk, and that the position of any new development does not divert the flow path to a neighbouring area. Towards the southern end of Cartersfield Road there is a small region which has a high susceptibility to surface water ponding.

There have been 18 reported incident of surface water flooding within 1km of the site, all but two were located north of the site.

Site Assessment Summary – WALE4 Cartersfield Road/Brooker Road



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Figure C Risk of Flooding from Surface Water (RoFSW)

Geology:

The underlying geology is London Clay formation. This type of geology comprises clay, silt and sand and is typically not very permeable, resulting in rapid runoff of surface water across the ground surface. Overlying this is a layer of Taplow Gravel Formation. This is a more permeable strata.

Historic Records:

There have been no reported groundwater flooding incidents within 1km of the site.

Groundwater Flood Risk

The AS_tGWF mapping (also presented in the Level 1 SFRA, Appendix B Figure 9) indicates that the site lies within a region which has a medium susceptibility to groundwater flooding (>=25% <50%). The risk of groundwater flooding in this area is therefore generally considered to be medium. This information will need to be confirmed during site investigation survey.

Other Sources

The Environment Agency 'Risk of Flooding from Reservoirs' mapping indicates that the site is at risk from flooding due to reservoir failure, with the maximum flood depth expected to be between 0.3 and 2m. Given the regular inspection of these reservoirs in accordance with the Reservoirs Act 1975, flooding from reservoirs is considered to be a managed risk.

Site Specific Recommendations

Fluvial Modelling

As part of a site specific FRA for this site at the planning application stage, additional hydraulic modelling will be required comparing a range of probability events to determine the impact of climate change on the risk of flooding at this location. The 1% AEP (1 in 100 year) flood event including the Central (25%) and Higher Central (35%) allowance are of relevance to the proposed Less Vulnerable development. The modelling will also need to address any potential impact the proposed development may have on flood risk to the surrounding area.

Set-back Distance

Due to the close proximity of Cobbin's Brook, a main river, to the site, development should be set back at least 8m from the watercourse. The

Site Assessment Summary – WAL.E4 Cartersfield Road/Brooker Road

Environment Agency will need to be consulted and an Environmental Permit obtained for any works within 8m of the watercourse.

Access / Egress

It will be necessary to consider whether safe dry access to and from the site can be achieved. The M25 and Sewardstone Road pass over Cobbin's Brook and so egress south of the site during a fluvial flood event is not an option. Egress should be made north along Sewardstone Road.

Safe Refuge

Given the proximity to the ordinary watercourse and the potential for the access / egress route to be affected by flooding, internal access should be provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. An area of safe refuge should be located above the 1% AEP fluvial flood level including an allowance for climate change. This refuge will have to be permanent and accessible to all occupants and users of the site.

Site Layout and Design

The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of SuDS, taking care to consider SuDS features in accordance with the hierarchy of SuDS (i.e. considering infiltration measures first wherever possible). The suitability of locating proposed surface water drainage features within the fluvial floodplain, as they may be rendered ineffective during times of fluvial flooding.

Finished Floor Levels

Given the proposed use is Less Vulnerable there is no requirement to raise finished floor levels.

Floodplain Compensation

Land raising and any built development should be avoided within Flood Zone 3. Where alterations to the floodplain are proposed, compensatory floodplain storage will need to be provided on a level-for-level and volume-for-volume basis with respect to the 1% AEP (1 in 100 year) design event, including an allowance for climate change. The land used to provide compensation storage will need to be in hydraulic connectivity with the existing floodplain, but not already part of the floodplain.

Resilience Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. Guidance on resilience measures can be found in the 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' published by The Department for Communities and Local Government (CLG).

Emergency Planning

The site is shown to be within an Environment Agency Flood Warning Area, the Lower River Lee at Hoddesdon and Cheshunt Flood warning area. Due to the proximity of the site to the watercourse, Flood Response Plans should be prepared by residents of the site.

LLFA Consultation

It is recommended that potential developers contact Essex CC as the LLFA for further information prior to taking forward site specific plans.

Summary

The proposed development is classified as Less Vulnerable and therefore does not require the formal application of the Exception Test in accordance with the NPPF. The site specific recommendations set out above should be considered as part of a site specific FRA for the site at the planning application stage, to ensure that future development on the site is safe and does not increase flood risk to the site or surrounding area.

Site Assessment Summary – WAL.E5 Meridian Business Park & Sainsbury’s Distribution Centre

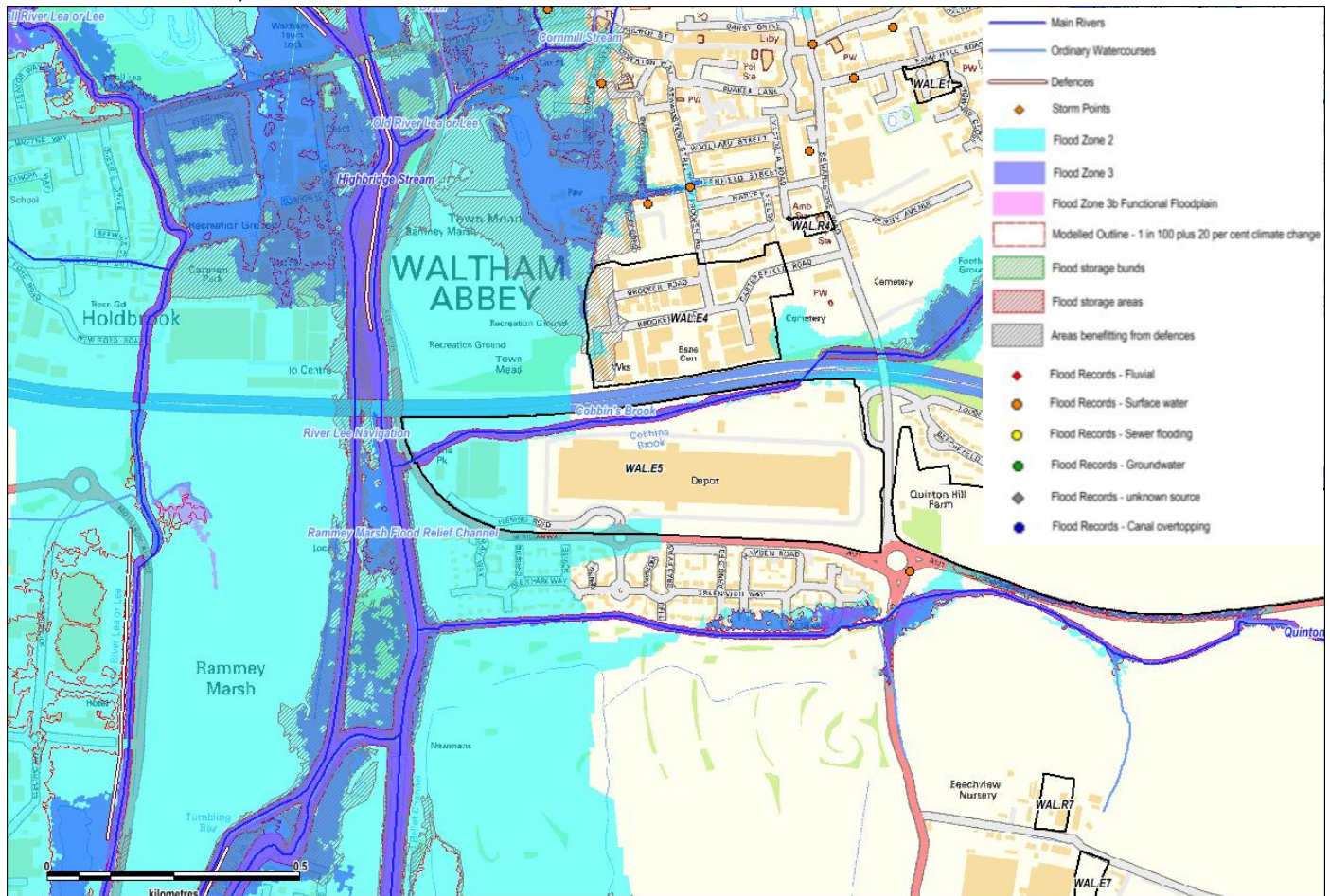
Allocation Reference: WAL.E5	Address: Waltham Abbey, EN9 3BZ	Area (ha): 23.65	Proposed Use: Employment	Vulnerability Classification: Less Vulnerable
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Fluvial Flood Risk

Flood Zone 1: 75%	Flood Zone 2: 19%	Flood Zone 3a: 0%	Flood Zone 3b: 6%
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Flood Zones and Flood Defences

Cobbin’s Brook flow westwards through the north of this site, whilst Quinton Hill Brook flows westwards approximately 200m south of the site. To the north-east of the site lies a complex network of channels which flow south ultimately forming the River Lee Navigation and Rammey Marsh Flood Relief Channel. It is these watercourses that pose a flood risk for the WAL.E5 site. The small area of Flood Zone 2 in the south-east of the site arises from Cobbin’s Brook, whilst the area of Flood Zone 2 in the west of the site is associated with the River Lee Navigation and Rammey Marsh Flood Relief Channel in the north-east. The area of the site designated as Flood Zone 3b is located adjacent to Cobbin’s Brook. Flood Zone 3b is defined as land where water has to be stored in times of flood. It is not appropriate to locate development within this area. This area is not shown to benefit from the presence of flood defences.



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Figure A Flood Map for Planning (Rivers and Sea)

Historic Records

The Environment Agency Historic Flood Map records one incident of fluvial flooding within this area, this took place in March 1947.

Climate Change

In accordance with the PPG, for Less Vulnerable development proposed in Flood Zone 3, the Central (25%) and Higher Central (35%) climate change allowances should be considered. Analysis of the stage-discharge relationship along Cobbins Brook identifies that the 0.1% AEP (1 in 1000 year) flood level for the undefended model scenario, which corresponds to Flood Zone 2, is greater than the flood levels calculated for the Central and Higher Central climate change allowances. The outline of Flood Zone 2 is therefore appropriate to use as a proxy when considering the impact of climate change on flood risk for this site and surrounding area.

Site Assessment Summary – WAL.E5 Meridian Business Park & Sainsbury’s Distribution Centre

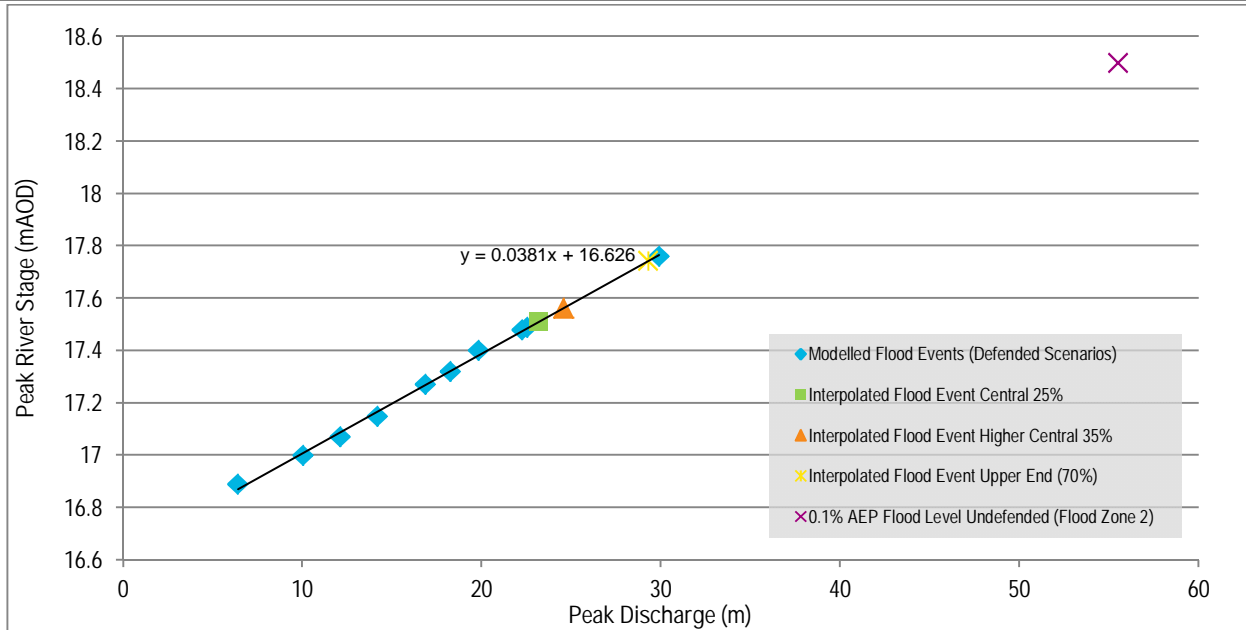


Figure B Stage-Discharge relationship at Node CB014 of the River Lee Modelling Study 2014

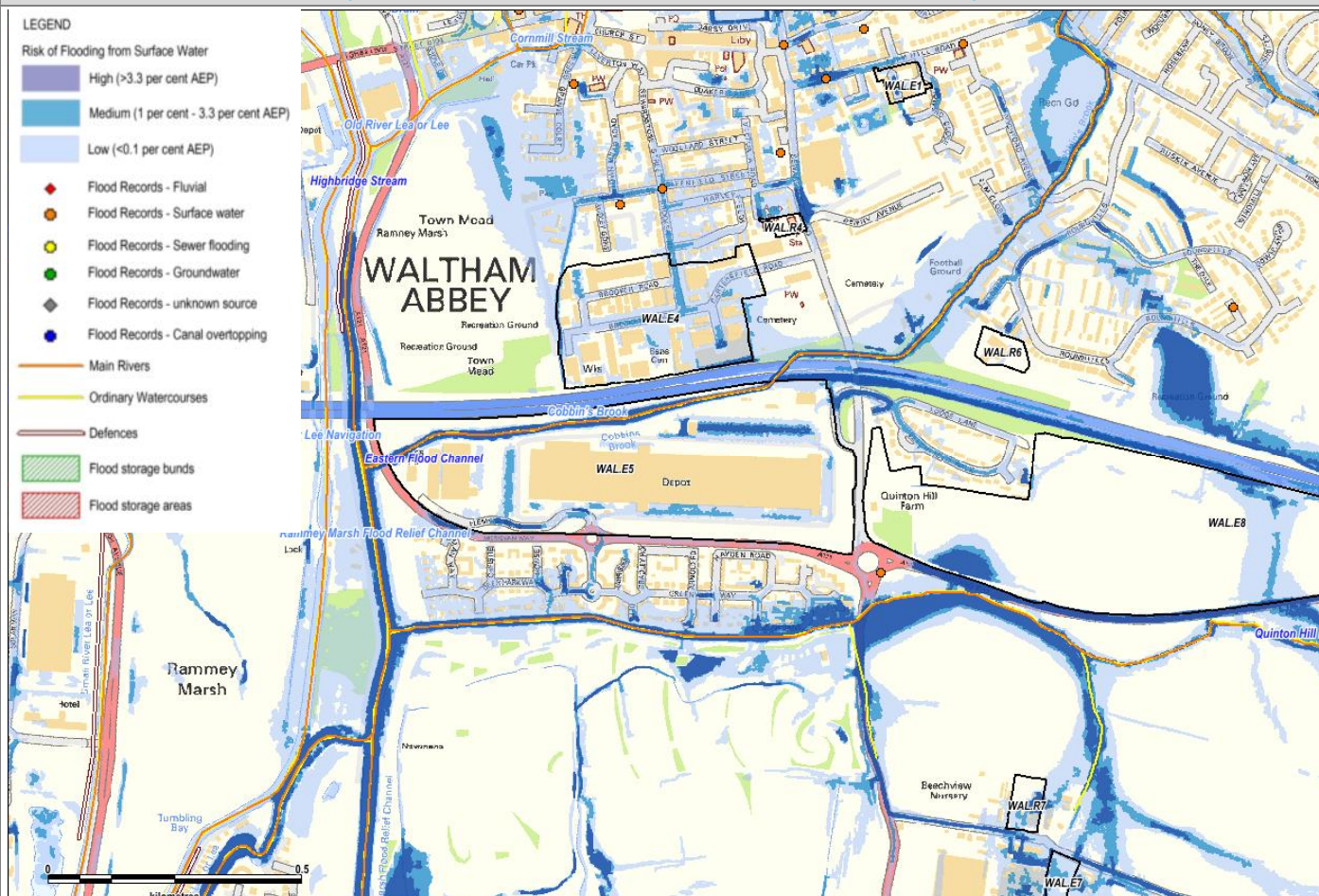
Surface Water Flood Risk

Risk of Flooding from Surface Water (RoFSW)

The RoFSW mapping indicates that there are several low to medium risk flow pathways situated around the Depot. The flow pathway of primary importance within this site, however, is that which is adjacent to Cobbins Brook. This flow path cuts through the north of the site. All these flow paths should be considered carefully in the development of the site layout to ensure that new development is not placed at surface water flood risk, and that the position of any new development does not divert the flow path to a neighbouring area.

There have been 14 reported incident of surface water flooding within 1km of the site, all but two were located north of the site.

Site Assessment Summary – WAL.E5 Meridian Business Park & Sainsbury’s Distribution Centre



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Figure C Risk of Flooding from Surface Water (RoFSW)

Geology:

The underlying geology is London Clay formation. This type of geology comprises clay, silt and sand and is typically not very permeable, resulting in rapid runoff of surface water across the ground surface. Overlying this is a layer of Taplow Gravel Formation. This is a more permeable strata.

Historic Records:

There has been no reported groundwater flooding incidents within 1km of the site.

Groundwater Flood Risk

The ASStGWF mapping (also presented in the Level 1 SFRA, Appendix B Figure 9) indicates that the western third of this site is situated within a region which has a very high susceptibility to groundwater flooding (>=75%) whilst the remainder of the site is lies within a region which has a medium susceptibility (>=25% <50%). This information will need to be confirmed during site investigation survey.

Other Sources

The Environment Agency ‘Risk of Flooding from Reservoirs’ mapping indicates that the majority of the site is at risk from flooding due to reservoir failure, with the maximum flood depth expected to be between 0.3 and 2m. There is a small parcel of land located in the centre of the site which is not at risk of groundwater flooding. Given the regular inspection of these reservoirs in accordance with the Reservoirs Act 1975, flooding from reservoirs is considered to be a managed risk.

Site Specific Recommendations

Fluvial Modelling

As part of a site specific FRA for this site at the planning application stage, additional hydraulic modelling will be required comparing a range of probability events to determine the impact of climate change on the risk of flooding at this location. The 1% AEP (1 in 100 year) flood event including the Central (25%) and Higher Central (35%) allowance are of relevance to the proposed Less Vulnerable development. The modelling will also need to address any potential impact the proposed development may have on flood risk to the surrounding area.

Set-back Distance

Site Assessment Summary – WAL.E5 Meridian Business Park & Sainsbury's Distribution Centre

Due to the close proximity of Cobbin's Brook, a main river, to the site, development should be set back at least 8m from the watercourse. The Environment Agency will need to be consulted and an Environmental Permit obtained for any works within 8m of the watercourse.

Access / Egress

It will be necessary to consider whether safe dry access to and from the site can be achieved. The M25, Sewardstone Road and the A121 pass over Cobbin's Brook and so careful considerations should be made for when planning access/egress routes. Egress should be made north along Sewardstone Road.

Safe Refuge

Given the proximity to the ordinary watercourse and the potential for the access / egress route to be affected by flooding, internal access should be provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. An area of safe refuge should be located above the 1% AEP fluvial flood level including an allowance for climate change. This refuge will have to be permanent and accessible to all occupants and users of the site.

Site Layout and Design

The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of SuDS, taking care to consider SuDS features in accordance with the hierarchy of SuDS (i.e. considering infiltration measures first wherever possible). The suitability of locating proposed surface water drainage features within the fluvial floodplain, as they may be rendered ineffective during times of fluvial flooding.

Finished Floor Levels

Given the proposed use is Less Vulnerable there is no requirement to raise finished floor levels.

Floodplain Compensation

Land raising and any built development should be avoided within Flood Zone 3. Where alterations to the floodplain are proposed, compensatory floodplain storage will need to be provided on a level-for-level and volume-for-volume basis with respect to the 1% AEP (1 in 100 year) design event, including an allowance for climate change. The land used to provide compensation storage will need to be in hydraulic connectivity with the existing floodplain, but not already part of the floodplain.

Resilience Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. Guidance on resilience measures can be found in the 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' published by The Department for Communities and Local Government (CLG).

Emergency Planning

The site is shown to be within an Environment Agency Flood Warning Area, the Cobbin's Brook at Waltham Abbey Flood warning area. Due to the proximity of the site to the watercourse, Flood Response Plans should be prepared by residents of the site.

LLFA Consultation

It is recommended that potential developers contact Essex CC as the LLFA for further information prior to taking forward site specific plans.

Summary

The proposed development is classified as Less Vulnerable and therefore does not require the formal application of the Exception Test in accordance with the NPPF. The site specific recommendations set out above should be considered as part of a site specific FRA for the site at the planning application stage, to ensure that future development on the site is safe and does not increase flood risk to the site or surrounding area.

Site Assessment Summary – WAL.E6 Galley Hill Road Industrial Estate

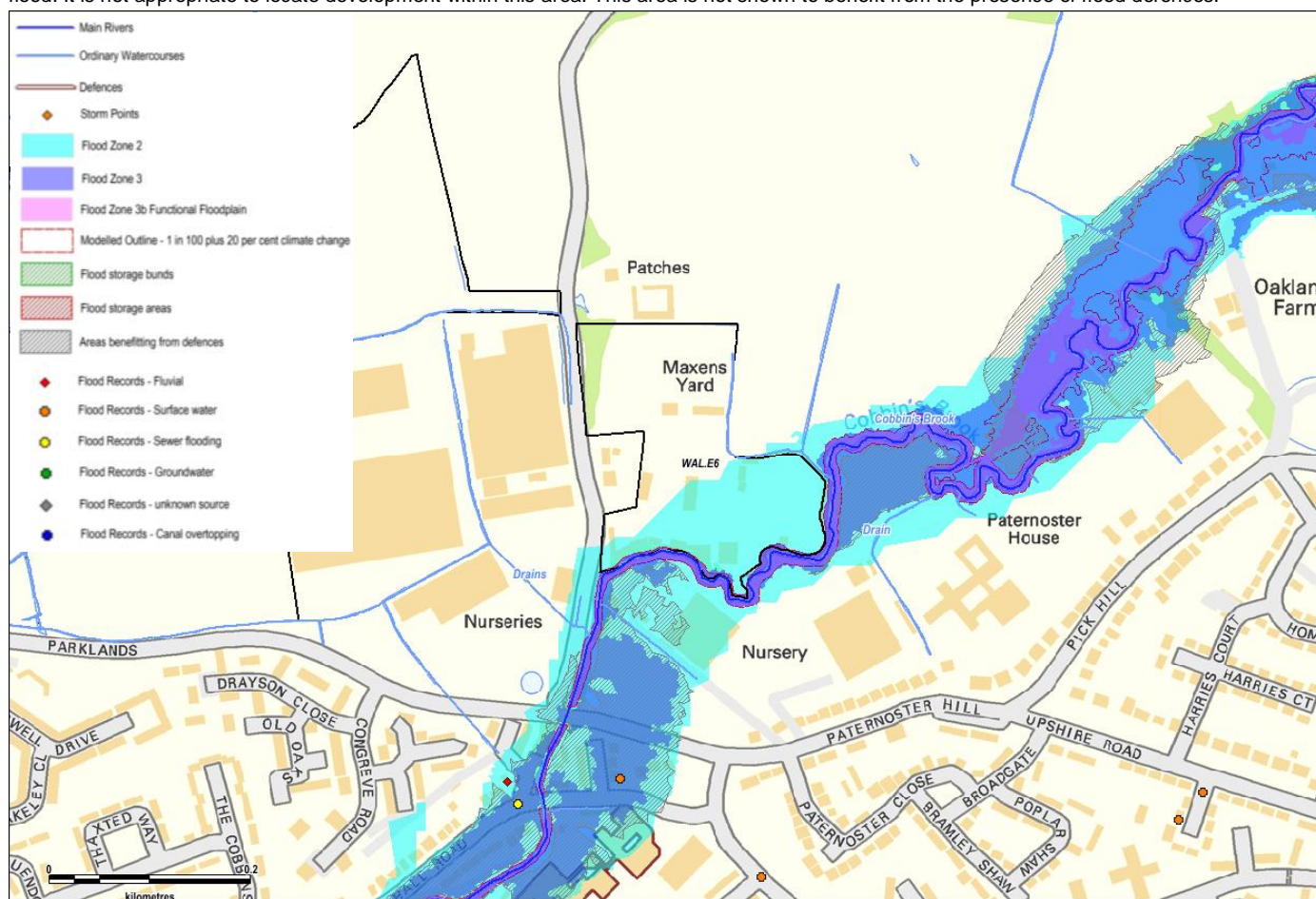
Allocation Reference: WAL.E6	Address: Waltham Abbey, EN9 2AG	Area (ha): 3.89	Proposed Use: Employment	Vulnerability Classification: Less Vulnerable
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Fluvial Flood Risk

Flood Zone 1: 60%	Flood Zone 2: 38.2%	Flood Zone 3a: 0.2%	Flood Zone 3b: 1.6%
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Flood Zones and Flood Defences

Cobbin’s Brook flow westwards along the southern perimeter of the site. A large area of Flood Zone 2 (38.2%) and smaller areas of Flood Zone 3a and 3b within the south of this site are associated with this main river. The majority of this site is designated as Flood Zone 1. The area of the site designated as Flood Zone 3b is located adjacent to Cobbin’s Brook. Flood Zone 3b is defined as land where water has to be stored in times of flood. It is not appropriate to locate development within this area. This area is not shown to benefit from the presence of flood defences.



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Figure A Flood Map for Planning (Rivers and Sea)

Historic Records

The Environment Agency Historic Flood Map records one incident of fluvial flooding within this area, this took place in March 1947. An additional fluvial flooding incident was recorded approximately 250m south-west of the site.

Climate Change

In accordance with the PPG, for Less Vulnerable development proposed in Flood Zone 3, the Central (25%) and Higher Central (35%) climate change allowances should be considered. Analysis of the stage-discharge relationship along Cobbins Brook identifies that the 0.1% AEP (1 in 1000 year) flood level for the undefended model scenario, which corresponds to Flood Zone 2, is greater than the flood levels calculated for the Central and Higher Central climate change allowances. The outline of Flood Zone 2 is therefore appropriate to use as a proxy when considering the impact of climate change on flood risk for this site and surrounding area.

Site Assessment Summary – WAL.E6 Galley Hill Road Industrial Estate

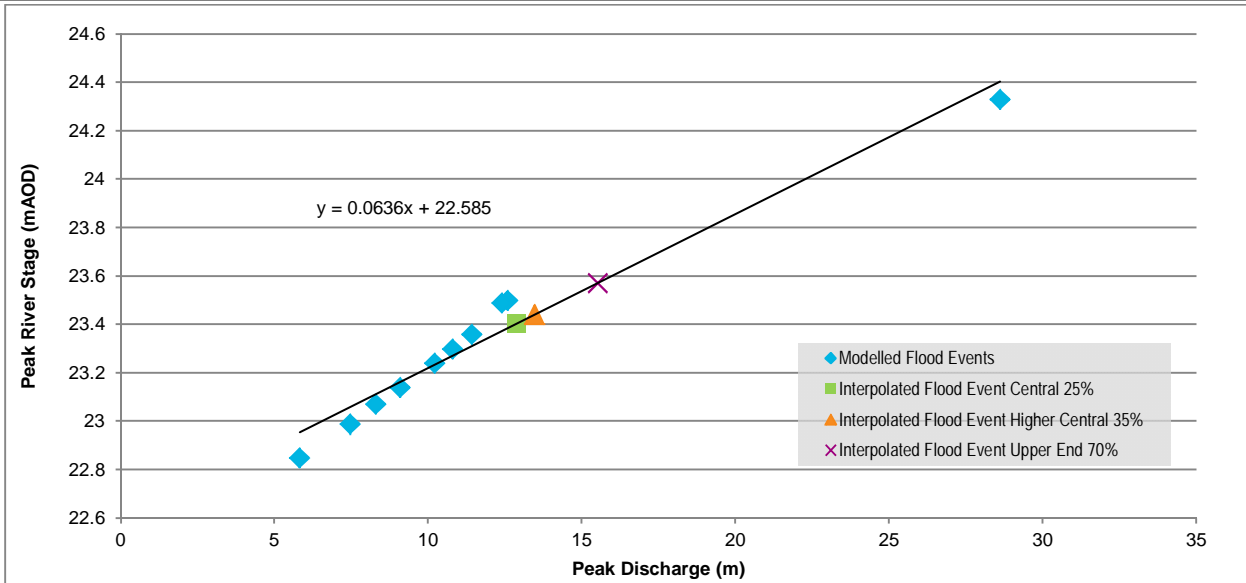


Figure B Stage-Discharge relationship at Node CB045 of the River Lee Modelling Study 2014

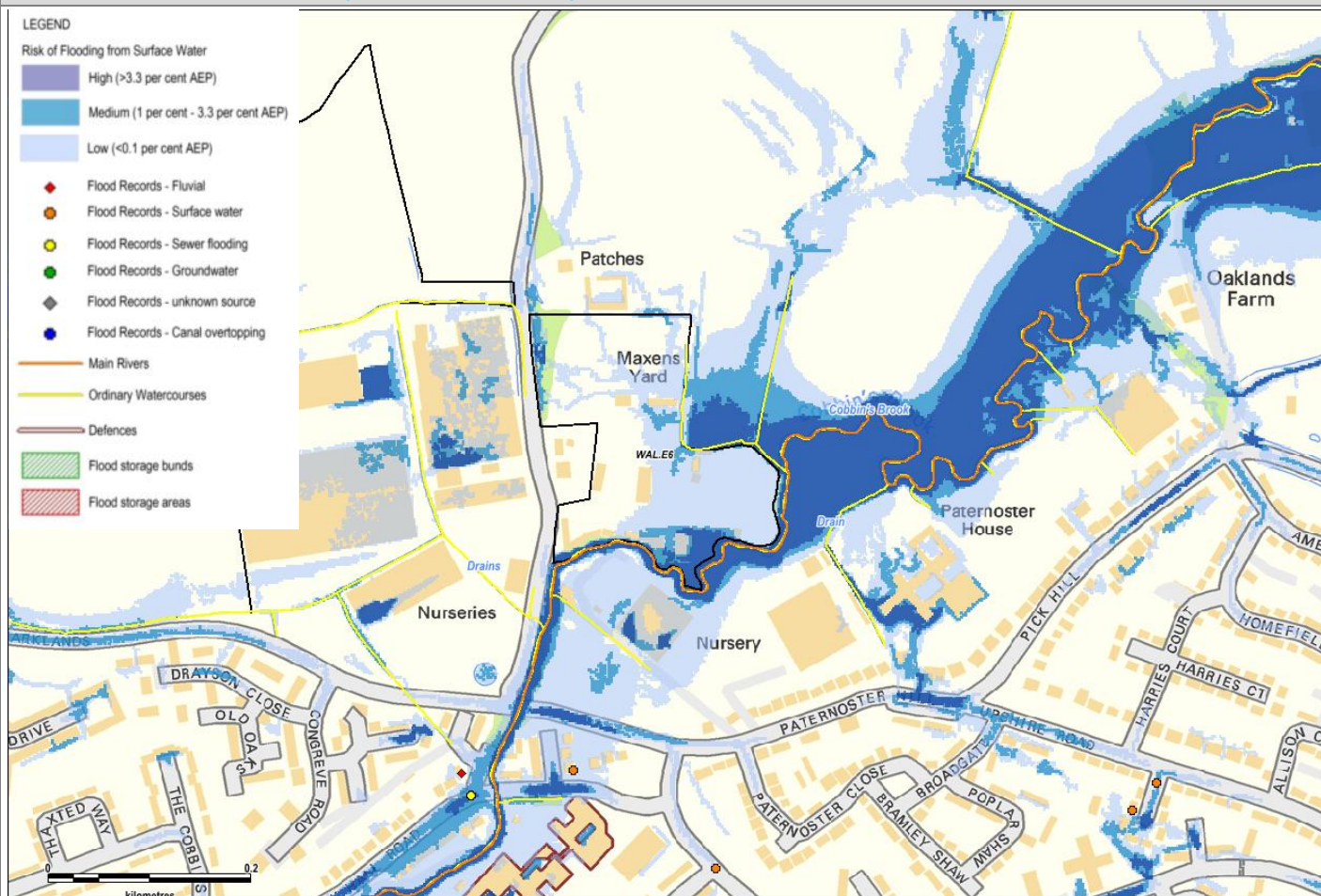
Surface Water Flood Risk

Risk of Flooding from Surface Water (RoFSW)

The RoFSW mapping indicates that approximately half of the site is not at risk from surface water flooding. Surrounding the south-east of the site is a large area which is at high risk of surface water flooding. There are small areas at high risk of surface water flooding in the south of the site associated with this larger region of high risk. The remainder of the site lies in a region which has a low risk of surface water flooding.

There have been 24 reported incident of surface water flooding within 1km of the site.

Site Assessment Summary – WAL.E6 Galley Hill Road Industrial Estate



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Figure C Risk of Flooding from Surface Water (RoFSW)

Geology:

The underlying geology is London Clay formation. This type of geology comprises clay, silt and sand and is typically not very permeable, resulting in rapid runoff of surface water across the ground surface. Overlying this is a layer of Alluvium. This, much like the London Clay Formation, is often highly impermeable.

Groundwater Flood Risk

The AS_tGWF mapping (also presented in the Level 1 SFRA, Appendix B Figure 9) indicates that this site is situated within a region which has a low susceptibility to groundwater flooding (<25%). The risk of groundwater flooding in this area is therefore generally considered to be low. This information will need to be confirmed during site investigation survey.

Other Sources

The Environment Agency ‘Risk of Flooding from Reservoirs’ mapping indicates that the majority this site (with the exception of the north-west of the site) is at risk from flooding due to reservoir failure, with the maximum flood depth expected to be over 2m in certain regions. Given the regular inspection of these reservoirs in accordance with the Reservoirs Act 1975, flooding from reservoirs is considered to be a managed risk.

Site Specific Recommendations

Fluvial Modelling

As part of a site specific FRA for this site at the planning application stage, additional hydraulic modelling will be required comparing a range of probability events to determine the impact of climate change on the risk of flooding at this location. The 1% AEP (1 in 100 year) flood event including the Central (25%) and Higher Central (35%) allowance are of relevance to the proposed Less Vulnerable development. The modelling will also need to address any potential impact the proposed development may have on flood risk to the surrounding area.

Set-back Distance

Due to the close proximity of Cobbin’s Brook, a main river, to the site, development should be set back at least 8m from the watercourse. The Environment Agency will need to be consulted and an Environmental Permit obtained for any works within 8m of the watercourse.

Site Assessment Summary – WAL.E6 Galley Hill Road Industrial Estate

Access / Egress

It will be necessary to consider whether safe dry access to and from the site can be achieved. Galley Hill Road, the only route to access the site, is located within Flood Zone 2 in the south. It is therefore suggested that the best exit route is northbound along this road.

Safe Refuge

Given the proximity to the main watercourse and the potential for the access / egress route to be affected by flooding, internal access should be provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. An area of safe refuge should be located above the 1% AEP fluvial flood level including an allowance for climate change. This refuge will have to be permanent and accessible to all occupants and users of the site.

Site Layout and Design

The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of SuDS, taking care to consider SuDS features in accordance with the hierarchy of SuDS (i.e. considering infiltration measures first wherever possible). The suitability of locating proposed surface water drainage features within the fluvial floodplain, as they may be rendered ineffective during times of fluvial flooding.

Finished Floor Levels

Given the proposed use is Less Vulnerable there is no requirement to raise finished floor levels.

Floodplain Compensation

Land raising and any built development should be avoided within Flood Zone 3. Where alterations to the floodplain are proposed, compensatory floodplain storage will need to be provided on a level-for-level and volume-for-volume basis with respect to the 1% AEP (1 in 100 year) design event, including an allowance for climate change. The land used to provide compensation storage will need to be in hydraulic connectivity with the existing floodplain, but not already part of the floodplain.

Resilience Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. Guidance on resilience measures can be found in the 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' published by The Department for Communities and Local Government (CLG).

Emergency Planning

The site is shown to be within an Environment Agency Flood Warning Area, the Cobbin's Brook at Waltham Abbey Flood warning area. Due to the proximity of the site to the watercourse, Flood Response Plans should be prepared by residents of the site.

LLFA Consultation

It is recommended that potential developers contact Essex CC as the LLFA for further information prior to taking forward site specific plans.

Summary

The proposed development is classified as Less Vulnerable and therefore does not require the formal application of the Exception Test in accordance with the NPPF. The site specific recommendations set out above should be considered as part of a site specific FRA for the site at the planning application stage, to ensure that future development on the site is safe and does not increase flood risk to the site or surrounding area.

Site Assessment Summary – WAL.E8 Land North of A121

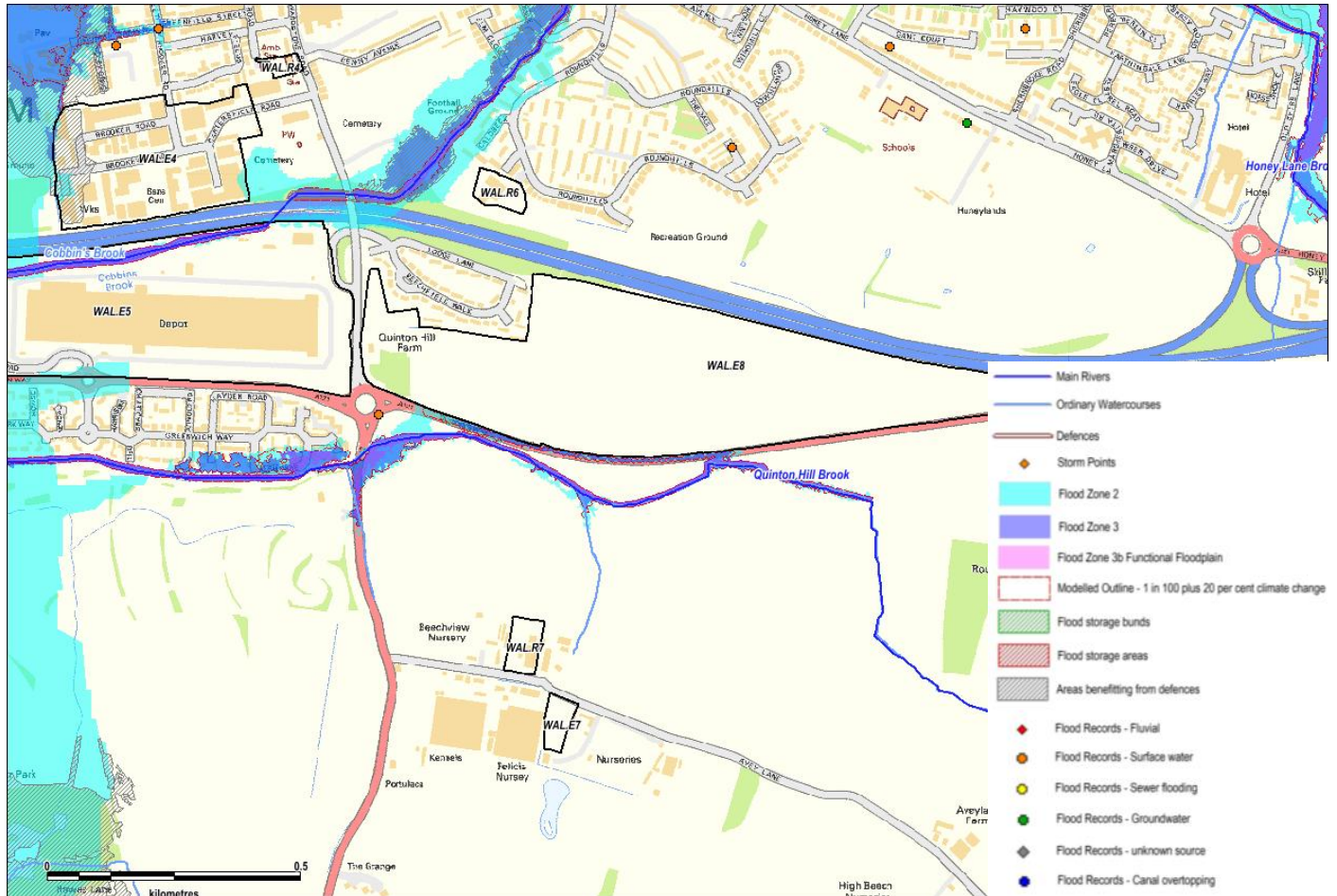
Allocation Reference: WAL.E8	Address: South of Waltham Abbey, EN9 3AA	Area (ha): 27.84	Proposed Use: Employment	Vulnerability Classification: Less Vulnerable
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Fluvial Flood Risk

Flood Zone 1: 99.91%	Flood Zone 2: 0.08%	Flood Zone 3a: 0.01%	Flood Zone 3b: -%
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Flood Zones and Flood Defences

This site is predominantly designated as Flood Zone 1; however there are very small areas of Flood Zone 2 and 3a located in the south of the site. These Flood Zones are associated with Quinton Hill Brook which flows westwards south of the site. Cobbin's Brook is located approximately 200m north-west of the site. This area is shown not to benefit from the presence of flood defences.



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Figure A Flood Map for Planning (Rivers and Sea)

Historic Records

The Environment Agency Historic Flood Map does not record any incidents of fluvial flooding within this area. One incident of fluvial flooding has been reported within 1km of the site, this was located approximately 950m south-east of the site.

Climate Change

In accordance with the PPG, for Less Vulnerable development proposed in Flood Zone 2, the Central (25%) climate change allowance should be considered. Analysis of the stage-discharge relationship along Quinton Hill identifies that the 0.1% AEP (1 in 1000 year) flood level for the undefended model scenario, which corresponds to Flood Zone 2, is greater than the flood levels calculated for the Central and Higher Central climate change allowances. The outline of Flood Zone 2 is therefore appropriate to use as a proxy when considering the impact of climate change on flood risk for this site and surrounding area.

Site Assessment Summary – WAL.E8 Land North of A121

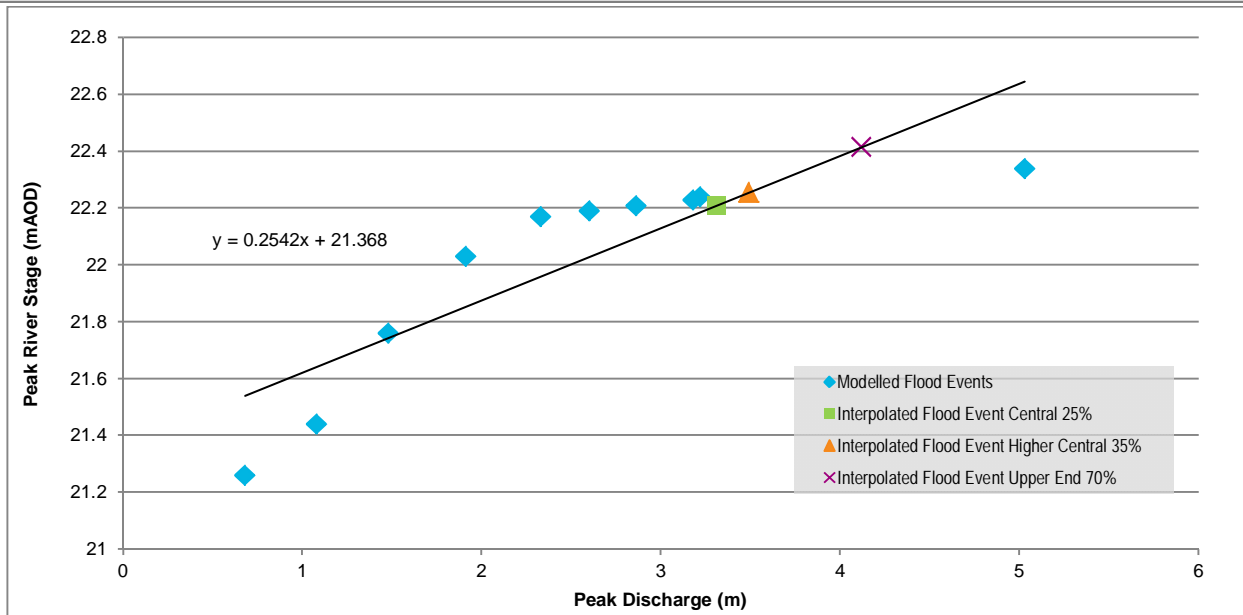


Figure B Stage-Discharge relationship at Node 1.036 of the River Lee Modelling Study 2014

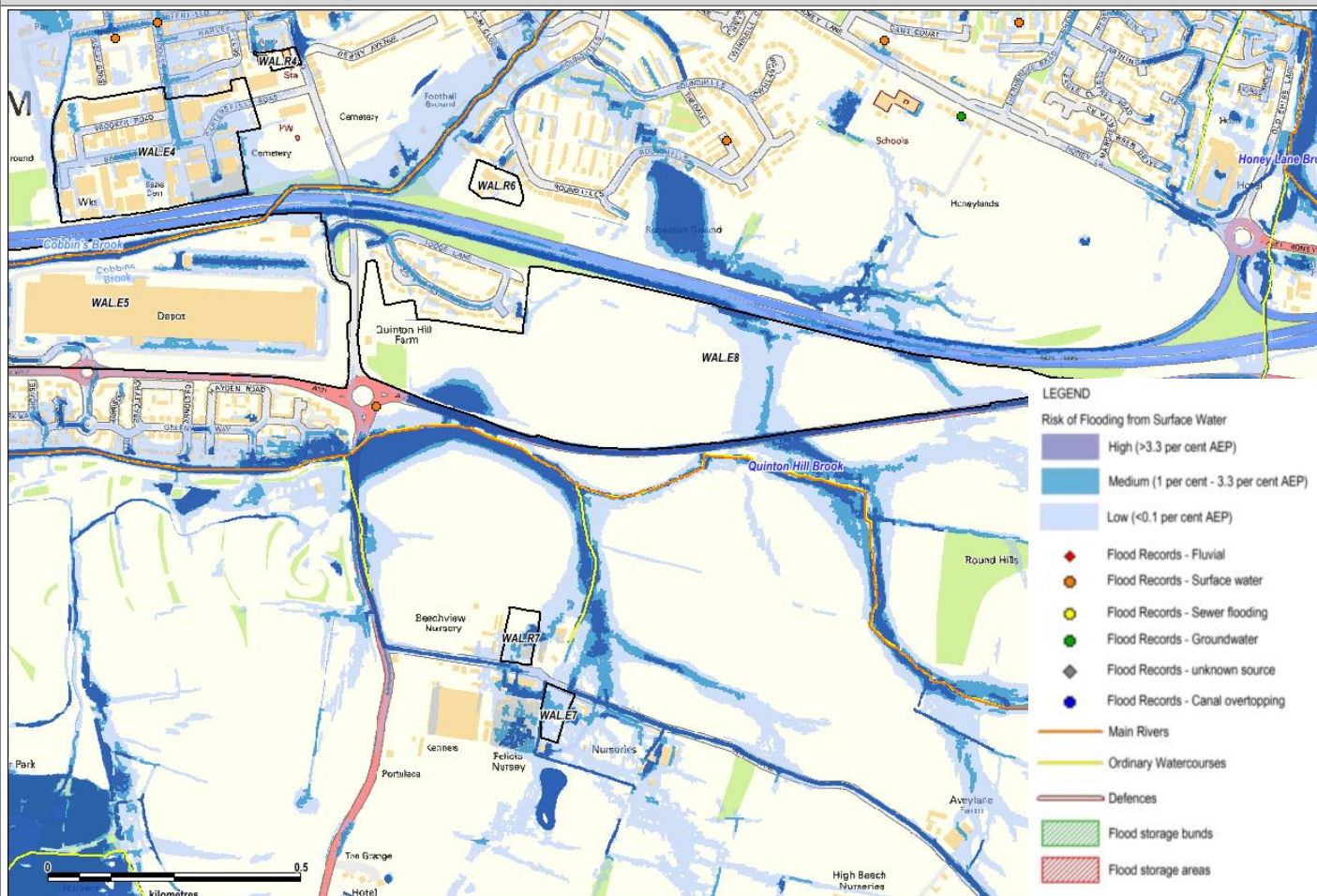
Surface Water Flood Risk

Risk of Flooding from Surface Water (RoFSW)

The RoFSW mapping indicates that there are three notable areas of surface water flood risk within this site. The first is an area of land in the south-west of the site, east of Quinton Hill Farm, which is highly susceptible to surface water ponding. The other two are surface water flow pathways which flow northwards across the site. These flow paths are primarily of low risk; however there are certain parts which are of medium to high risk, especially regions closer to the M25. All these flow paths should be considered carefully in the development of the site layout to ensure that new development is not placed at surface water flood risk, and that the position of any new development does not divert the flow path to a neighbouring area. Bordering the south of the site is the A121. Along this stretch of road there is a high risk surface flow pathway.

There have been 15 reported incidents of surface water flooding within 1km of the site, the majority located north of the site.

Site Assessment Summary – WAL.E8 Land North of A121



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Figure C Risk of Flooding from Surface Water (RoFSW)

Geology:

The underlying geology is London Clay formation. This type of geology comprises clay, silt and sand and is typically not very permeable, resulting in rapid runoff of surface water across the ground surface.

Historic Records:

There has been one reported groundwater flooding incidents within 1km of the site. This occurred approximately 500m north of the site, close to the Marriott Hotel.

Groundwater Flood Risk

The ASStGWf mapping (also presented in the Level 1 SFRA, Appendix B Figure 9) indicates that the western third of this site is located in a region which has a medium susceptibility to groundwater flooding ($\geq 25\%$ $< 50\%$), whilst the remainder of the site is situated in a region with a low susceptibility ($< 25\%$). This information will need to be confirmed during site investigation survey.

Other Sources

The Environment Agency 'Risk of Flooding from Reservoirs' mapping indicates that this site is not at risk of flooding if a failure were to occur at a nearby reservoir.

Site Specific Recommendations

Fluvial Modelling

As part of a site specific FRA for this site at the planning application stage, additional hydraulic modelling will be required comparing a range of probability events to determine the impact of climate change on the risk of flooding at this location. The 1% AEP (1 in 100 year) flood event including the Central (25%) and Higher Central (35%) allowance are of relevance to the proposed Less Vulnerable development. The modelling will also need to address any potential impact the proposed development may have on flood risk to the surrounding area.

Set-back Distance

Due to the close proximity of Quinton Hill Brook, a main river, to the site, development should be set back at least 8m from the watercourse. The

Site Assessment Summary – WAL.E8 Land North of A121

Environment Agency will need to be consulted and an Environmental Permit obtained for any works within 8m of the watercourse.

Access / Egress

It will be necessary to consider whether safe dry access to and from the site can be achieved. The A121 and Sewardstone Road are the only routes to access the site, both of which pass through Flood Zone 2.

Safe Refuge

Given the proximity to the main watercourse and the potential for the access / egress route to be affected by flooding, internal access should be provided to upper floors (first floor or a mezzanine level) to provide safe refuge in a flood event. An area of safe refuge should be located above the 1% AEP fluvial flood level including an allowance for climate change. This refuge will have to be permanent and accessible to all occupants and users of the site.

Site Layout and Design

The drainage strategy for the site must be considered early in the site planning process to ensure adequate inclusion of SuDS, taking care to consider SuDS features in accordance with the hierarchy of SuDS (i.e. considering infiltration measures first wherever possible). The suitability of locating proposed surface water drainage features within the fluvial floodplain, as they may be rendered ineffective during times of fluvial flooding.

Finished Floor Levels

Given the proposed use is Less Vulnerable there is no requirement to raise finished floor levels.

Floodplain Compensation

Land raising and any built development should be avoided within Flood Zone 3. Where alterations to the floodplain are proposed, compensatory floodplain storage will need to be provided on a level-for-level and volume-for-volume basis with respect to the 1% AEP (1 in 100 year) design event, including an allowance for climate change. The land used to provide compensation storage will need to be in hydraulic connectivity with the existing floodplain, but not already part of the floodplain.

Resilience Measures

A number of flood resistance and resilience measures can also be implemented into new developments to mitigate potential flooding. Guidance on resilience measures can be found in the 'Improving the Flood Performance of New Buildings, Flood Resilient Construction' published by The Department for Communities and Local Government (CLG).

Emergency Planning

The site is shown to be just outside the Environment Agency Flood Warning Area for Cobbins Brook at Waltham Abbey. Site occupants should register to receive the warning service. Due to the proximity of the site to the watercourse, Flood Response Plans should be prepared by residents of the site.

LLFA Consultation

It is recommended that potential developers contact Essex CC as the LLFA for further information prior to taking forward site specific plans.

Summary

The proposed development is classified as Less Vulnerable and therefore does not require the formal application of the Exception Test in accordance with the NPPF. The site specific recommendations set out above should be considered as part of a site specific FRA for the site at the planning application stage, to ensure that future development on the site is safe and does not increase flood risk to the site or surrounding area.

4. Flooding from Ordinary Watercourses

4.1 Overview

4.1.1 When reviewing the sites that Epping Forest DC identified for potential development, it was noted that a further 20 sites are not shown to be located within Flood Zone 2 or 3 but do have ordinary watercourses passing through, or close by to the site. The sites that have been identified are detailed in Table 4-1.

Table 4-1 Sites located near Ordinary Watercourses

Allocation Reference	Site Address	Proposed Use	Vulnerability
CHIG.R5	Part of Chigwell Nurseries, 245 High Road, Chigwell, Essex, 1G7 5BL	Residential	More Vulnerable
EPP.R1	Land South of Epping - West	Residential	More Vulnerable
EPP.R2	Land South of Epping - East	Residential	More Vulnerable
LOU.E1	Oakwood Hill Industrial Estate, Loughton, IG10 3DQ	Employment	Less Vulnerable
NAZE.R2	The Fencing Centre, Pecks Hill, Nazeing, EN9 2NY	Residential	More Vulnerable
ONG.R5	Land at Greensted Road, Chipping Ongar, Essex, CM5 9HJ	Residential	More Vulnerable
RUR.E3	Matching Airfield/The Paper Store, Anchor Lane, Abbess Roding, CM5 0JR	Employment	Less Vulnerable
RUR.E10	Little Hyde Hall Farm, Hatfield Heath Road, CM21 9HX	Employment	Less Vulnerable
RUR.E11	Quickbury Farm, Hatfield Heath Road, CM21 9HY	Employment	Less Vulnerable
RUR.E13	Warlies Park House, Horseshoe Hill, EN9 3SL	Employment	Less Vulnerable
RUR.E14	Matching Airfield/The Paper Store, Anchor Lane, Abbess Roding, CM5 0JR	Employment	Less Vulnerable
RUR.T3	James Mead, Waltham Road, Long Green, Nazeing, Essex, EN9 2LU	Traveller	Highly Vulnerable
SP 4.1	Land to east of Rye Hill Road, London Road, Harlow, Essex, CM18 7HT	Residential	More Vulnerable
STAP.R1	Land at Oakfield Road, Stapleford Abbots, Essex, RM4 1JH	Residential	More Vulnerable
STAP.R3	The Drive, Stapleford Road, Stapleford Abbots, Essex, RM4 1EJ	Residential	More Vulnerable
THYB.R1	Land at Forest Drive, Theydon Bois	Residential	More Vulnerable
THYB.R2	Theydon Bois London Underground Car Park, Station Approach, Theydon Bois, Essex, CM16 7HR	Residential	More Vulnerable
WAL.R1	Land Lying to the west side of Galley Hill Road, Northern Portion	Residential	More Vulnerable
WAL.R2	Lea Valley Nursery, Crooked Mile, Waltham Abbey	Residential	More Vulnerable

WAL.R3	Land adjoining Parklands, Waltham Abbey	Residential	More Vulnerable
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- 4.1.2 It is important that the risk of flooding from ordinary watercourses is taken into account during the assessment of flood risk. In order to inform this, the RoFfSW mapping has been used to provide an indication of the risk of flooding from overland flow including these ordinary watercourses. Figure 4-1 shows the sites and the RoFfSW mapping.

Figure 4-1 Risk of Flooding from Surface Water (RoFSW)

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LEGEND		
<p>LEGEND</p> <p>Risk of Flooding from Surface Water</p> <ul style="list-style-type: none"> High (>3.3 per cent AEP) Medium (1 per cent - 3.3 per cent AEP) Low (<0.1 per cent AEP) 	<ul style="list-style-type: none"> Flood Records - Fluvial Flood Records - Surface water Flood Records - Sewer flooding Flood Records - Groundwater Flood Records - unknown source Flood Records - Canal overtopping 	<ul style="list-style-type: none"> Main Rivers Ordinary Watercourses Defences Flood storage bunds Flood storage areas

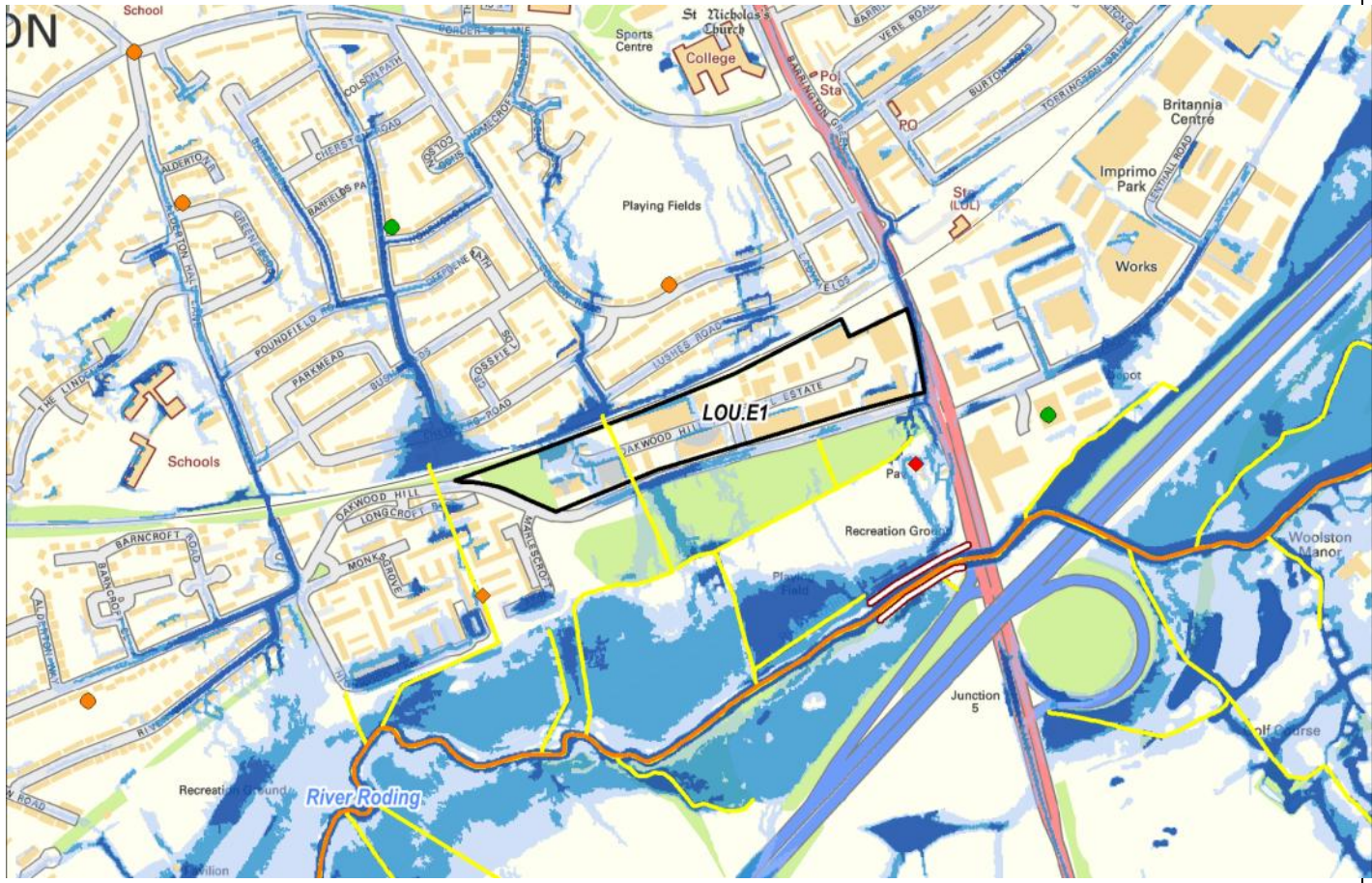
CHIG.R5 Part of Chigwell Nurseries	245 High Road, Chigwell, Essex, 1G7 5BL	Residential	More Vulnerable
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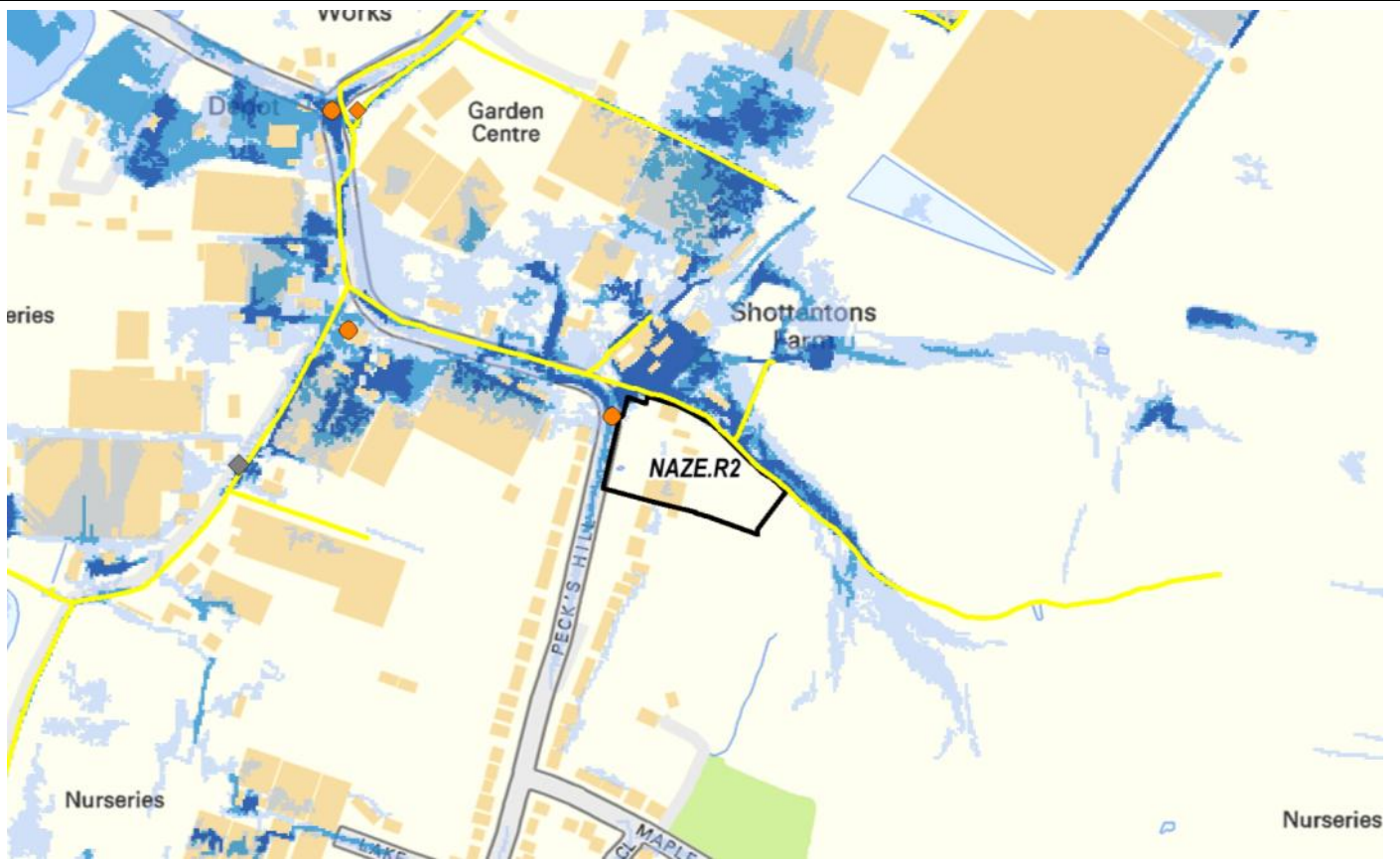
EPP.R1 / EPP.R2 Land South of Epping – West and East	Residential	More Vulnerable
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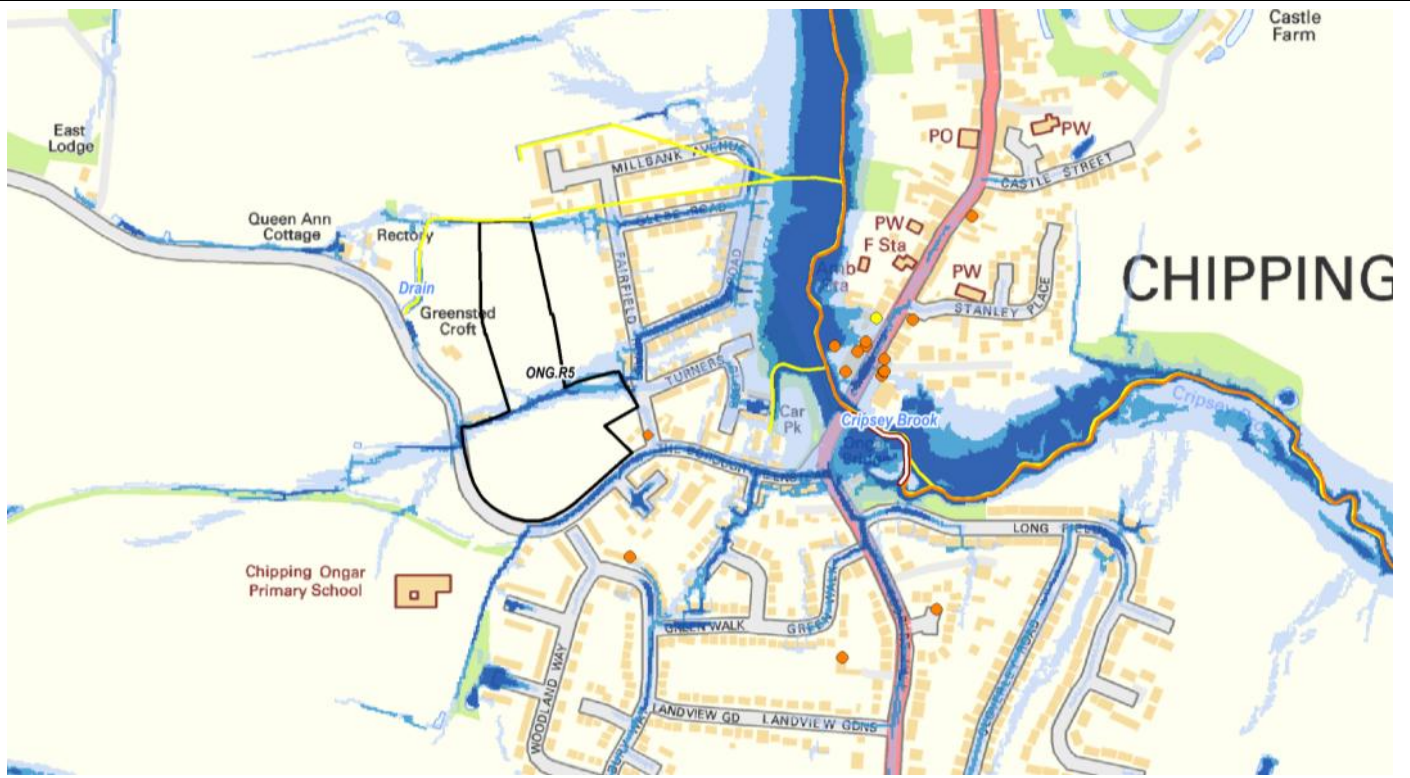
LOU.E1 Oakwood Hill Industrial Estate	Loughton, IG10 3DQ	Employment	Less Vulnerable
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NAZE.R2 The Fencing Centre	Pecks Hill, Nazeing, EN9 2NY	Residential	More Vulnerable
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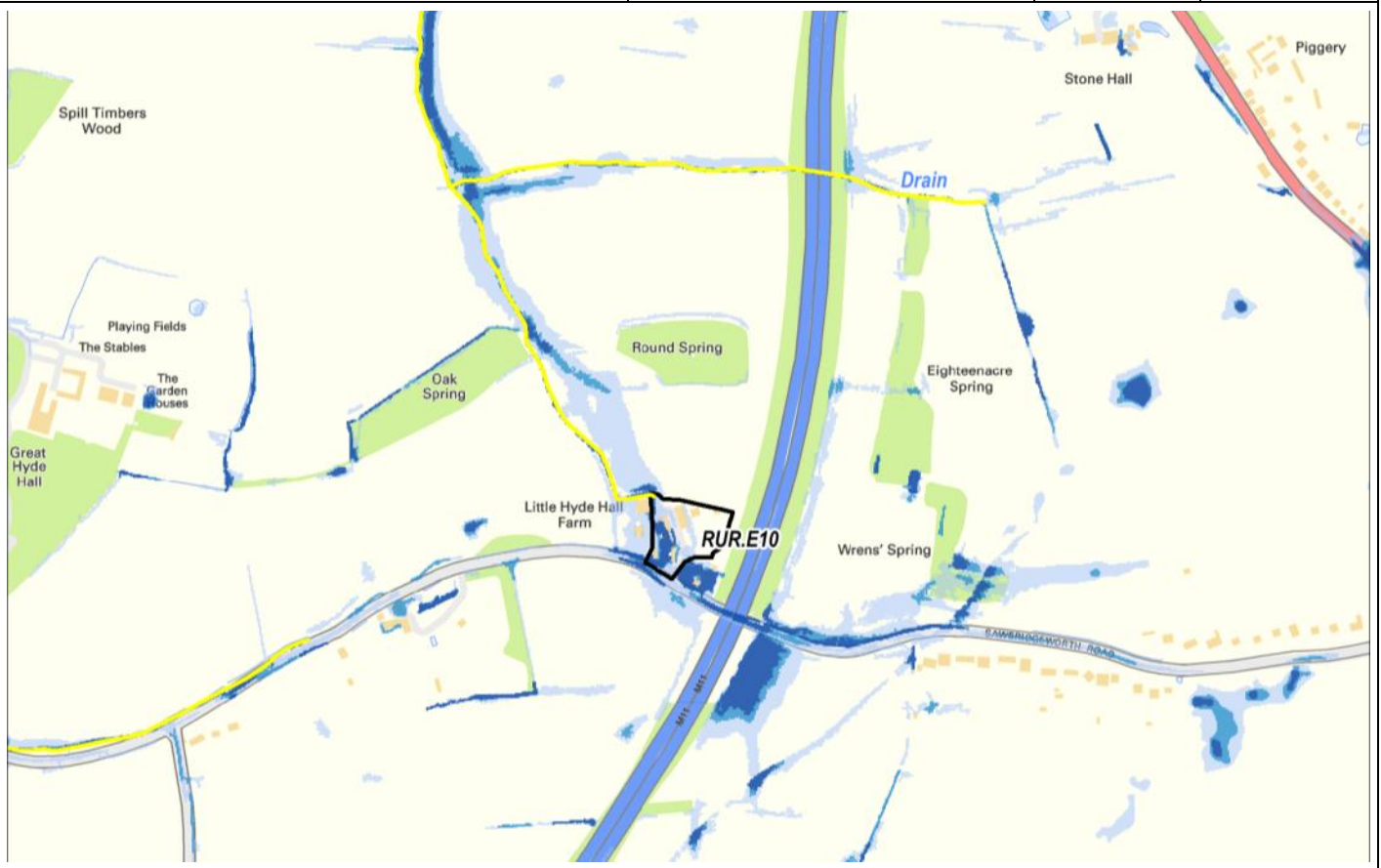
ONG.R5 Land at Greensted Road	Chipping Ongar, Essex, CM5 9HJ	Residential	More Vulnerable
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RUR.E3 Matching Airfield/The Paper Store	Anchor Lane, Abbes Roding, CM5 0JR	Employment	Less Vulnerable
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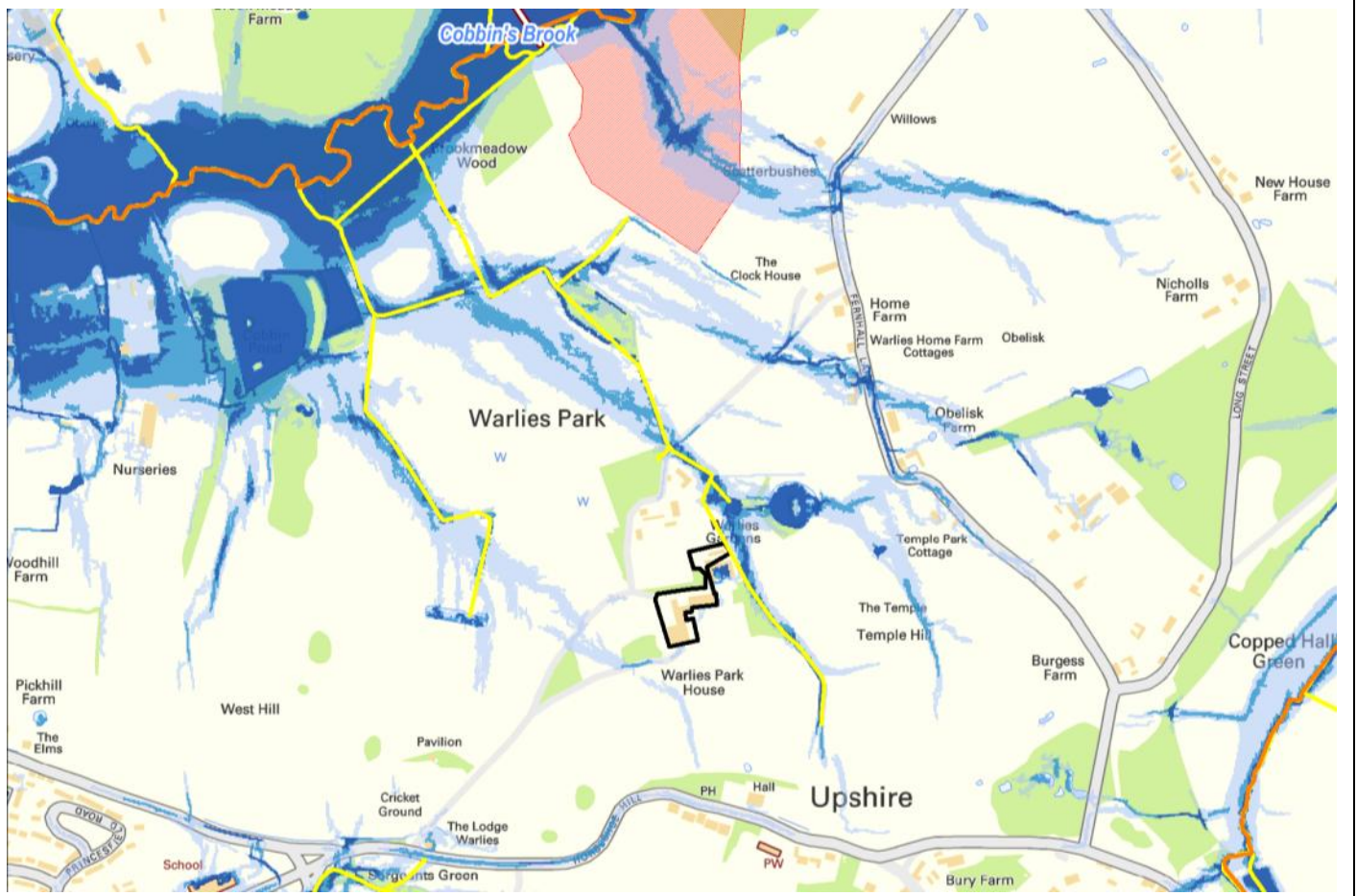
RUR.E10 Little Hyde Hall Farm	Hatfield Heath Road, CM21 9HX	Employment	Less Vulnerable
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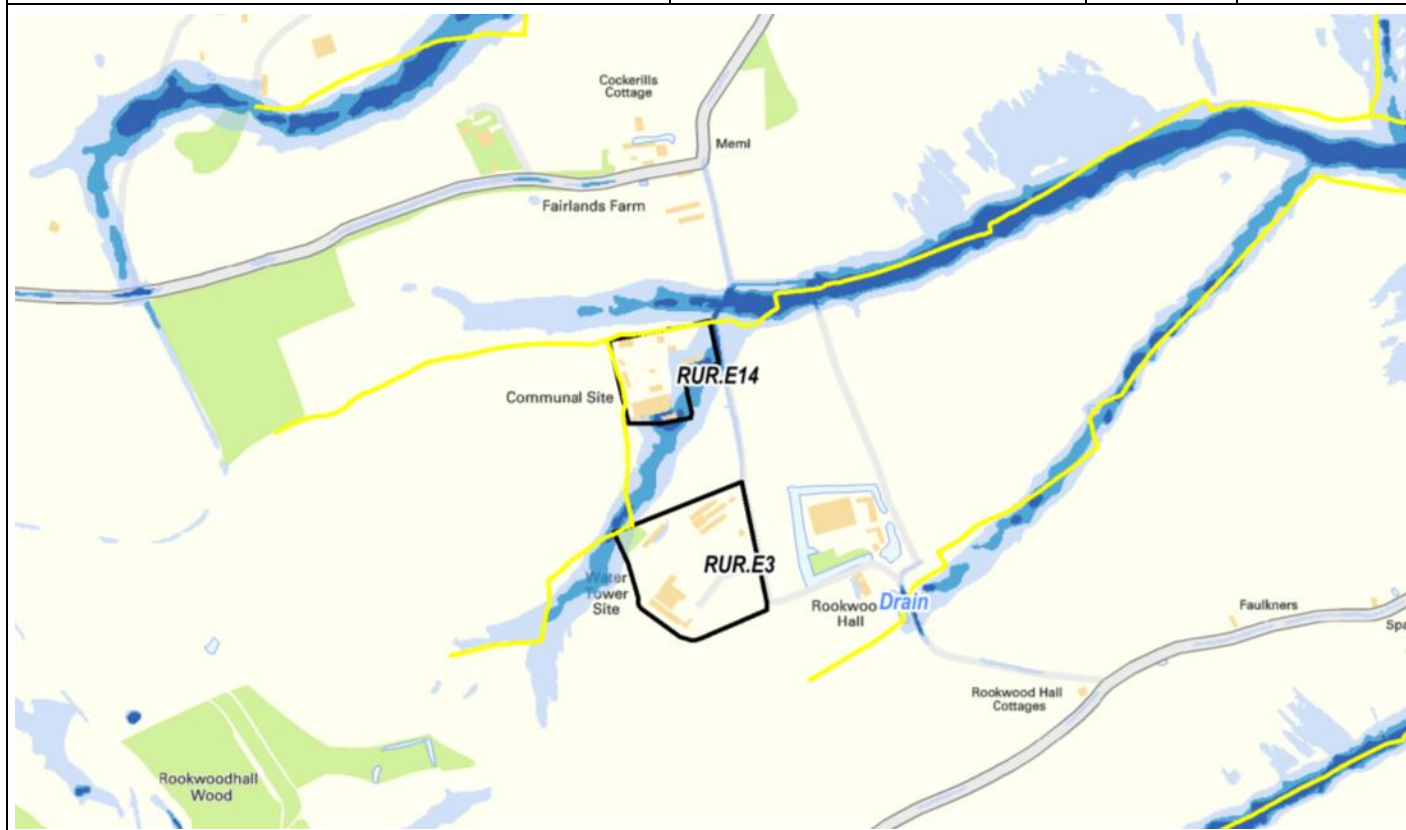
RUR.E11 Quickbury Farm	Hatfield Heath Road, CM21 9HY	Employment	Less Vulnerable
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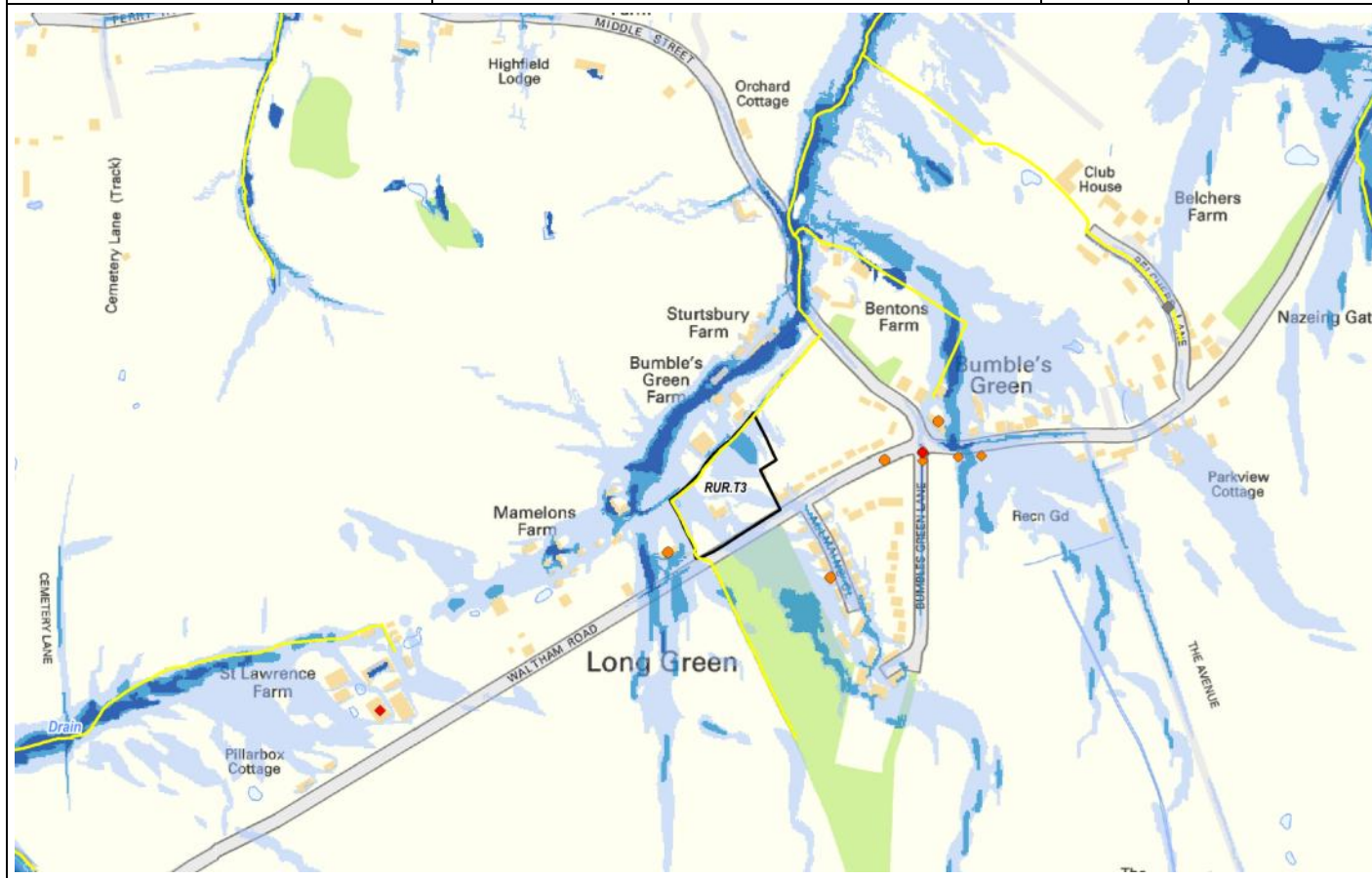
RUR.E13 Warlies Park House	Horseshoe Hill, EN9 3SL	Employment	Less Vulnerable
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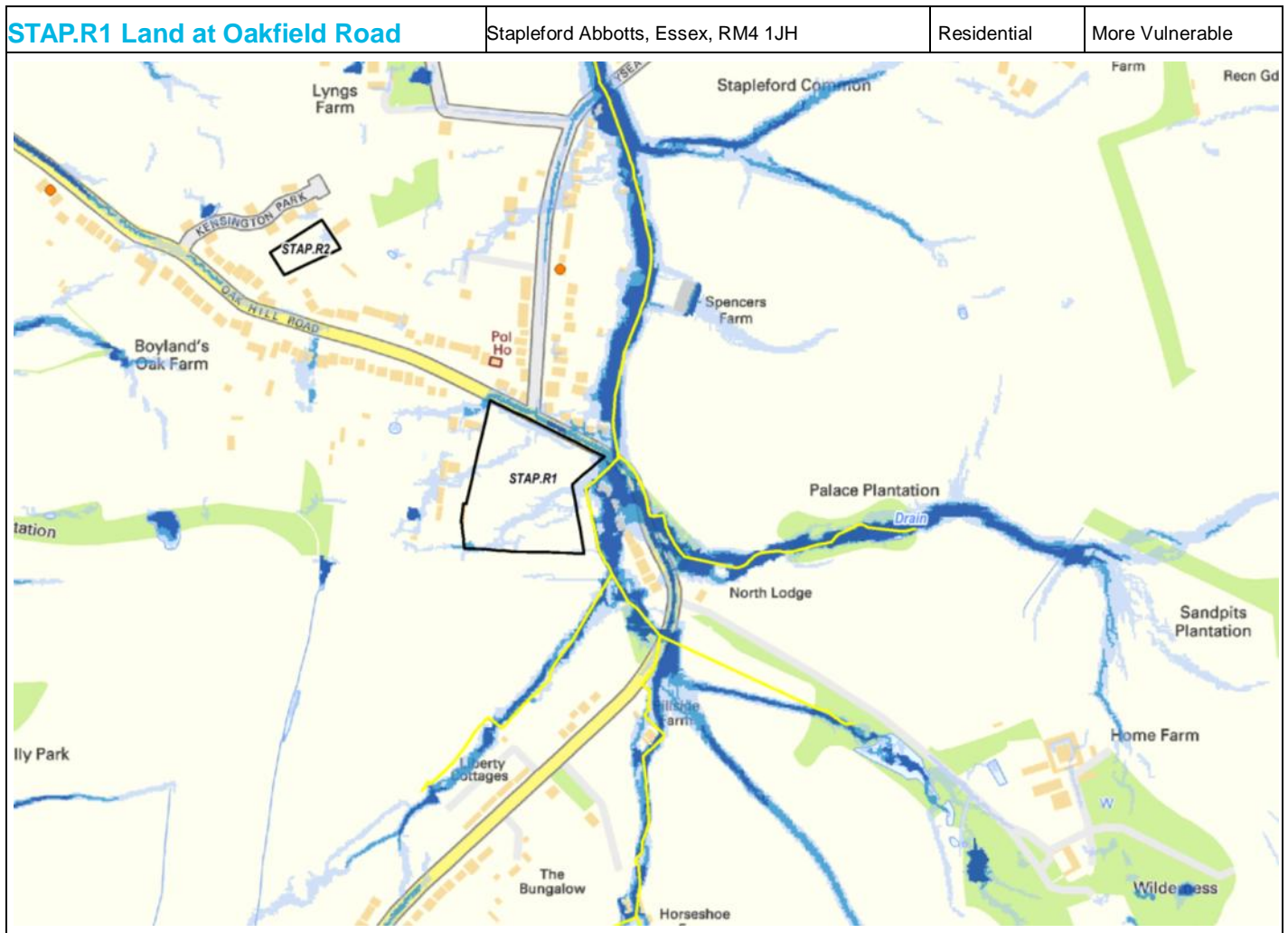


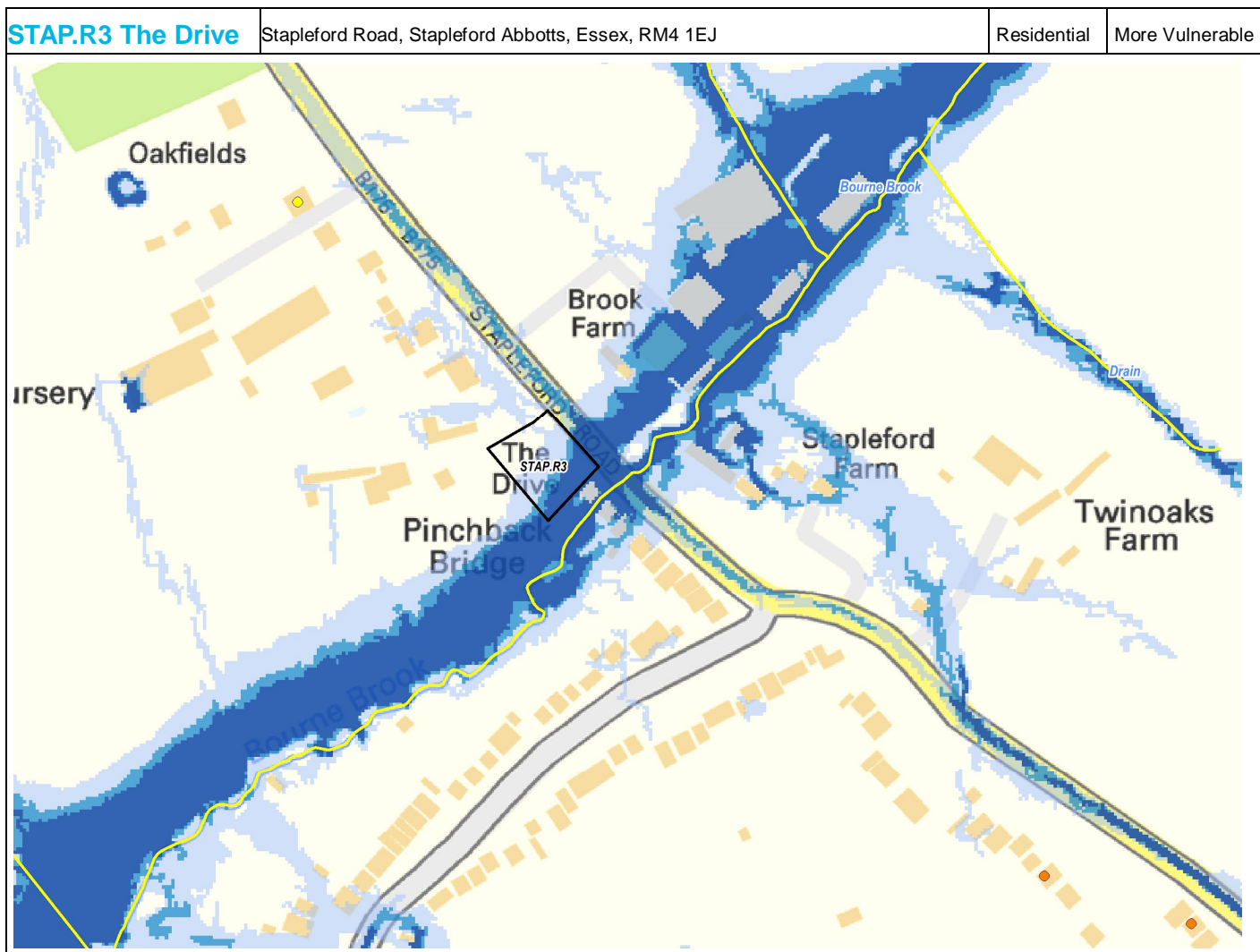
RUR.E14 Matching Airfield/The Paper Store	Anchor Lane, Abbess Roding, CM5 0JR	Employment	Less Vulnerable
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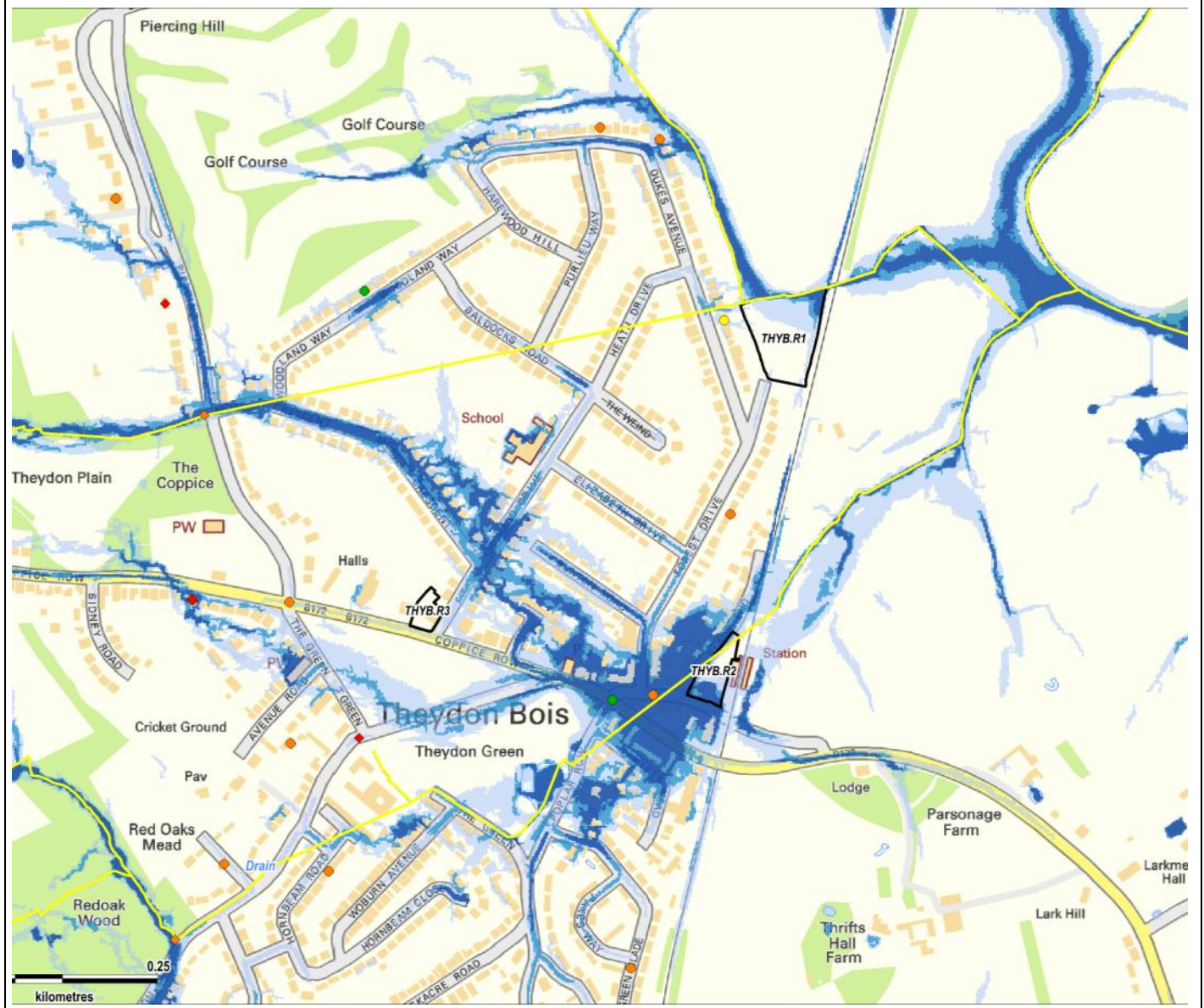
RUR.T3 James Mead	Waltham Road, Long Green, Nazeing, Essex, EN9 2LU	Traveller	Highly Vulnerable
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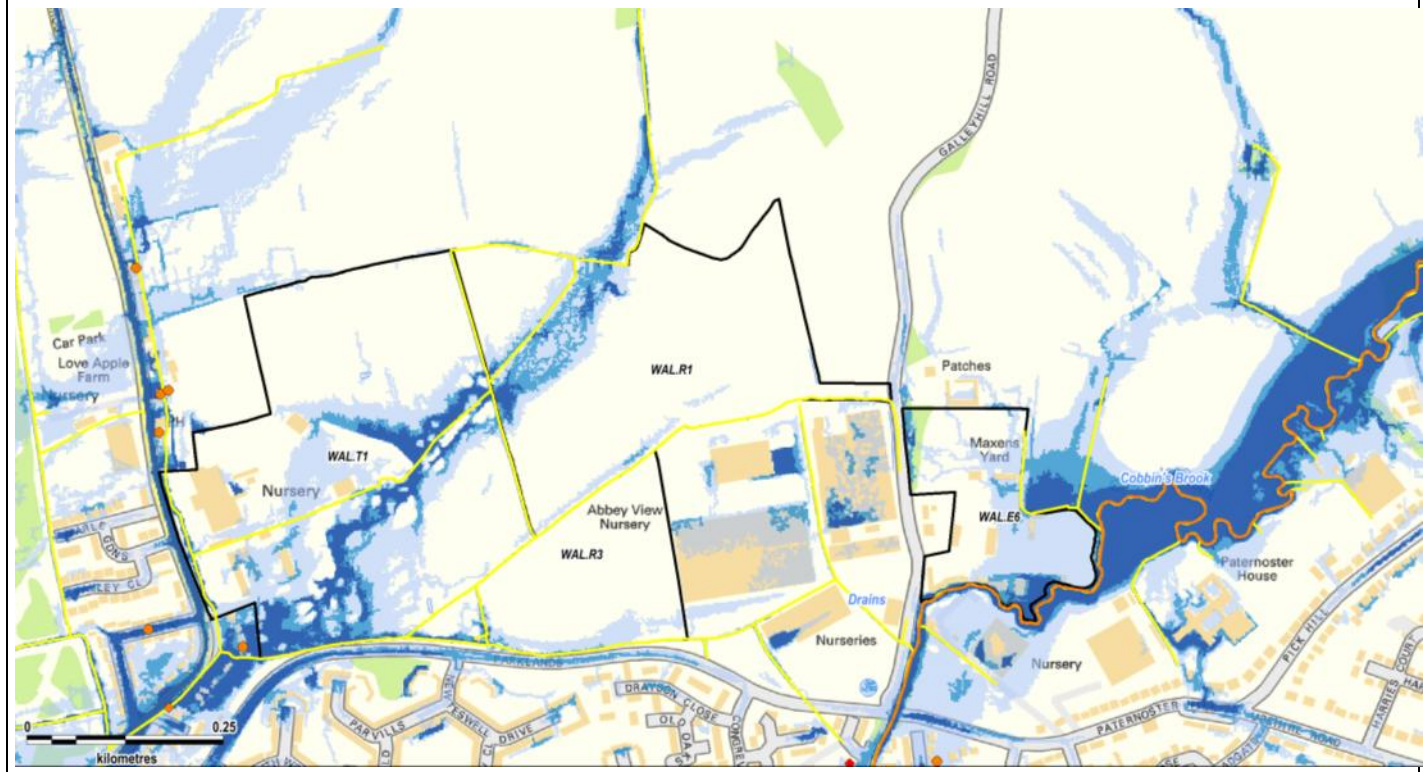




THYB.R1 Land at Forest Drive	Theydon Bois	Residential	More Vulnerable
THYB.R2 Theydon Bois London Underground Car Park	Station Approach, Theydon Bois, Essex, CM16 7HR	Residential	More Vulnerable



WAL.R1 Land Lying to the west side of Galley Hill Road	Northern Portion	Residential	More Vulnerable
WAL.R2 Lea Valley Nursery	Crooked Mile, Waltham Abbey	Residential	More Vulnerable
WAL.R3 Land adjoining Parklands	Waltham Abbey	Residential	More Vulnerable



Recommendations for site-specific FRA at planning stage

- 4.1.3 All of the sites in Table 4-1 are within Flood Zone 1 and are therefore considered to be appropriate for development of all vulnerability classifications in accordance with the requirements of the NPPF, as set out in Table 1-1 of this document.
- 4.1.4 The risk of flooding from the ordinary watercourses will need to be assessed further as part of a site specific FRA at the planning application stage. In order to inform this assessment, hydraulic modelling of the Ordinary Watercourse(s) may be required. The modelling should compare a range of probability events to determine the impact of climate change on the risk of flooding at this location.
- For sites proposed for employment use, the 1% AEP (1 in 100 year) flood event including the Central (25%) and Higher Central (35%) allowance are of relevance for Less Vulnerable development.
 - For sites proposed for residential use, the 1% AEP (1 in 100 year) flood event including the Higher Central (35%) and Upper End (70%) allowance are of relevance for More Vulnerable development.
- 4.1.5 The modelling will also need to address any potential impact the proposed development may have on flood risk to the surrounding area.
- 4.1.6 Future development should be set back from the Ordinary Watercourses by at least 8m. Any work affecting the ordinary watercourse may require consent under Section 23 Land Drainage Act (1991) from Essex County Council as the Lead Local Flood Authority (LLFA). Essex CC should therefore be consulted early in the site planning process.
- 4.1.7 The drainage strategy for the sites must be considered early in the site planning process to ensure adequate inclusion of SuDS, taking care to consider SuDS features in accordance with the hierarchy of SuDS (i.e. considering infiltration measures first wherever possible).

