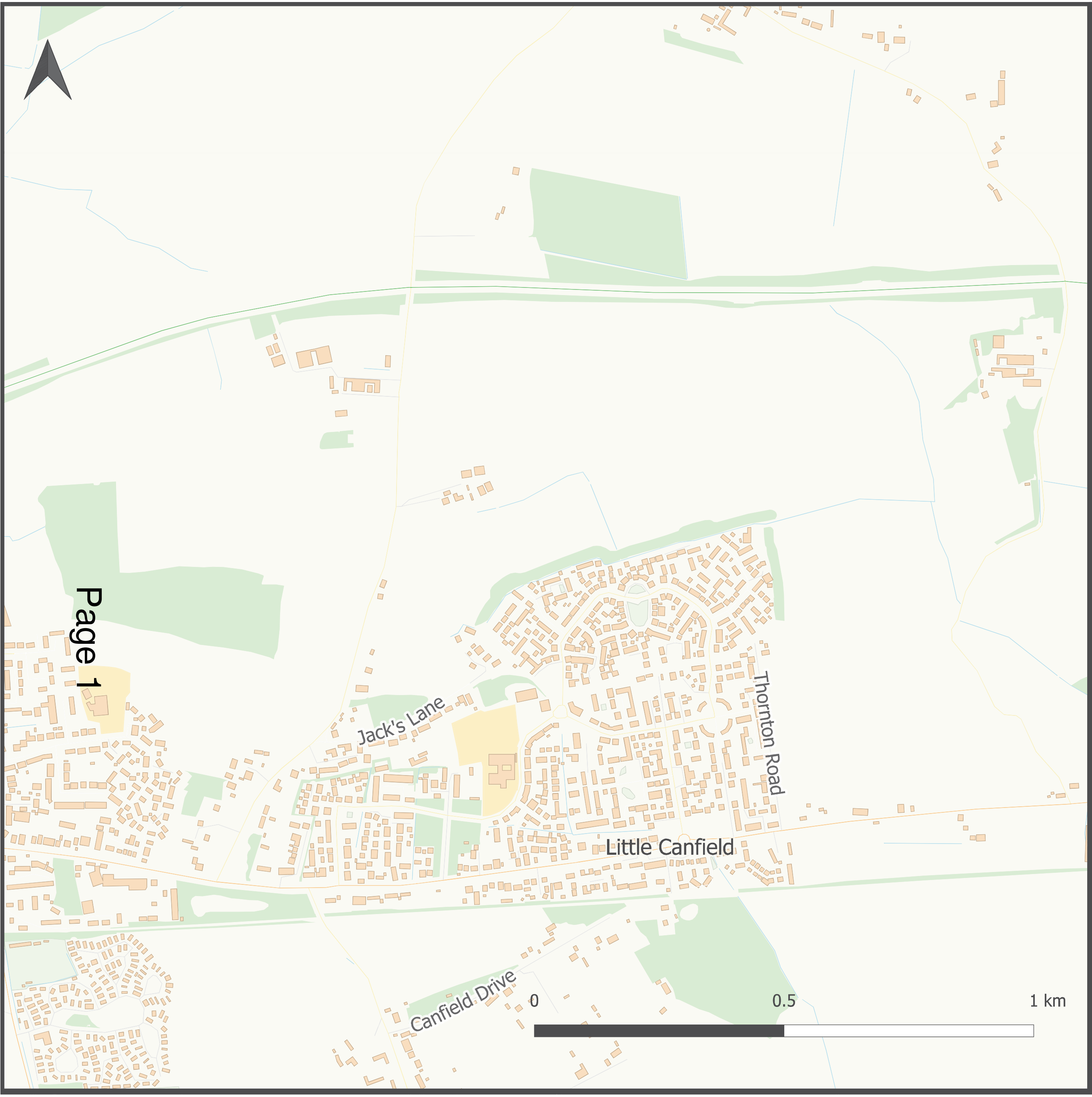
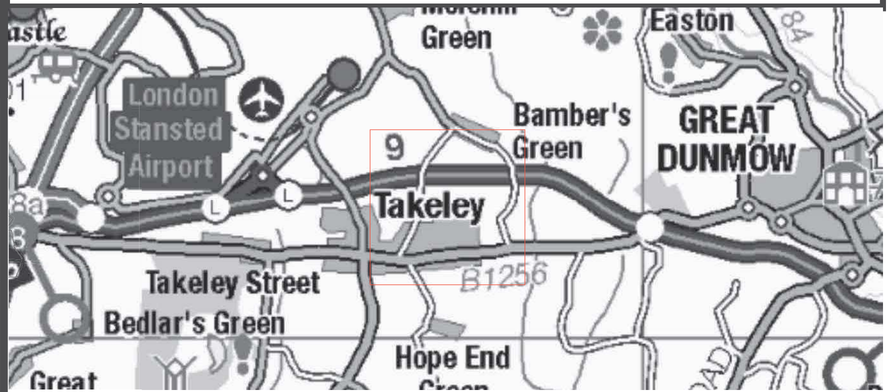


Uttlesford District Level 2
Strategic Flood Risk Assessment



Note: All layers are turned off by default. Click the box next to the layer of interest to turn on.

- Takeley 7
- Watercourse Buffer (8m)
- Watercourses

Historical Data
- Recorded Flood Outlines
- Historic Flood Map

Emergency Planning
- Flood Warning Areas
- Flood Alert Areas

Flood Zones
- Flood Zone 3b
- Indicativce Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2

Reservoir Extents
- Dry Day
- Wet Day

JBA Groundwater Emergence Mapping
- No risk.
- Groundwater levels are at least 5m below the ground surface.
- Groundwater levels are between 0.5m and 5m below the ground surface.
- Groundwater levels are between 0.025m and 0.5m below the ground surface.
- Groundwater levels are either at or very near (within 0.025m of) the ground surface.

Risk of Flooding from Surface Water

Depth (m)
- 3.3% AEP
- 1% AEP
- 0.1% AEP
- 3.3% AEP + CC
- 1% AEP + CC

- 0.00 - 0.15
- 0.15 - 0.30
- 0.30 - 0.60
- 0.60 - 0.90
- 0.90 - 1.20
- > 1.20

Velocity (m/s)
- 3.3% AEP
- 1% AEP
- 0.1% AEP
- 3.3% AEP + CC
- 0.1% AEP + CC

- 0.00 - 0.25
- 0.25 - 0.50
- 0.50 - 1.00
- 1.00 - 2.00
- > 2.00

Extents
- 3.3% AEP
- 3.3% AEP + CC
- 1% AEP
- 1% AEP + CC
- 0.1% AEP

Hazard
- 3.3% AEP
- 1% AEP
- 0.1% AEP
- 3.3% AEP + CC
- 1% AEP + CC

- Very low hazard/ caution
- Danger for some
- Danger for most
- Danger for all

Fluvial Climate Change*
- Indicative 3.3% AEP Central (modelled proxy)
- Indicative 1% AEP Central (modelled proxy)
- Indicative 1% AEP Higher Central (modelled proxy)
- Indicative 1% AEP (FZ2 where no modelled proxy)

Risk of Flooding from Rivers and Sea
- High
- Medium
- Low
- Very Low

Reduction In Risk of Flooding from Rivers and Sea
- County to Town
- National to County

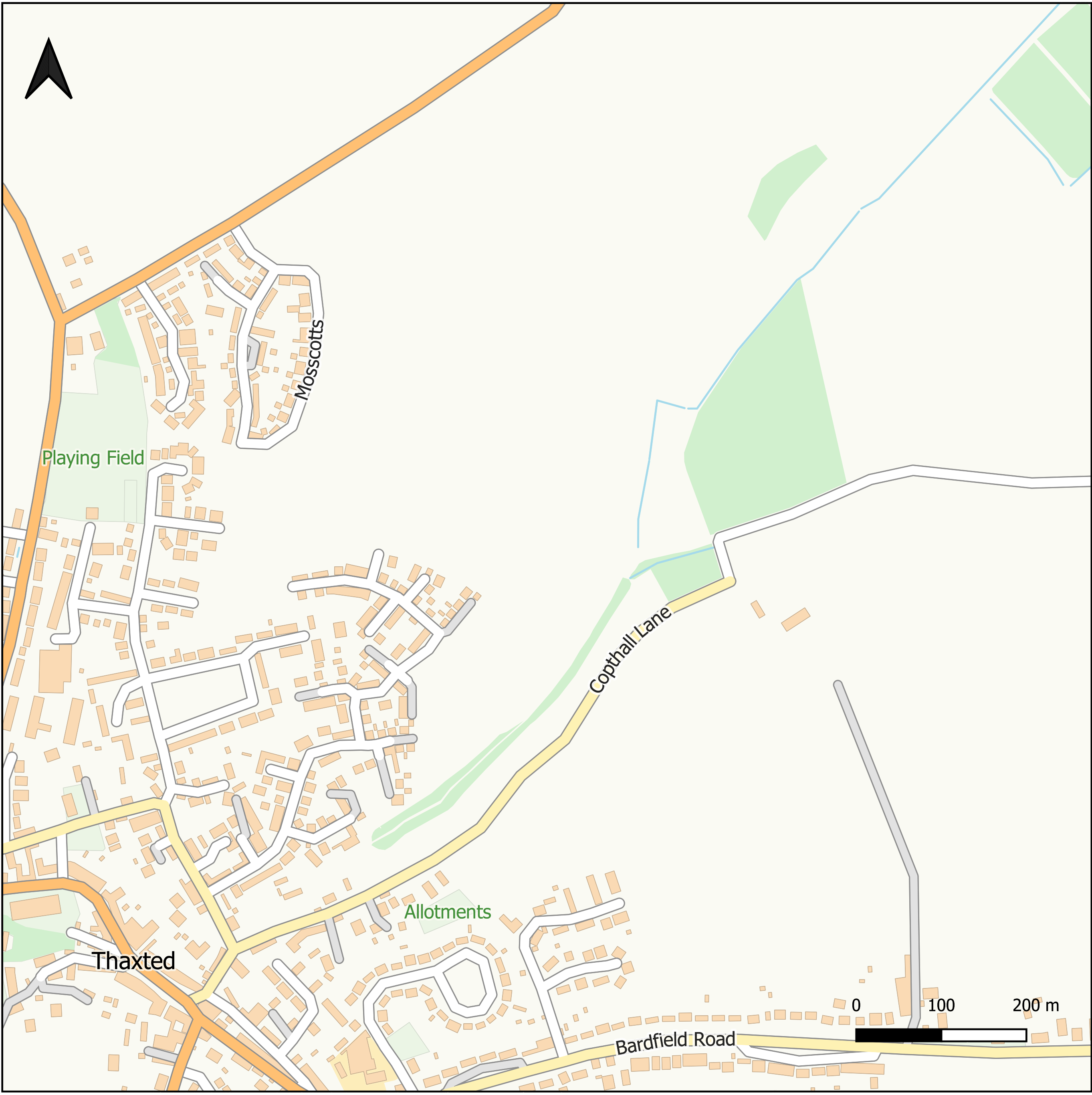
Defences
- Bridge Abutment
- Demountable Defence
- Embankment
- Engineered High Ground
- Flood Gate
- Natural High Ground
- Wall

JBA consulting

*Please refer to the L2 SFRA for commentary on how climate change extents have been derived

Agenda Item 9a

Uttlesford District Level 2
Strategic Flood Risk Assessment



Note: All layers are turned off by default. Click the box next to the layer of interest to turn on.

- Thaxted 4
- Watercourse Buffer (8m)
- Watercourses

Historical Data

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- Historic Flood Map

Emergency Planning

- Flood Warning Areas
- Flood Alert Areas

Flood Zones

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Depth (m)

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- 1% AEP
- 0.1% AEP
- 3.3% AEP + CC
- 1% AEP + CC

0.00 - 0.15
0.15 - 0.30
0.30 - 0.60
0.60 - 0.90
0.90 - 1.20
> 1.20

Velocity (m/s)

- 3.3% AEP
- 1% AEP
- 0.1% AEP
- 3.3% AEP + CC
- 0.1% AEP + CC

0.00 - 0.25
0.25 - 0.50
0.50 - 1.00
1.00 - 2.00
> 2.00

Extents

- 3.3% AEP
- 3.3% AEP + CC
- 1% AEP
- 1% AEP + CC
- 0.1% AEP

Hazard

- 3.3% AEP
- 1% AEP
- 0.1% AEP
- 3.3% AEP + CC
- 1% AEP + CC

Very low hazard/ caution
Danger for some
Danger for most
Danger for all

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- Indicative 1% AEP (FZ2 where no modelled proxy)

Please refer to the L2 SFRA for commentary on how climate change extents have been derived

Risk of Flooding from Rivers and Sea

- High
- Medium
- Low
- Very Low

Reduction In Risk of Flooding from Rivers and Sea

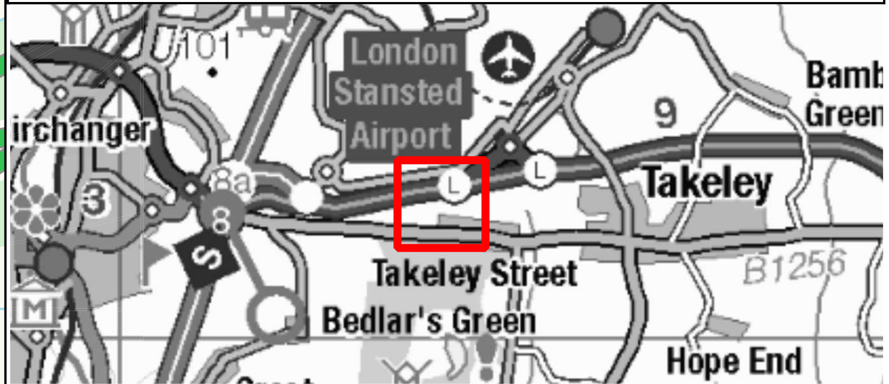
- County to Town
- National to County

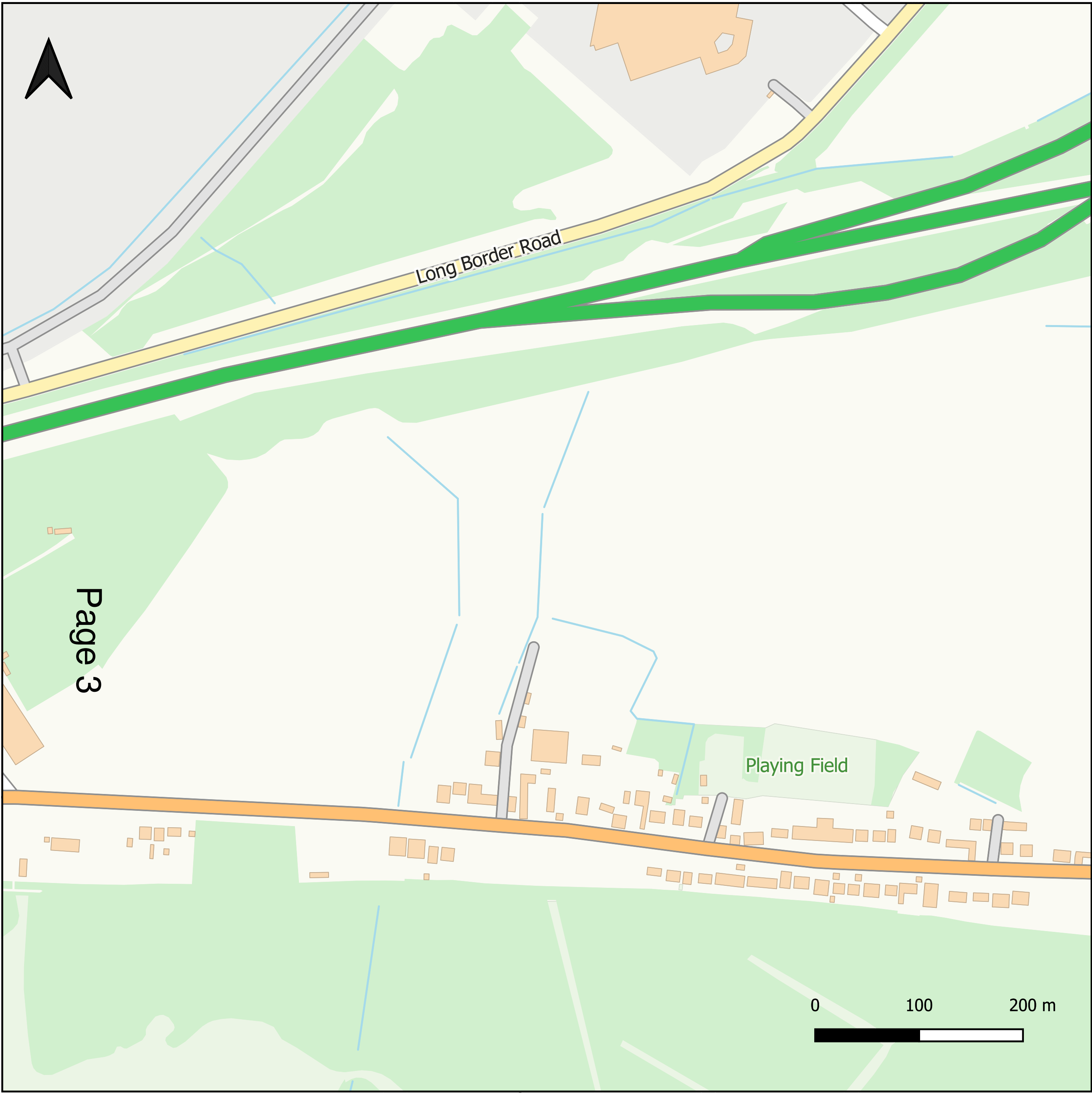
Defences

- Bridge Abutment
- Demountable Defence
- Embankment
- Engineered High Ground
- Flood Gate
- Natural High Ground
- Wall

JBA consulting

Uttlesford District Level 2
Strategic Flood Risk Assessment





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- 1% AEP
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- 1% AEP + CC

- 0.00 - 0.15
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- 0.60 - 0.90
- 0.90 - 1.20
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Velocity (m/s)
- 3.3% AEP
- 1% AEP
- 0.1% AEP
- 3.3% AEP + CC
- 0.1% AEP + CC

- 0.00 - 0.25
- 0.25 - 0.50
- 0.50 - 1.00
- 1.00 - 2.00
- > 2.00

Extents
- 3.3% AEP
- 3.3% AEP + CC
- 1% AEP
- 1% AEP + CC
- 0.1% AEP

Hazard
- 3.3% AEP
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- Flood Gate
- Natural High Ground
- Wall

*Please refer to the L2 SFRA for commentary on how climate change extents have been derived

	Uttlesford District Council **Level 2 Strategic Flood Risk Assessment** **Detailed Site Summary Table**
Site details	
Site Code	**Chesterford**
Address	Chesterford Research Park
Area	11.57ha
Current land use	Fields and car park
Proposed land use	Employment
Flood Risk Vulnerability	Less Vulnerable
Sources of flood risk	
Location of the site within the catchment	The majority of the site is located to the east of the Cam catchment, with the eastern most part of the site in the west of the Slade River catchment. The site is located to the east of Little Chesterford. It is bounded agricultural land to the east, south and west. The Chesterford Research Park is located to the north of the site.
Topography	The ground has a maximum elevation of 103m AOD to the east of the site and a minimum elevation of 96m AOD to the west of the site. The site is located on high ground between two river catchments.
Existing drainage features	There are no Ordinary Watercourses on the site. There are several small isolated ponds around the Research Park and the source of an Ordinary Watercourse just west of the most south-westerly site boundary, which flows south-west into the Cam.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 0% FZ2 – 0% FZ1 – 100% **Fluvial model outputs:** 3.3% AEP fluvial event – N/A 1% AEP fluvial event – N/A 0.1% AEP fluvial event – N/A **Available data:** The EA Flood Map for Planning Rivers and Sea Flood Zone shows available data for fluvial flood risk of Main Rivers. Any sources of Ordinary Watercourses near to the site have a catchment area less than 3km^2, and therefore are not covered by hydraulic modelling used to define the Flood Map for Planning. In the absence of Flood Zone mapping, the Risk of Flooding from Surface Water (ROFfSW) mapping has been used as a proxy for the risk of fluvial flooding from the Ordinary Watercourses.

	Flood characteristics: The EA Flood Map for Planning indicates that the site is located in Flood Zone 1 and therefore has a very low risk of fluvial flooding from Main Rivers. The source of an Ordinary Watercourse commences just west of the most southern point of the site boundary, which flows south-west into the Cam. There is no anticipated risk to the site given the topography slopes north-east to south-west away from the site.
Surface Water	**Proportion of site at risk (RoFfSW):** **3.3% AEP** – 0.13% Max depth – 0.00-0.15m Max velocity – 1.00-2.00m/s **1% AEP** – 0.14% Max depth – 0.00-0.15m Max velocity – 1.00-2.00m/s **0.1% AEP** – 6.80% Max depth – 0.00-0.15m Max velocity – 1.00-2.00m/s **Available data:** The Environment Agency's Risk of Flooding from Surface Water (ROFfSW) map has been used within this assessment. **Description of surface water flow paths:** During the 3.3% and 1% surface water AEP events is a very small extent of flooding in the northeast of the site. The maximum depth and velocity of this flooding is 0.15m and 2.00m/s respectively. During the 0.1% surface water AEP event the flooding in the northeast of the site increases in extent. Flow paths emerge in the centre of the site flowing from northeast to southwest towards the woods and the Ordinary Watercourse which commences south of the site. The maximum depth and velocity of this flooding is 0.15m and 2.00m/s respectively. These patches of 0.1% AEP risk do bisect the site in several locations here, so development should be steered away from these areas so that floodwater is not displaced elsewhere in the site.
Reservoir	This site is not shown to be at risk of reservoir flooding in both the 'dry day' and 'wet day' scenarios.
Groundwater	Using JBA's Groundwater Emergence map, this site is not considered to be susceptible to groundwater flooding, due to the nature of the local geological conditions.
Sewers	According to the Thames Water Flood Data, there are no incidents of flooding in the CM10 1 postcode area. The site is located within the Thames sewer catchment.
Flood history	The EA Historic Flooding Map shows that the site has not previously been affected by fluvial flooding from Main Rivers. The nearest EA historic flood extent is located approximately 1,653m east of the site, and relates to flooding from the River Granta in 2001, but the cause of the flooding is unknown. Historic flooding data provided by Essex County Council also showed no historic flood incidents for this site. There are no published Section 19 Flood Investigations for Saffron Walden and no Parish Flood Risk Survey information.

Flood risk management infrastructure	
Defences	The site is not currently protected by any formal flood defences.
Residual risk	There is no residual risk to the site.
Emergency planning	
Flood warning	The site is not covered by any EA Flood Warning Areas, or Flood Alert Areas.
Access and egress	Currently, the site can be accessed via the unnamed road leading to Chesterford Research Park both along the northwestern boundary and the northern boundary to the east of the Research Park (it may be that other access points are proposed in future master planning). The access road to the research park branches off Walden Road. Access is also possible from the east from Little Walden. Although safe access and egress can occur on the access road to the Research Park, Walden Road floods in places to depths and velocities not conducive with safe access and egress, to the north and south of the access road during the 3.3%, 1% and 0.1% AEP events, associated with ordinary watercourses. This means that safe access and egress to the site cannot be guaranteed as flood depths and velocities on this road range from a maximum of 0.60m and 2.00m/s respectively in the 3.3% AEP event to 0.90m and >2.00m/s respectively in the 0.1% AEP event. Petts Lane to the east leading to Little Walden is heavily impacted by surface water flood risk as the Slade flows parallel to this road, in a southerly direction. Little Walden itself is also at significant risk of flooding in all AEP events, therefore access and egress should be steered away from this direction. Safe access and egress are not possible in the 3.3% surface water plus climate change (SW+CC) model and greater. Depths and velocities to the north and south of Walden Road are too great for safe access and egress to occur. The maximum depths and velocities are 0.44m and 3.5m/s to the south of Walden Road where the ordinary Watercourse crosses the road.
Dry Islands	The site is not located on a dry island.
Climate change	
Implications for the site	**Management Catchment:** Cam and Ely Ouse **Fluvial:** The site is located in Flood Zone 1 and is not at fluvial flood risk. **Surface Water:** The RoFfSW 3.3% AEP and 1% AEP models have been upscaled and run for climate change using the Upper End allowance. The 3.3% and 1% SW+CC AEP models show a greater extent of flooding compared to the 3.3% and 1% AEP events. The maximum depth and velocity of this flooding is 0.13m and 2.19m/s respectively, meaning it is a 'hazard for some'. This shows that the site is vulnerable to the impacts of climate change.

	Development proposals at the site must address the potential changes associated with climate change and be designed to be safe for the intended lifetime. The provisions for safe access and egress must also address the potential increase in severity and frequency of flooding.
Requirements for surface water drainage and integrated flood risk management	

Broad-scale assessment of potential SuDS	**Geology & Soils**
	• The bedrock geology is 'Lewis Nodular Chalk Formation and Seaford Chalk Formation (Undifferentiated)- Chalk'.
	    ○ Relatively permeable.
	• The superficial deposit is 'Lowestoft Formation- Diamicton'
	    ○ Characterised by chalk and flint content as well as silts and clays, meaning it has varying permeability.
	
	Sustainable Drainage Systems (SuDS)
	• The site is not considered to be susceptible to groundwater flooding, due to the nature of the local geological conditions. This should be confirmed through additional site investigation work.
	• BGS data indicates that the underlying geology is 'Lewis Nodular Chalk Formation and Seaford Chalk Formation (Undifferentiated)', overlain with the superficial deposit of 'Lowestoft Formation' and is likely to have varying drainage. Any proposed use of infiltration should be supported by infiltration testing. Off-site discharge in accordance with the SuDS hierarchy is required to discharge surface water runoff.
	• The site is not located within a historic landfill site.
	• Use of infiltration SuDS not appropriate if the site is located on contaminated ground.
	• Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques.
	• The ROFfSW mapping indicates the presence of surface water flow paths on the site during the 3.3%, 1% and 0.1% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space.
	• If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.
	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints.
	• Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development.
	• Opportunities to incorporate filtration techniques such as filter strips, filter drains and bioretention areas must be considered.

	Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site. • The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.
Opportunities for wider sustainability benefits and integrated flood risk management	• The use of Natural Flood Resilience (NFM) measures upstream of the Ordinary Watercourse south of the site should be investigated, where suitable, to manage runoff and help mitigate flood events downstream in Chesterford and the wider Slade River catchment. • Opportunities for using source control SuDS to manage runoff rates and volumes, contributing to the reduction of flood peaks on the Ordinary Watercourses on the site and the River Chelmer downstream, as well as existing surface water flow paths leaving the site. • Waterside areas, or areas along known flow routes, can act as blue green infrastructure, being used for recreation, amenity, and environmental purposes, allowing the preservation of flow routes and flood storage, and at the same time providing valuable social and environmental benefits contributing to other sustainability objectives.
NPPF and planning implications	
Exception Test requirements	The Local Authority will need to confirm that the Sequential Test has been carried out in line with national guidelines. The Sequential Test will need to be passed before the Exception Test is applied. The Exception Test is not required for this development as the site is classified as 'Less Vulnerable' (Employment and not present in the Flood Zones/ no ordinary watercourses). Flood risk from surface water should still be considered and development steered away from this risk.

Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:**
	• At the planning application stage, a site-specific FRA will be required as the proposed development site is:
	  ○ Greater than one hectare
	  ○ At risk of other sources of flooding (surface water)
	• All sources of flooding should be considered as part of a site-specific FRA.
	• Consultation with the Local Authority, Lead Local Flood Authority, Water Company, and the Environment Agency should be undertaken at an early stage.
	• Any FRA should be carried out in line with the National Planning Policy Framework (NPPF); Flood Risk and Coastal Change Planning Practice Guidance (PPG); Uttlesford District Council's Local Plan Policies and Essex County Council's SuDS Guidance.

	• Detailed modelling will be required to confirm Flood Zone and climate change extents for the Ordinary Watercourses at the site as part of a site-specific FRA, to determine the flood extents, climate change and flood 1 in 1000-year flood level (0.1% AEP) The Environment Agency and LLFA should be consulted at the time of the flood risk assessment. They will advise as to whether existing detailed models are available, and if so, whether they need to be updated.Climate change should be assessed using recommended climate change allowances at the time of the assessment (Flood risk assessments: climate change allowances - GOV.UK (www.gov.uk)) for the type of development and level of risk. The current allowances were published in May 2022 but may be subject to change in the future. • Trash screens on culverts downstream of sites can build up with debris and increase flood risk. Additionally, Parish Councils can seek access improvements for trash screens and the ownership of the screen may be unknown. • If any culverts or flood risk infrastructure are found to be under the required conditions, then the new development must not compromise assets downstream, and if there is scope, then improvements should be sought to bring the assets up to condition. • Compensatory flood storage should be provided where development is proposed within the 1 in 100-year (1% AEP) flood extent, including an appropriate allowance for climate change. Ideally, proposed developments should have a net gain of floodplain storage to reduce the risk of flooding, on site and elsewhere. **Guidance for site design and making development safe:** • The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG). • The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates. • Planning permission is required to surface more than 5 square metres of unpaved ground using a material that cannot absorb water. • Arrangements for safe access and egress will need to be demonstrated for the 1% AEP surface water event with an appropriate allowance for climate change, using the depth, velocity, and hazard outputs. As safe access and egress may not be possible during a 3.3%, 1% or 0.1% surface water event, a Flood Warning and Evacuation Plan will be required. • Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere. ○ set finished floor levels to 300mm above the 1% AEP flood level, including an appropriate allowance for climate change.

	○ include property flood resistance and resilience measures. • Other examples of flood resistance and resilience measures include: ○ using flood resistant materials that have low permeability to at least 300mm above the estimated flood level. ○ making sure any doors, windows or other openings are flood resistant to at least 300mm above the estimated flood level. ○ raising all sensitive electrical equipment, wiring and sockets to at least 300mm above the estimated flood level. ○ The EA advises that minimum flood floor level for 'More Vulnerable' development such as residential properties should be set 600mm above the 1% AEP fluvial plus climate change peak flood level, where the appropriate new climate change allowances have been used. Therefore, if the vulnerability of the site increases then the minimum flood floor level would have to increase.

Key messages

Development is likely to be able to proceed if:

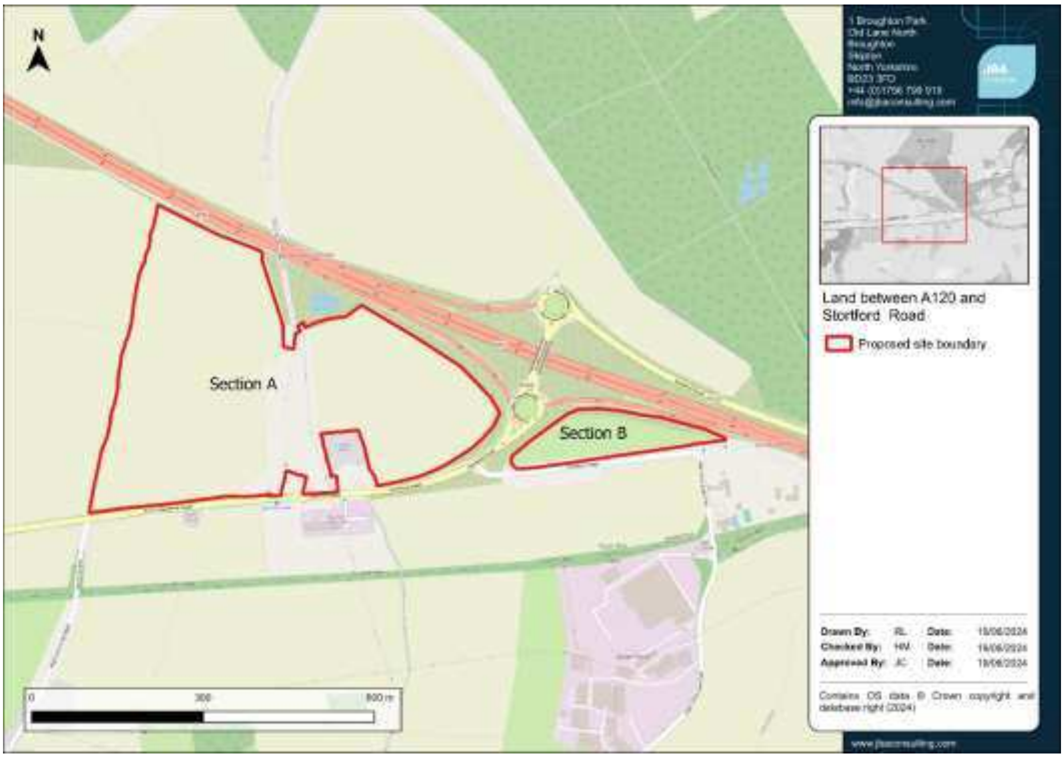
- Development is steered away the flow paths/areas of surface water ponding in the centre and northeast of the site. These should be incorporated and considered within the development design. These patches of 0.1% AEP risk do bisect the site in several locations here, so development should be steered away from these areas so that floodwater is not displaced elsewhere in the site.
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site.
- Safe access and egress can be demonstrated in the fluvial and surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere. Access should be directed west as Little Walden to the east is significantly impacted by flood risk along the Slade watercourse which runs in parallel to the road and village.
- A site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas.
- If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another).

Mapping Information

Flood Zones	Flood Zones 2 and 3 have been taken from the EA Flood Map for Planning mapping.
Climate change	The ROFfSW mapping has been used for the 3.3% AEP + climate change and the 1% AEP + climate change events.
Fluvial depth, velocity and hazard mapping	Depth, velocity, and hazard data was derived from the EA ROFfSW mapping.
Surface Water	The EA ROFfSW dataset has been used for this assessment.

	The latest climate change allowances (updated May 2022) have also been applied to the Risk of Flooding from Surface Water map to indicate the impact on pluvial flood risk.
Surface water depth, velocity and hazard mapping	The surface water depth, velocity, and hazard mapping for the 3.3%, 1% and 0.1% AEP events (considered to be high, medium, and low risk) have been taken from EA ROFfSW mapping.
Groundwater	Groundwater data was derived from JBA's Groundwater Emergence maps.
Sewer	Uttlesford's sewers are managed by both Thames Water (for catchments flowing south) and Anglian Water (for catchments flowing north). Data for sewer flooding was provided by Thames Water. Sewer flooding data was requested from Anglian Water but not received within the study timeframe.
Reservoir	The EA 'Dry Day' and 'Wet Day' Reservoir flood maps have been used in this assessment.

	Uttlesford District Council **Level 2 Strategic Flood Risk Assessment** **Detailed Site Summary Table**
Site details	
Site Code	**E**
Address	Land Between A120 and Stortford Road
Area	23.5 ha
Current land use	Greenfield (Arable Farmland)
Proposed land use	Employment
Flood Risk Vulnerability	Less Vulnerable
Sources of flood risk	
Location of the site within the catchment	The proposed development is located in the northeast of the Upper Roding catchment, which drains an area of 102 km^2. The site lies over an unnamed tributary of the River Roding, which flows parallel north to south. Section A is bound by the A120 to the north, the A120 Dunmow west interchange to the east, the B1256 Stortford Road to the south and fields to the west. Section B lies to the east of Section A. It is bound by the A120 to the north, Stortford Road to the west and High Cross Lane East to the south.
Topography	Section A encompasses a small valley, with an Ordinary Watercourse (a tributary to the River Roding) flowing north to south through the centre of the site. The lowest elevation is located in the central south of the site at 85.3m AOD, and highest in the southeast, at 96.9m AOD. The site is high ground along its western and eastern boundaries. Section B has a maximum elevation of approximately 200.0m AOD along the northern, eastern and southern boundaries of the site. The elevation reduces to approximately 140.0m AOD in the west and centre of the site

	
Existing drainage features	In Section A an Ordinary Watercourse (tributary to the River Roding) flows north to south through the centre of the site, bisecting it. Its source is approximately 0.6km north of the site at the Canfield Spring/ Highwood Quarry. It flows under the A120 and through the site parallel with an access road from the B1256 to the Quarry to Strood Court, which forms part of the site boundary. It enters culvert at the B1256, shifting ~60m east past Blue Gates Industrial Park, before continuing south, then south-west to meet the Roding approximately 1.2km north of Great Canfield. A second Ordinary Watercourse is present outside of the site, joining the other at the A120 culvert north of the site. The source of this watercourse is approximately 750m north-east in High Wood. No ordinary watercourses are present in Section B.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 0% FZ2 – 0% FZ1 – 100% **Fluvial model outputs:** 3.3% AEP fluvial event – Not Available 1% AEP fluvial event – Not Available 0.1% AEP fluvial event – Not Available **Available data:** The EA Flood Map for Planning Rivers and Sea Flood Zone shows available data for fluvial flood risk of Main Rivers. The Ordinary Watercourses on the site have a catchment area less than 3km^2, and therefore are not covered by hydraulic modelling used to define the Flood Map for Planning. Flood Zones are present for this watercourse approximately 920m downstream of the site, but this is based on 2D generalised modelling (national FMfP). The

	River Roding model is a detailed 1D-2D hydraulic model, which does not include this tributary. In the absence of Flood Zone mapping, the Risk of Flooding from Surface Water (RoFSW) mapping has been used as a proxy for the risk of fluvial flooding from the Ordinary Watercourses. **Flood characteristics:** Using the RoFfSW dataset as a proxy for fluvial flood risk in the absence on any detailed modelling or national Flood Zones, this shows that in Section A the floodplain around the banks of the channel is at flood risk for all modelled return periods. Flood risk should be confined to the north-south course of the ordinary watercourse given the land rises away from the floodplain on both sides, with the greatest flood depths along the channel centre line. Flood depths within the floodplain, outside of the main channel, are expected to reach up to 0.3m depth. There is a small difference between the 3.3% and 1% AEP extents, with a wider extent in the 0.1% AEP event. The RoFfSW extents would likely overestimate risk around the B1256 junction as it does not represent the culvert structure or channel capacity. However, the site is bisected from the Ordinary Watercourse. Section B does not have any main or ordinary watercourses.It is therefore recommended that a detailed hydraulic model is developed to assess the risk of fluvial flooding from the ordinary watercourse at the site, as part of a site-specific FRA.
Surface Water	**Proportion of site at risk (RoFfSW):** **3.3% AEP** – 3.1% Max depth – 0.6-0.9m Max velocity – 1-2m/s **1% AEP** – 4.8% Max depth – 0.6-0.9m Max velocity – 1-2m/s **0.1% AEP** – 14.6% Max depth – >1.2m Max velocity – >2m/s **Available data:** The Environment Agency's Risk of Flooding from Surface Water (RoFSW) map has been used within this assessment. **Description of surface water flow paths:** RoFSW mapping shows flow paths generated on the site within the 3.3%, 1% and 0.1% AEP events, bisecting the Section A due to the path of the Ordinary Watercourse. <u>Section A</u> For the 3.3% AEP event, the majority of surface water flooding occurs within the confines of the channel floodplain in the centre of the site, with localised sections along the northern and southern perimeter. This flooding has a maximum depth and velocity of 0.9m and 1-2m/s respectively. This corresponds to a hazard level of 'danger for most'. In the 1% AEP event, the extent of flooding within the central channel expands slightly. The localised flooding in the north and south of the site expand but remain minor along the boundaries. The 1% AEP event is

	expected to generate a maximum depth and velocity of 0.9m and 2m/s respectively and corresponds to a maximum hazard level of 'danger for all'. In the 0.1% AEP event, the flood extents widen more significantly. Through the centre of the site, the extents are wider but are still confined to the lower lying floodplain topography. Some isolated patches occur in the central eastern portion of the site, and the two flow paths along the northern and southern boundaries increase significantly to flood the full width of the lower western half of the site and encroaching into the site's northern boundary. The 0.1% AEP event is expected to generate a maximum depth and velocity in excess of 1.2m and 2m/s respectively. The maximum hazard level on site is 'danger for all'. Section B For the 3.3% AEP event, the surface water flooding pools in the centre of the site. This has a maximum depth and velocity of 1.20m and 1,00m/s respectively. In the 1% AEP event, the extent of flooding expands slightly, but the maximum depth and velocity of the flood remains the same. This corresponds to a hazard level of 'danger for all'. For the 0.1% AEP event, the extent increases, covering a larger proportion of the centre of the site. The maximum depth and velocity increases to >1.20m and 2.00m/s respectively with the hazard level remaining at a 'danger for all'.
Reservoir	The site is not expected to be at risk from reservoir flooding in the 'dry day' or 'wet day' scenario.
Groundwater	JBA's Groundwater Emergence Risk Map is provided as 5m resolution grid squares. The entire site is expected to have no risk of groundwater flooding. As a result, this zone is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological deposits.
Sewers	Sewer flooding records for Uttlesford district provided by Thames Water showed 11 instances of sewer flood events affecting the CM6 1 postcode. The site is located within the Thames sewer catchment. While Uttlesford district is not identified as a flood priority catchment in Thames Water's Drainage and Wastewater Management Plan (DWMP), developers should consult Thames Water as part of any development proposal to ensure development does not exacerbate existing issues and maximise opportunities for development to deliver benefits to Thames Water's strategic aims.
Flood history	The Environment Agency's Historic Flood Map shows no records of flooding on the site.
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is not protected by formal flood defences.
Residual risk	The Ordinary Watercourse in Section A enters several culverts in the vicinity of the site: under the A120, then another short access road along the site's central northern boundary, and then again by Strood Court at the Stortford Road B1256.

	If these culverts were to block in the event of a flood, it could exacerbate localised risk around the northern and southern boundaries. Flood risk would be expected to remain confined to the floodplain given the rising topography east and west away from the channel. The impacts should be investigated in a site-specific FRA using a hydraulic model. There is no residual risk in Section B.
Emergency planning	
Flood warning	The site is not located within a Flood Warning or Flood Alert area.
Access and egress	Vehicular access Section A is possible via a private access road which connects to the B1256 to the south and an access track connected to Loverose Way to the north. In the 3.33% AEP event, a small area of flooding is expected to occur at the access road's junction with the B1256, with flood depths of up to 0.3m and velocities of up to2m/s. While this may potentially restrict vehicular access through a hazard level of 'caution', access to the west of the site through the south is expected to remain largely dry. To the north, while there is only minimal flooding to the access track itself, access may be challenging under this scenario, as flood depths on the connecting Loverose Way are expected to reach 0.9m with velocities in excess of 2m/s. Access and egress to the north is thus expected to be challenging and generates a 'danger for most' hazard rating. In the 1% AEP event, flooding is expected to expand at the access road's junction with the B1256, while maximum flood depths and velocities are expected to remain the same, at 0.3m and 2m/s, respectively. This may further restrict vehicular access, while maintaining a hazard rating of 'caution'. In the 0.1% AEP event, flooding at the access road's junction with the B1256 is expected to reach a maximum depth and velocity of 0.9m and >2m/s, respectively. Access and egress to the site, from either side, is thus expected to be challenging, with a 'danger for most' hazard rating. Consideration is needed with regards to the site being bisected by both fluvial and surface water risk north to south. The access road is west of the watercourse, so how the eastern portion of the site can safely reach this road, or whether access can be gained directly to the B1256 from that half of the site, needs to be investigated and confirmed in a site-specific assessment. The Dunmow West Interchange is free of flood risk, with stretches of risk in all AEP events along the A120 to the north of the site. Away from the site, there are just isolated stretches of risk on both roads where watercourses and surface water flow paths cross roads. Vehicular access to Section B is possible via Stortford Road, which connects to the A120 to the north. In the 3.3% and 1% AEP events the access road to Section B is not flooded, however, Stortford Road and the A120 is flooded to the west of the site with a maximum depth and velocity of 0.90m and 2.00m/s. However, access and egress are still possible from the east of Stortford Road. In the 0.1% AEP event there is more substantial flooding on Stortford Road to the east of Section B, as well as on the A120 to the east and west of Section B, making access and egress more challenging. However, access and egress are still possible via Stortford Road to the south of the site. This road does have localised pooled flooding but this is not at a depth or extent

	that could impede access and egress. The maximum depth and velocity of this flooding is 0.30m and 1.00m/s.
Dry Islands	The site is not located on a dry island.
Climate change	
Implications for the site	**Management Catchment:** Roding, Beam and Ingrebourne **Fluvial:** There is no detailed model coverage to assess the impacts of climate change on fluvial flood risk. The RoFfSW 3.3% AEP and 1% AEP models have been upscaled and run for climate change using the Upper End allowance. This mapping can provide an indication on fluvial flooding with climate change, including for Ordinary Watercourses. However, it is recommended that a detailed hydraulic model of the Ordinary Watercourse on the site is developed, as part of a site-specific FRA, to fully assess the impacts of climate change on the developable land. The 1% AEP RoFSW extent has been used as a proxy for the 3.3% AEP + climate change fluvial event. The RoFSW mapping shows only a minor expansion in flood extent between the 3.3% and 1% AEP events, which suggests that climate change is not expected to have a significant impact on the extent of flooding from the Ordinary Watercourse during a 3.3% AEP event. The 0.1% RoFSW AEP extent has been used as a proxy for the 1% AEP + climate change fluvial event. The increase in flood extent in the RoFSW mapping along ordinary watercourses indicates that climate change may increase the extent of fluvial flooding, especially in the south of the site. **Surface Water:** Section A The 3.3% AEP + climate change event shows that climate change would make the flood extents greater than the 1% AEP event, though increases mainly along the existing channel floodplain running through the centre of the site. Under this scenario, maximum depths of 0.96m and velocities of 1.56m/s are possible within the Ordinary Watercourse and its surrounding banks, while previously dry areas are subject to isolated shallow (<0.15m) surface water flooding along the south and northern border. The 1% AEP + climate change event indicates that the surface water flooding is akin to the 0.1% AEP event extents and hence floods wider in the floodplain of the ordinary watercourse and along the northern and southern boundaries to the west, although the latter flow paths are shallow (<0.25m). Under this scenario, flood depths of 1.17m and velocities of up to 2.02m are expected within the Ordinary Watercourse and its surrounding floodplain, particularly in the northern portion of the site. Apart from a larger area of isolated ponding in the eastern half of the site, the extents overall are similar to the existing surface water flooding AEPs. There are no ‘new’ flow paths activated. Section B The 3.3% AEP + climate change event shows that climate change will increase the flood extent in the centre of the site, with a similar extent to the

	0.1% AEP event without climate change. Under this scenario the maximum depth and velocity is 0.95m and 0.05m/s. The 1% AEP + climate change event indicates that the extent is slightly larger than the 3.3% AEP + climate change event. The maximum depth and velocity of this flooding is 1.25m and 1.30m/s. Development proposals at the site must address the potential changes associated with climate change and be designed to be safe for the intended lifetime. The provisions for safe access and egress must also address the potential increase in severity and frequency of flooding.
Requirements for surface water drainage and integrated flood risk management	
Broad-scale assessment of potential SuDS	**Geology & Soils** The site sits on a bedrock of London Clay Formation, consisting of clay, silt and sand. This is overlain by a superficial layer of sedimentary diamicton of the Lowestoft Formation. **Sustainable Drainage Systems (SuDS)** • The site is not considered to be susceptible to groundwater flooding, due to the nature of the local geological conditions. This should be confirmed through additional site investigation work. • BGS data indicates that the underlying geology is London Clay Formation, overlain with superficial deposits of mainly Lowestoft Formation Diamicton and is likely to have varying drainage. Any proposed use of infiltration should be supported by infiltration testing. Off-site discharge in accordance with the SuDS hierarchy is required to discharge surface water runoff. • The site is not located within a Groundwater Source Protection Zone and there are no restrictions over the use of infiltration techniques with regard to groundwater quality. • The site is designated in one Nitrate Vulnerable Zones (NVZs) ○ Surface Water - “Surface Water S441 - Roding (Cripsey Brook to Loxford Water) NVZ” • The site is not located within a historic landfill site. • Use of infiltration SuDS not appropriate if the site is located on contaminated ground. • Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques. • The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 0.1% AEP event. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space. • If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.

	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such as filter strips, filter drains and bioretention areas must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site. • The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.
Opportunities for wider sustainability benefits and integrated flood risk management	• The use of Natural Flood Resilience (NFM) measures on the Ordinary Watercourse which affects the site should be investigated, where suitable, to manage runoff and help mitigate flood events downstream in the wider Roding catchment. • Opportunities for using source control SuDS to manage runoff rates and volumes, contributing to the reduction of flood peaks on the Ordinary Watercourse and the Roding downstream, as well as existing surface water flow paths leaving the site. • Waterside areas, or areas along known flow routes, can act as blue green infrastructure, being used for recreation, amenity, and environmental purposes, allowing the preservation of flow routes and flood storage, and at the same time providing valuable social and environmental benefits contributing to other sustainability objectives.
NPPF and planning implications	
Exception Test requirements	The Local Authority will need to confirm that the Sequential Test has been carried out in line with national guidelines. The Exception Test is shown to not currently be required for this development as the site is classified as 'Less Vulnerable' (Employment and not present in the Flood Zones). However, there is still significant surface water flood risk and fluvial flood risk from the Ordinary Watercourses which needs to be investigated in more detail and confirmed in a FRA, which if detailed modelling shows that parts of the site lie within FZ2/FZ3, the Exception test will need to be applied.

Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:**
	• At the planning application stage, a site-specific FRA will be required as the proposed development site is:
	  ○ Greater than one hectare
	  ○ At risk from Ordinary Watercourses through the site
	  ○ At risk of other sources of flooding (surface water and fluvial)
	• All sources of flooding should be considered as part of a site-specific FRA.
	• Consultation with the Local Authority, Lead Local Flood Authority, Water Company, and the Environment Agency should be undertaken at an early stage.
	• Any FRA should be carried out in line with the National Planning Policy Framework (NPPF); Flood Risk and Coastal Change Planning Practice Guidance (PPG); Uttlesford District Council's Local Plan Policies and Essex County Council's SuDS Guidance.
	• The development should be designed with mitigation measures in place where required.
	• Detailed modelling will be required to confirm Flood Zone and climate change extents for the Ordinary Watercourses at the site as part of a site-specific FRA, to determine the flood extents, climate change and flood 1 in 1000-year flood level (0.1% AEP) The Environment Agency and LLFA should be consulted at the time of the flood risk assessment. They will advise as to whether existing detailed models are available, and if so, whether they need to be updated. Climate change should be assessed using recommended climate change allowances at the time of the assessment (Flood risk assessments: climate change allowances - GOV.UK (www.gov.uk)) for the type of development and level of risk. The current allowances were published in May 2022 but may be subject to change in the future.
	• Blockage scenario modelling should be conducted to assess the residual risk associated with potential blockage of the culverts on the Ordinary Watercourse around the site boundaries.
	• Trash screens on culverts downstream of sites can build up with debris and increase flood risk. Additionally, Parish Councils can seek access improvements for trash screens and the ownership of the screen may be unknown.
	• If any culverts or flood risk infrastructure are found to be under the required conditions, then the new development must not compromise assets downstream, and if there is scope, then improvements should be sought to bring the assets up to condition.
	• Compensatory flood storage should be provided where development is proposed within the 1 in 100-year (1% AEP) flood extent, including an appropriate allowance for climate change. Ideally, proposed developments should have a net gain of floodplain storage to reduce the risk of flooding, on site and elsewhere.
	Guidance for site design and making development safe:
	• The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards

	throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).
	• The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates.
	• Planning permission is required to surface more than 5 square metres of unpaved ground using a material that cannot absorb water.
	• Arrangements for safe access and egress will need to be demonstrated for the 1% AEP tidal event and surface water events with an appropriate allowance for climate change, using the depth, velocity, and hazard outputs. As access and egress to some sections of the site will not be possible during the 0.1% AEP event, a Flood Warning and evacuation Plan will be required.
	• An environmental permit for flood risk activities may be required for work in, under, over or within 8m from a fluvial main river and from any flood defence structure or culvert.
	• Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
	    ○ raise them as much as possible.
	    ○ include extra flood resistance and resilience measures.
	• Other examples of flood resistance and resilience measures include:
	    ○ using flood resistant materials that have low permeability to at least 600mm above the estimated flood level.
	    ○ making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level.
	    ○ by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages

Development is likely to be able to proceed if:

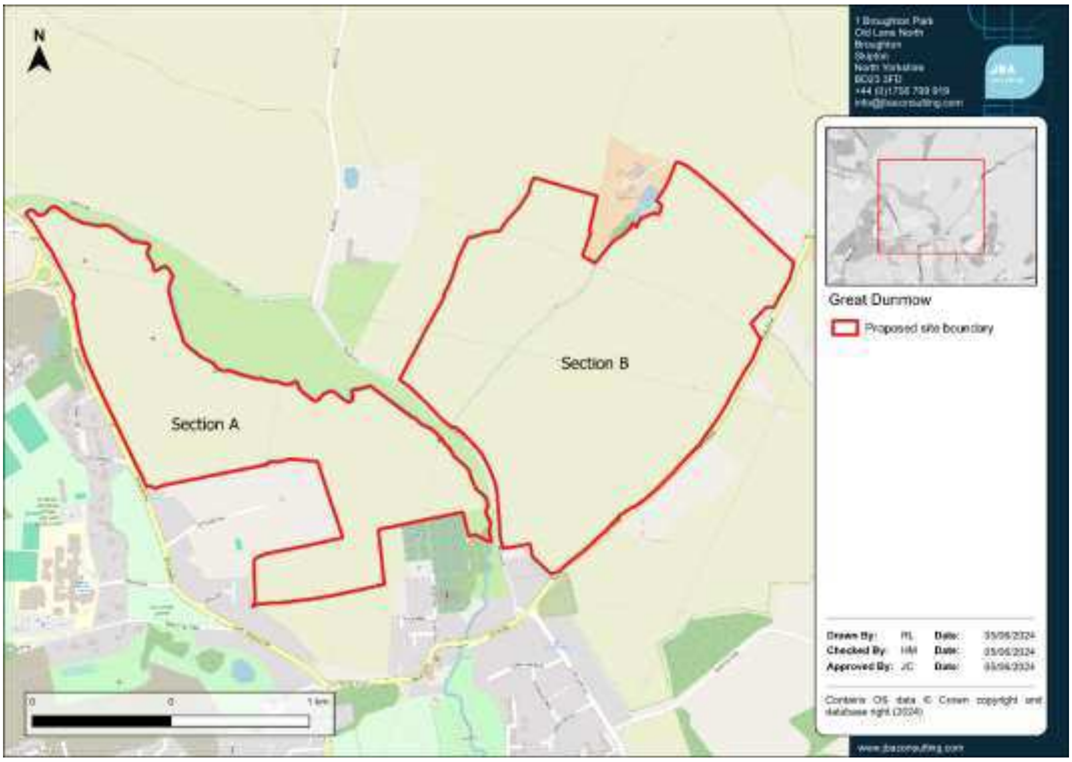
- Fluvial flood risk is confirmed through hydraulic modelling in a site-specific FRA, and development is steered away from the areas of fluvial and surface water flooding in the central portion of the Section A (north to south) and the central portion of Section B (east to west).
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site, including the areas on the northern and southern boundaries of the site.
- Safe access and egress can be demonstrated in the fluvial and surface water plus climate change events. This includes measures to reduce flood risk along these routes such as

raising access, but not displacing floodwater elsewhere. As the site is bisected by fluvial and surface water flood risk, consideration is needed for the eastern half of the site given the current access road is west of the watercourse.

- A site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas.
- If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another).

Mapping Information

Flood Zones	Flood Zones 2 and 3 have been taken from the EA Flood Map for Planning mapping. As the risk of fluvial flooding from Ordinary Watercourses on the site is not represented in the Flood Map for Planning, the RoFSW mapping has been used as a proxy dataset.
Climate change	A detailed fluvial hydraulic model is not available for this site, and therefore the impacts of climate change cannot be assessed in detail. Instead, the RoFSW mapping has been used as a proxy for fluvial flooding using the upscaled 3.3% AEP + climate change and the 1% AEP + climate change events.
Fluvial depth, velocity and hazard mapping	Depth, velocity, and hazard data was derived from the EA RoFSW mapping, in the absence of a detailed fluvial hydraulic model.
Surface Water	The EA RoFSW dataset has been used for this assessment. The latest climate change allowances (updated May 2022) have also been applied to the Risk of Flooding from Surface Water map to indicate the impact on pluvial flood risk.
Surface water depth, velocity and hazard mapping	The surface water depth, velocity, and hazard mapping for the 3.3%, 1% and 0.1% AEP events (considered to be high, medium, and low risk) have been taken from EA RoFSW mapping.
Groundwater	Groundwater data was derived from JBA's Groundwater Emergence maps.
Sewer	Uttlesford's sewers are managed by both Thames Water (for catchments flowing south) and Anglian Water (for catchments flowing north). Data for sewer flooding was provided by Thames Water. Sewer flooding data was requested from Anglian Water but not received within the study timeframe.
Reservoir	The EA 'Dry Day' and 'Wet Day' Reservoir flood maps have been used in this assessment.

	Uttlesford District Council **Level 2 Strategic Flood Risk Assessment** **Detailed Site Summary Table**
Site details	
Site Code	**Great Dunmow**
Address	Land off The Broadway, Great Dunmow
Area	70.32ha
Current land use	Greenfield
Proposed land use	Residential
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located in the northern half of the River Chelmer catchment. The site is located to the north of Great Dunmow. It is bounded by agricultural land to the north, east and southeast. To the southwest and west the site is bounded by a residential area and the B1008. The site has been divided into two land parcels due to the River Chelmer flowing northwest to southeast through the middle of it parallel with Bigods Lane, therefore the land to the west will be referred to as Section A, and the land to the east as Section B. 
Topography	Section A has a maximum elevation of 73m AOD to the west of the site and a minimum elevation of 52m AOD to the east of the site; land slopes downwards in a north-easterly direction towards the floodplain of the Chelmer.

	Section B has a maximum elevation of 82m AOD to the east of the site and a minimum elevation of 55m AOD to the west of the site; land slopes downwards in a south-westerly direction towards the floodplain of the Chelmer.
Existing drainage features	The Environment Agency's Statutory Main River Map indicates that the River Chelmer forms the northern site boundary of Section A. It flows between the two land parcels in a north-westerly to south-easterly direction before turning south to the east of Church End. There are two Ordinary Watercourses within Section B flowing north-east to south-west in parallel through the centre of the site (from approximately the centre of the site at the foot of the raised land). These join the Chelmer the other side of Bigods Lane. An Ordinary Watercourse flows towards Section A from Hoglands Wood, northeast between the leisure centre and Bowyers Road, into culvert at the B1008, and forming the north-easterly site boundary to join the Chelmer at the site's northern tip.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 9.6% FZ2 – 10.9% FZ1 – 89.1% **Fluvial model outputs:** 3.3% AEP fluvial event – 8.7% 1% AEP fluvial event – 9.6% 0.1% AEP fluvial event – 10.9% **Climate change scenarios:** 3.3% AEP Central – 9.3% 3.3% AEP Higher Central – 10.0% 1% AEP Central – 9.9% 1% AEP Higher Central – 10.2% 0.1% AEP Central – 11.6% 0.1% AEP Higher Central – 12.9% **Available data:** The EA Flood Map for Planning Rivers and Sea Flood Zone shows available data for fluvial flood risk of Main Rivers. The River Chelmer 1D-2D 2020 hydraulic model has been used in this assessment of flood risk and takes precedence over the national FMfP. It includes central and higher climate change scenarios for each of the return periods. There is also modelling available for the Chelmer Tributaries (2020), but the two watercourses included in this model are further south in Great Dunmow and hence are outside of the site boundary and area of influence. The two small Ordinary Watercourses in Section B have a catchment area less than 3km^2, and therefore are not covered by hydraulic modelling used to define the Flood Map for Planning. In the absence of Flood Zone mapping, the Risk of Flooding from Surface Water (RoFSW) mapping has been used as a proxy for the risk of fluvial flooding from the Ordinary Watercourses.

	Flood characteristics: Overall, the flood extents between FZ3b, FZ3a and FZ2 are quite similar; the extents increase in each event, but the floodplain is wide and well-defined, meaning the floodplain is largely filled in each event with little difference overall. <u>Section A</u> During a 3.3% AEP fluvial flooding event, flooding occurs along the site's border with the River Chelmer, particularly in the northern section where the floodplain is lower, and the flood extent encroaches further into the site. Flood depths along the site's eastern boundary, close to the river's centreline, may reach up to 4.5m flowing at 2m/s. This generates a maximum hazard of 'danger for all'. Out of the main channel, flood depths are greater through the northern central portion of the floodplain, at depths of around 0.7m and velocities of 0.5m/s, corresponding to a hazard of 'danger for most'. On the outer floodplain, flood extents are shallower, with depths and velocity reaching approximately 0.3m and 0.3m/s. Under the Central 3.3% AEP fluvial flooding scenario, maximum depths of 4.6m and velocities of 1.8m/s are present in channel, while across the floodplain, depth and velocities are around 1m and 0.7m/s respectively. In the 3.3% AEP plus Higher Central scenario, maximum depth and velocity reaches 1.5m and 0.7m/s respectively. During a 1% AEP fluvial flooding event, maximum flooding extent is increased slightly, to a maximum depth of 4.6m and velocity of 1.8m/s. The central portion of the floodplain has a depth and velocity of 0.9m and 0.7m/s, respectively. The fringes of this floodplain decrease in depth and velocity, to approximately 0.45m and 0.4m/s respectively. Under the Central 1% AEP fluvial flooding scenario, maximum depths of 4.8m and velocities of 1.8m/s are possible within the channel of the River Chelmer, while in the wider floodplain, depths and velocities reach a maximum of 1.5m and 0.7m/s respectively. In the Higher Central 1% AEP scenario, depths and velocities in channel reaching 4.9m and 1.8m/s;, and depths and velocities across the floodplain reaching 1.6m and 0.8m/s respectively. During a baseline 0.1% AEP fluvial flooding event, maximum flood extent is again increased slightly, with a maximum depth and velocity of 5.1m and 2.1m/s in the channel, respectively. Under this scenario, the central portion of floodplain has a depth of 1.3m and velocity of 0.8m/s, while the outer floodplain areas are up to 0.6m and 0.5m/s. Under the Central 0.1% AEP fluvial flooding scenario, maximum depths and velocities of 5.3m and 2.1m/s are possible in the River Chelmer channel, while across the floodplain, these reach 2.1m and 1.3m/s. For the higher central scenario, depths and velocities increase to 5.6m and 2.1m/s in channel, and 2.4m and 1.3m/s across the floodplain . <u>Section B</u> Section B is expected to be largely unaffected by flood risk from the Chelmer; all AEP events meet the southwestern boundary but are not shown to flow beyond Bigods Road into the site. A 3.3% AEP fluvial flood shows minimal, shallow encroachment onto the site boundary at depths and velocities of 0.4m and 0.4m/s, respectively. Under the Central 3.3% AEP fluvial flooding scenario, depths of 0.53m and

	velocities of 0.6m/s, while under the Higher Central 3.3% AEP scenario, depths of 0.8m and velocities of 1.7m/s may occur. Under the 1% AEP, the flood extent is expected to remain broadly similar, with flood depths on the westernmost border of 0.6m and velocities of 0.7m/s. Under the Central 1% AEP fluvial flooding scenario, depths of 0.5m and velocities of 0.6m/s, while under the Higher Central 1% AEP scenario, depths of 0.8m and velocities of 1.7m/s may occur. Under the 0.1% AEP, the flood extent is expected to remain broadly similar again, with flood depths on the westernmost border of 1m and velocities of 1.7m/s. Under the Central 0.1% AEP fluvial flooding scenario, depths of 0.5m and velocities of 1.7m/s, while under the Higher Central 0.11% AEP scenario, depths of 1.5m and velocities of 1.7m/s may occur. For the two parallel Ordinary Watercourses, the RoFSW mapping was used as a proxy for fluvial flooding. Under a 3.3% AEP event, the channel is expected to experience flood depths of 0.9m and velocities of up to 2m/s. Under a 1% AEP event, flooding is expected to remain within the channel, with a maximum flood depth of 1.2m and velocity of >2m/s along the southern Ordinary Watercourse close to its confluence with the River Chelmer. Under the 0.1% AEP event, flooding is expected to exceed bank capacity, and maximum depths and velocities of >1.2m and >2m/s are possible.
Surface Water	**Proportion of site at risk (RoFfSW):** **3.3% AEP** – 3.7% Max depth – 0.60-0.90m Max velocity – 1.00-2.00m/s **1% AEP** – 6.2% Max depth 0.90-1.20m Max velocity – 1.00-2.00m/s **0.1% AEP** – 16.2% Max depth – 0.90-1.20m Max velocity – >2.00m/s **Available data:** The Environment Agency's Risk of Flooding from Surface Water (RoFSW) map has been used within this assessment. **Description of surface water flow paths:** <u>Section A</u> During the 3.3% surface water AEP event, there are flow paths in the north and southeast of the site, largely in alignment with the Flood Zones and Chelmer floodplain. These have a maximum depth and velocity of 0.90m and 1.00m/s respectively. During the 1% surface water AEP event, the flow paths in the north and southeast of the site increase in extent. The maximum depth and velocity of this flooding increases to 1.20m and 1.00m/s respectively. During the 0.1% surface water AEP event, the entire north of the site and the eastern boundary is inundated more significantly; still contained in the Chelmer floodplain but encroaching further into the northern end of the site than the fluvial Flood Zones due to another flow path joining from the ordinary watercourse to the south-west by Bowyers Road. The maximum

	depth and velocity of this flooding increases to >1.20m and 2.00m/s respectively. <u>Section B</u> During the 3.3% surface water AEP event, there are three flow paths, which converge into two, associated with the topography of the Ordinary Watercourses on the site. These are flowing from the high ground in the northeast around Marks Farm to the lower ground southwest of the site and are tributaries to the River Chelmer. The flooding appears to be largely contained towards the depressed channels. These have a maximum depth and velocity of 0.90m and 2.00m/s respectively. During the 1% surface water AEP event, the flow paths are still largely contained in their depressed channels. Ponding occurs in the centre and southwest of the site. The maximum depth and velocity of this flooding increases to 1.20m and >2.00m/s respectively. During the 0.1% surface water AEP event, the existing flow paths are wider and there are now approximately 5 parallel surface water flow paths flowing towards the Chelmer. A new flow path is established in the south of the site and there is additional ponding in numerous locations across the site. The maximum depth and velocity of the flooding in the channel is >1.20m and >2.00m/s respectively. The maximum depth and velocity of the ponded water is 0.30m and 2.00m/s.
Reservoir	This site is shown to be at risk of reservoir flooding in both the 'dry day' and 'wet day' scenarios. In the 'dry day 'scenario Section A is inundated, in the north and along the eastern border of the site. Section B is not inundated during this 'dry day' scenario. In the 'wet day' scenario Section A is inundated to a greater extent in the north and along the eastern boundary. There is also a very small extent of flooding in Section B, on the western boundary.
Groundwater	Using JBA's Groundwater Emergence map, the majority of Section A is not considered to be susceptible to groundwater flooding, due to the nature of the local geological conditions. However, in the southeast of the site groundwater levels are either at or very near (within 0.025m of) the ground surface. Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots. In the southeast of the site there is a small area where groundwater levels are between 0.5m and 5m below the ground surface. There is a risk of flooding to subsurface assets but surface manifestation of groundwater is unlikely. Section B is not considered to be susceptible to groundwater flooding, due to the nature of the local geological conditions.
Sewers	According to the Thames Water Flood Data, there are no incidents of flooding in the CM6 2 postcode area. The site is located within the Thames sewer catchment. While Uttlesford is not identified as a flood priority catchment in Thames Water's Drainage and Wastewater Management Plan (DWMP), developers should consult Thames Water as part of any development proposal to ensure development does not exacerbate existing issues and maximise opportunities for development to deliver benefits to Thames Water's strategic aims.

Flood history	The EA Historic Flooding Map shows that the site was previously flooded in 1947 by the River Chelmer, due to the channel capacity being exceeded. This inundated the western boundary of Section A and the eastern boundary of the Section B. Historic flooding data provided by Essex County Council also showed no historic flood incidents for this site. There are no published Section 19 Flood Investigations for Great Dunmow and no Parish Flood Risk Survey information.
Flood risk management infrastructure	
Defences	The site is not currently protected by any formal flood defences.
Residual risk	There are several structures in the vicinity of the site which, in the event of a blockage, could exacerbate risk in the localised area. The River Chelmer flows under the B1008 at the northern tip of Section A; water would likely back up outside of the site and the site is already inundated in this area of low floodplain, but it could increase localised depths and velocities. The Ordinary Watercourse flowing towards this same end of Section A, flows under the B1008 downstream of Bowyers Road. This could cause additional water to flow into the site as shown in the RoFfSW mapping. The Chelmer flows under Church End Road just downstream of the site, and it is unlikely there would be a significant impact to the site here looking at the flood extents and topography, but it may cause localised increases at the site boundaries. The two Ordinary Watercourses in Section B flow under Bigods Lane to meet the Chelmer. If these were to block, localised increases in flood risk could be seen along the boundary, though risk is anticipated to be low as the Chelmer extents are confined. The RoFfSW mapping can be used as an indication of where water could pool. It is recommended that the residual risk to the site due to a blockage of these culverts is assessed using the River Chelmer model, as part of a site-specific FRA.
Emergency planning	
Flood warning	The site is not covered by the Environment Agency's Flood Warning Service. However, the Flood Alert Service does cover the eastern boundary of Section A, and a small proportion of the western boundary of Section B.
Access and egress	<u>Section A</u> Vehicular access of Section A is possible via an access road off the B1008, on the western boundary, and Bigods Lane to the east. During the 3.3% AEP surface water event, although there is ponding on the B1008, this is to a maximum depth and velocity of 0.30m and 0.25m/s respectively and so access and egress to the site is still possible via the west. However, under the same AEP, Bigods Lane is expected to become inundated with up to 0.6m water flowing >2m/s and should be avoided where possible. For a 3.3% AEP fluvial event, this road is at low risk of flooding to the south, while there is a potential for flooding to the north where the road, renamed Dunmow Road/B184, crosses the River Chelmer and depths and velocities of 0.5m and 0.6m/s, respectively, are expected. Flooding on Bigods Lane is

	expected to reach depths of 0.7m flowing at 0.65m/s in places, and thus should be avoided. During the 1% and 0.1% surface water AEP events the flooding is more extensive, blocking the access road connected to the B1008 with maximum depths and velocities of 0.30m and 2.00m/s. The velocity of this water is high which may impede safe access and egress. For the egress route via B1008, all AEP events, the depths and velocities of surface water flooding at the roundabout to the north of the B1008 are high, which may impede safe access and egress via this route. Therefore, access and egress should be in a southerly direction from the site. Access and egress conditions are expected to remain similar in the baseline and climate change scenarios. <u>Section B</u> Vehicular access to Section B is possible via an access road off the B1057 on the northeastern site boundary, and along the southwest via the same section of Bigods Lane as Section A. For the B1057 access route, access and egress are not impacted in any of the surface water AEP events. In all AEP events, the depths and velocities of surface water flooding at the to the northeast of the B1057 may make safe access and egress challenging via this route. Therefore, access and egress should be in a south-westerly direction from the site. As the access and egress to Section B is expected to be along the same section of Bigods Lane, conditions under the different AEPs is expected to also apply to Section B. Access and egress conditions are expected to remain similar in the baseline and climate change scenarios.
Dry Islands	The site is not located on a dry island.
Climate change	
Implications for the site	**Management Catchment:** Combined Essex Management Catchment **Fluvial:** The River Chelmer 2020 1D-2D hydraulic model has been used to assess the impacts of climate change on fluvial risk. The River Chelmer has available climate change outputs for the Central and Higher Central allowances for a 3.33% AEP event, and the Higher Central allowance for a 0.1% AEP event. The FZ3b+CC extent was also available. In the 3.3% fluvial AEP plus Central climate change allowance, there is a very similar extent to the 1% baseline AEP event, with similar flood depths (4.6m for both) and velocities (both 1.8m/s) within the channel. Within the floodplain, water may reach 1m deep and travel at 0.7m/s under the Central climate change simulation, versus 1.3m and 0.7m/s for the baseline 1% AEP. Under the 3.3% fluvial AEP plus Higher Central climate change allowance, there is again a similar extent to the 1% baseline AEP event, albeit with slightly higher maximum flood depths and velocities in the channel of 4.9m and 2.1m/s. Within the floodplain, water may reach 1.5m deep and travel at 0.7m/s under the Higher Central climate change simulation.

	In the 1% fluvial AEP plus Central climate change allowance, there is a very similar extent to the 1% baseline AEP event, with similar flood depths (4.6m for the baseline, 4.8 for the climate change simulation) and velocities (both 1.8m/s) within the channel. Within the floodplain, water may reach 1.5m deep and travel at 0.7m/s under the 1% AEP Central climate change simulation, versus 1.4m and 0.7m/s for the baseline 1% AEP event. Under the 1% fluvial AEP plus Higher Central climate change allowance, there is again a similar extent to the 1% baseline AEP event, albeit with slightly higher maximum flood depths and velocities in the channel of 4.9m while maintaining the same velocity of 1.8m/s. Within the floodplain, water may reach 1.6m deep and travel at 0.8m/s under the Higher Central climate change simulation. In the 0.1% AEP plus Central climate change scenario, the maximum depths and velocities are expected to be similar to those in the baseline 0.1% AEP event, at 5.3m and 2.1m/s, and 5.1m and 2.1m/s, respectively. Under the 0.1% AEP Higher Central scenario, depths of 5.6m in the channel are possible. In the floodplain, flood depths of 1.9m, 2.1m, 2.4m are possible for the baseline, Central and Higher Central 0.1% AEP events respectively. This corresponds to velocities of 1.3m/s for all three simulations. Furthermore, FZ3b+CC shows a similar extent to the baseline. This indicates that the site is relatively insensitive to changes to fluvial flooding as a result of climate change, as the floodplain is well contained within the baseline footprint. For the Ordinary Watercourses on the Section B site, the RoFSW mapping can provide an indication on fluvial flooding with climate change. The RoFSW mapping shows a moderate increase in flood extent between the baseline 3.3% and 3.3%+CC AEP events along the Ordinary Watercourses, suggesting that climate change will have a moderate impact on the extent of flooding from these watercourses during a 3.3% AEP event. The RoFSW mapping shows a large increase in flood extent between the baseline 1% and 1%+CC AEP events along the Ordinary Watercourses, suggesting that climate change will cause greater out-of-channel flooding along these watercourses during a 1% AEP event. **Surface Water:** The RoFfSW 3.3% AEP and 1% AEP models have been upscaled and run for climate change using the Upper End allowance. The 3.3% AEP + climate change event shows that climate change is expected to moderately increase the risk of surface water to the site, with the extent of the flow path in Section B increasing, and additional flow paths and ponding emerging in Section B. The 1% AEP + climate change event shows that climate change is expected to significantly increase the risk of surface water to the site. This mapping indicates that the flow path in the north and along the eastern boundary of Section A greatly increases in extent. In Section B there is a large increase in the extent of flow paths and the formation of numerous new ponding sites during the 1% AEP event, when climate change is taken into account. Development proposals at the site must address the potential changes associated with climate change and be designed to be safe for the intended lifetime. The provisions for safe access and egress must also address the potential increase in severity and frequency of flooding.

Requirements for surface water drainage and integrated flood risk management	

Broad-scale assessment of potential SuDS	**Geology & Soils**
	• The bedrock geology is 'London Clay Formation – clay, silt and sand'.
	  o Relatively impermeable, improved slightly by the presence of sand and flint gravel.
	• The superficial deposit is a mixture of 'Head – clay silt, sand and gravel', 'Alluvium – clay, silt, sand and gravel', 'Kesgrave Catchment Subgroup- sand and gravel', 'Lowestoft Formation – diamicton' and 'River Terrace Deposits, 1 – sand and gravel'.
	  o Due to the wide range of superficial deposits the drainage will vary.
	Sustainable Drainage Systems (SuDS)
	• The site is not considered to be susceptible to groundwater flooding, due to the nature of the local geological conditions. This should be confirmed through additional site investigation work.
	• BGS data indicates that the underlying geology is London Clay Formation, overlain with a large range of superficial and is likely to have varying drainage. Any proposed use of infiltration should be supported by infiltration testing. Off-site discharge in accordance with the SuDS hierarchy is required to discharge surface water runoff.
	• The site is not located within a historic landfill site.
	• Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques.
	• The RoFSW mapping indicates the presence of surface water flow paths on the site during the 3.3%, 1% and 0.1% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space.
	• If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.
	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints.
	• Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development.
	• Opportunities to incorporate filtration techniques such as filter strips, filter drains and bioretention areas must be considered. Consideration should be made to the existing condition of receiving

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waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies.

Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site.
The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.

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<tr><td>Opportunities for wider sustainability benefits and integrated flood risk management</td><td>

The use of Natural Flood Resilience (NFM) measures on the Ordinary Watercourses which affect the site should be investigated, where suitable, to manage runoff and help mitigate flood events downstream in Great Dunmow and the wider Chelmer catchment.
Opportunities for using source control SuDS to manage runoff rates and volumes, contributing to the reduction of flood peaks on the Ordinary Watercourses on the site and the River Chelmer, as well as existing surface water flow paths leaving the site.

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<tr><td colspan="2">NPPF and planning implications</td></tr>
<tr><td>Exception Test requirements</td><td>
The Local Authority will need to confirm that the Sequential Test has been carried out in line with national guidelines. The Sequential Test will need to be passed before the Exception Test is applied.

The NPPF classifies residential development as ‘More Vulnerable’.
The Exception Test is required for this site because there is significant fluvial flood risk within all Flood Zones at the eastern side of Section A and the development type is ‘More Vulnerable’.

‘More Vulnerable’ development is not permitted within Flood Zone 3b. Development should be steered away from areas of flood risk.
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<tr><td>Requirements and guidance for site-specific Flood Risk Assessment</td><td>
Flood Risk Assessment:

At the planning application stage, a site-specific FRA will be required as the proposed development site is:

Within fluvial Flood Zones 2 and 3
Greater than one hectare
At risk of other sources of flooding (surface water, groundwater, and reservoir)

All sources of flooding should be considered as part of a site-specific FRA.
Consultation with the Local Authority, Lead Local Flood Authority, Water Company, and the Environment Agency should be undertaken at an early stage.
Any FRA should be carried out in line with the National Planning Policy Framework (NPPF); Flood Risk and Coastal Change Planning Practice Guidance (PPG); Uttlesford District Council’s Local Plan Policies and Essex County Council’s SuDS Guidance.

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	• The development should be designed with mitigation measures in place where required.
	• Climate change should be assessed using recommended climate change allowances at the time of the assessment (Flood risk assessments: climate change allowances - GOV.UK (www.gov.uk)) for the type of development and level of risk. The current allowances were published in May 2022 but may be subject to change in the future.
	• Blockage modelling may need to be conducted using the existing River Chelmer model to assess the residual risk associated with potential blockage of the culverts.
	Guidance for site design and making development safe:
	• The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).
	• The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates.
	• Planning permission is required to surface more than 5 square metres of unpaved ground using a material that cannot absorb water.
	• Arrangements for safe access and egress will need to be demonstrated for the 1% AEP surface water event with an appropriate allowance for climate change, using the depth, velocity, and hazard outputs. As safe access and egress may not be possible during a 1% surface water event, a Flood Warning and Evacuation Plan will be required.
	• Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
	    ○ set finished floor levels to 600mm above the 1% AEP flood level, including an appropriate allowance for climate change
	    ○ include property flood resistance and resilience measures.
	• Other examples of flood resistance and resilience measures include:
	    ○ using flood resistant materials that have low permeability to at least 600mm above the estimated flood level
	    ○ making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level
	    ○ raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages	

Development is likely to be able to proceed if:

- The area of the eastern side of Section A, located in Flood Zone 3 is left undeveloped.
- Development is steered away from the area of fluvial flood risk in the eastern side of the site and the small flow paths/areas of surface water ponding are incorporated and considered within the development design.
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site.
- Safe access and egress can be demonstrated in the fluvial and surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere.
- A site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas.
- If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another).

Mapping Information	
Flood Zones	Flood Zones 2 and 3 have been taken from the EA Flood Map for Planning mapping and the River Chelmer 1D-2D hydraulic model for FZ3b. As the risk of fluvial flooding from Ordinary Watercourses on the site is not represented in the Flood Map for Planning, the RoFSW mapping has been used as a proxy dataset.
Climate change	The central and higher central allowances were available for the River Chelmer (2020) hydraulic model to indicate the impacts on fluvial flood risk. The latest climate change allowances (updated May 2022) have also been applied to the Risk of Flooding from Surface Water map to indicate the impact on pluvial flood risk.
Fluvial depth, velocity and hazard mapping	Depth, velocity, and hazard data was derived from the River Chelmer (2020) hydraulic model for the 3.3%, 1% and 0.1% AEP events.
Surface Water	The EA Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The surface water depth, velocity, and hazard mapping for the 3.3%, 1% and 0.1% AEP events (considered to be high, medium, and low risk) have been taken from EA RoFSW mapping.
Groundwater	Groundwater data was derived from JBA's Groundwater Emergence maps
Sewer	Uttlesford's sewers are managed by both Thames Water (for catchments flowing south) and Anglian Water (for catchments flowing north). Data for sewer flooding was provided by Thames Water.
Reservoir	The EA 'Dry Day' and 'Wet Day' Reservoir flood maps have been used in this assessment.

	Uttlesford District Council **Level 2 Strategic Flood Risk Assessment** **Detailed Site Summary Table**
Site details	
Site Code	**Saffron Walden A**
Address	Land behind Knights Park
Area	2.95ha
Current land use	Field
Proposed land use	Employment
Flood Risk Vulnerability	Less Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located in the upstream end of the Slade catchment, which flows into the River Cam, and is located southeast of Saffron Walden, east of Thaxted Road. It is bounded by agricultural fields on its northwestern, northeastern and southeastern boundaries and Knights Park retail park and industrial estate to the southwest.
Topography	EA LiDAR 1m DTM indicates that the site slopes north-westwards, from an elevation of approximately 94m AOD in the southeast of the site, to approximately 84m AOD in the northwest. The site is predominantly on high ground.
Existing drainage features	The Environment Agency's Statutory Main River Map indicates that there are no Main Rivers within the site boundary. The nearest Main River is a tributary of the Slade, located approximately 363m to the northwest of the northwestern boundary. An unnamed Ordinary Watercourse flows west, parallel (just slightly north) of the northeastern boundary of the site along Tiptofts Lane, to meet the small tributary of the Slade (and other small drains) around the Thaxted Road/ Cardamon Road junction. The tributary then flows north and meets the Slade at East Street, flowing then west towards the River Cam at Audley End.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 0% FZ2 – 0% FZ1 – 100% **Fluvial model outputs:** 3.3% AEP fluvial event – N/A 1% AEP fluvial event – N/A 0.1% AEP fluvial event – N/A

	Available data: The EA Flood Map for Planning Rivers and Sea Flood Zone shows available data for fluvial flood risk of Main Rivers. The Ordinary Watercourses on the site have a catchment area less than 3km2, and therefore are not covered by hydraulic modelling used to define the Flood Map for Planning. The detailed modelling available representing the Slade commences at the Thaxted Road/ Cardamon Road junction. In the absence of Flood Zone mapping, the Risk of Flooding from Surface Water (ROFfSW) mapping has been used as a proxy for the risk of fluvial flooding from the Ordinary Watercourses. **Flood characteristics:** The EA Flood Map for Planning indicates that the site is located in Flood Zone 1 and therefore has a very low risk of fluvial flooding from Main Rivers. However, as the Flood Zone maps only identify fluvial flood risk from Main Rivers, and therefore do not represent the risk of flooding form the Ordinary Watercourses on the site, the ROFfSW mapping has been used as a proxy for the risk of fluvial flooding of this watercourse. All three surface water AEP events along the channel are contained in the lower lying floodplain of the ordinary watercourse, approximately 35-40m away from the site's northern boundary. Close to the site's most northerly tip, the ordinary watercourse shifts across slightly (north then west again), from flowing along Tiptofts Lane. Here, there is a slightly wider extent of surface water risk as an overland surface water flow path along the site's eastern boundary also flows to meet the ordinary watercourse. The start of the Slade tributary modelling just downstream at Thaxted Road does show Flood Zone 3b and 3a as in-bank, with only FZ2 spreading out of bank. Due to the higher topography on site and the confined nature of an ordinary watercourse channel, it is deemed unlikely that this would have a significant effect on the site. Any potential effects would be confined to the site's most northerly boundary. It is recommended that the fluvial risk posed to the site from the ordinary watercourse is investigated in a site-specific FRA, which may require a detailed hydraulic model, or an extension to the existing model as part of a site-specific FRA.
Surface Water	**Proportion of site at risk (RoFfSW):** **3.3% AEP** – 0.0% Max depth – N/A Max velocity – N/A **1% AEP** – 0.0% Max depth – N/A Max velocity – N/A **0.1% AEP** – 6.62% Max depth – 0.13-0.30m Max velocity – 1.00-2.00m/s **Available data:** The Environment Agency's Risk of Flooding from Surface Water (ROFfSW) map has been used within this assessment. **Description of surface water flow paths:**

	There is no surface water flooding within the site boundary within the 3.3% or 1% AEP events. ROFfSW mapping shows flow paths generated on the site within the 0.1% AEP, along the southwestern boundary. This flows south-east to north-west towards the lower lying land. This has a maximum depth and velocity of 0.30m and 2.0m/s respectively. All three surface water AEP events along the channel are contained in the lower lying floodplain of the ordinary watercourse, approximately 35-40m away from the site's northern boundary. An overland surface water flow path is present in all AEP events parallel with the site's eastern boundary. The 0.1% AEP event reaches the site boundary with a maximum depth and velocity of 0.30m and 2.0m/s respectively. The flow path flows northwest to meet the ordinary watercourse in the location of where it shifts its course slightly north.
Reservoir	This site is not shown to be at risk of reservoir flooding in either the 'dry day' or 'wet day' scenarios.
Groundwater	Using JBA's Groundwater Emergence map, groundwater levels are either at or very near (0.025m of) the ground surface in the north of the site. In the southeast of the site groundwater levels are between 0.025 and 0.5m below the ground level. Therefore, this site is susceptible to groundwater flooding.
Sewers	According to the Thames Water Flood Data, there are no incidents of flooding in the CB10 2 postcode area. The site is located within the Thames sewer catchment. While Uttlesford is not identified as a flood priority catchment in Thames Water's Drainage and Wastewater Management Plan (DWMP), developers should consult Thames Water as part of any development proposal to ensure development does not exacerbate existing issues and maximise opportunities for development to deliver benefits to Thames Water's strategic aims.
Flood history	The EA Historic Flooding Map shows that the site has not previously been affected by fluvial flooding from Main Rivers. The nearest EA historic flood extent is located approximately 2.8km northwest of the site, and relates to flooding from the River Cam in 2001, but the cause of the flooding is unknown. Historic flooding data provided by Essex County Council also showed no historic flood incidents for this site. There are no published Section 19 Flood Investigations for Saffron Walden and no Parish Flood Risk Survey information.
Flood risk management infrastructure	
Defences	The site is not currently protected by any formal flood defences.
Residual risk	The unnamed Ordinary Watercourse appears to flow through several small structures as it flows west to meet Thaxted Road. However, given the site is largely raised out of the floodplain, and the likely confined nature of flood risk, it is deemed unlikely that any blockages would have an effect within the site boundary. This should be considered and confirmed in a Flood Risk Assessment.
Emergency planning	

Flood warning	The site is not covered by any EA Flood Warning Areas, or Flood Alert Areas.
Access and egress	Currently, the only vehicular access to the site is from the Knights Park industrial park, at the southwestern site boundary, from Thaxted Road (it may be that other access points are proposed in future master planning). Thaxted Road is at risk of surface water flooding in all AEP events in various locations. Access and egress should be steered south along Thaxted Road; it should be noted that there are still sections of the road that have surface water flow paths crossing (more prominent in the 0.1% AEP event), but to the north towards Saffron Walden, the road itself acts as a conduit for surface water flow paths. There is also risk to the road in the 0.1% AEP modelled event. Maximum depths and velocities are present on the road to the north of the site at >1.20m and >2.00m/s respectively. The 3.3% and 1% SW+CC model indicates that Thaxted road is flooded to the north and south of the site to a maximum depth and velocity of 1.50m and 3.20m/s respectively, limiting access and egress.
Dry Islands	The site is not located on a dry island.
Climate change	
Implications for the site	**Management Catchment:** Cam and Ely Ouse Management Catchment **Fluvial:** The site is located in Flood Zone 1 and there is no detailed model coverage to assess the impacts of climate change on fluvial risk. However, there are Ordinary Watercourses on the site, and the ROFfSW mapping can provide an indication on fluvial flooding with climate change. The 1% AEP ROFfSW extent has been used as a proxy for the 3.3% AEP + climate change fluvial event. The ROFfSW mapping shows very little difference in flood extent between the 3.3% and 1% AEP events, which suggests that climate change is not expected to have a significant impact on the extent of flooding from the Ordinary Watercourse during a 3.3% AEP event. This also does not affect the site. The 0.1% ROFfSW AEP extent has been used as a proxy for the 1% AEP + climate change fluvial event. The increase in flood extent in the ROFfSW mapping indicates that climate change may increase the extent of fluvial flooding at the northern tip of the site boundary. Climate change impacts of the ordinary watercourse should be investigated in a site-specific FRA; given the sloping topography and confined nature of the ordinary watercourse, it is unlikely that climate change will affect any part of the site other than around the site's northern boundary. This may need to be confirmed with modelling. **Surface Water:** The RoFfSW 3.3% AEP and 1% AEP models have been upscaled and run for climate change using the Upper End allowance. The 3.3% SW+CC AEP model shows a small extent of flooding along the southwestern boundary of the site. The maximum depth and velocity of this

	flooding is 0.22m and 0.94m/s respectively, meaning it is a 'hazard for some'. The 1% SW+CC AEP model shows surface water flooding along the whole length of the southwestern boundary. The extent, depth and velocity of this flooding is very similar to the 0.1% surface water AEP event, with a maximum depth and velocity of this flooding is 0.27m and 1.26m/s respectively, meaning it is a 'hazard for most'. There are no new surface water flow paths activated in the 3.3% or 1% SW+CC AEP events. This shows that the site is vulnerable to the impacts of climate change. Development proposals at the site must address the potential changes associated with climate change and be designed to be safe for the intended lifetime. The provisions for safe access and egress must also address the potential increase in severity and frequency of flooding.
Requirements for surface water drainage and integrated flood risk management	

Broad-scale assessment of potential SuDS	**Geology & Soils**
	• The bedrock geology is 'Lewes Nodular Chalk Formation and Seaford Chalk Formation'.
	  ○ Chalk has a high permeability.
	• The superficial deposit is not stated for this site but is likely to be the same as the surrounding area, which is 'Lowestoft Formation – Diamicton'; this is composed of sheets of chalky till, with outwash sands and gravels, silts and clays.
	  ○ This mixture of characteristics means that the drainage of the area will vary. Sands, gravel and chalk facilitate water permeation; however, silts and clays make the ground impermeable.
	  ○ The composition of these soils will influence the drainage of the site.
	
	Sustainable Drainage Systems (SuDS)
	• Groundwater levels are indicated to be at or very near (within 0.025m) ground level and there is a risk of groundwater flooding at the surface during a 1% AEP event, which may flow to and pool within topographic low spots. Detention and attenuation features should be designed to prevent groundwater ingress from impacting hydraulic capacity and structural integrity. Additional site investigation work may be required to support the detailed design of the drainage system. This may include groundwater monitoring to demonstrate that a sufficient unsaturated zone has been provided above the highest occurring groundwater level. Below ground development such as basements are not appropriate at this site
	• BGS data indicates that the underlying geology is Lewes Nodular Chalk Formation and Seaford Chalk Formation which is likely to be free draining. This should be confirmed through infiltration testing, with the use of infiltration maximised as much as possible in accordance with the SuDS hierarchy.
	• The site is not located within a Groundwater Source Protection Zone and there are no restrictions over the use of infiltration techniques with regard to groundwater quality.
	• The site is not located within a historic landfill site.
	• Use of infiltration SuDS not appropriate if the site is located on contaminated ground.

	• Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques. • The Risk of Flooding from Surface Water (ROFfSW) mapping indicates the presence of surface water flow paths during the 0.1% AEP event. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space. • If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner. • Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such as filter strips, filter drains and bioretention areas must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site. • The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.
Opportunities for wider sustainability benefits and integrated flood risk management	• The use of Natural Flood Resilience (NFM) measures on the Ordinary Watercourses which affect the site should be investigated, where suitable, to manage runoff and help mitigate flood events downstream in Saffron Walden and the wider Slade catchment. • Opportunities for using source control SuDS to manage runoff rates and volumes, contributing to the reduction of flood peaks on the Ordinary Watercourses on the site and the Slade River downstream, as well as existing surface water flow paths leaving the site. • Waterside areas, or areas along known flow routes, can act as blue green infrastructure, being used for recreation, amenity, and

	environmental purposes, allowing the preservation of flow routes and flood storage, and at the same time providing valuable social and environmental benefits contributing to other sustainability objectives.
NPPF and planning implications	
Exception Test requirements	The Local Authority will need to confirm that the Sequential Test has been carried out in line with national guidelines. The Sequential Test will need to be passed before the Exception Test is applied. The Exception Test is not required for this development as the site is classified as 'Less Vulnerable' (Employment and not present in the Flood Zones). However, there is still fluvial flood risk from the Ordinary Watercourse close to the site's northern boundary which needs to be investigated in more detail and confirmed in a FRA, with development steered away from areas of flood risk.

Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:**
	• At the planning application stage, a site-specific FRA will be required as the proposed development site is:
	   o Greater than one hectare
	   o At risk from Ordinary Watercourses through/ near the site
	   o At risk of other sources of flooding (surface water)
	• All sources of flooding should be considered as part of a site-specific FRA.
	• Consultation with the Local Authority, Lead Local Flood Authority, Water Company, and the Environment Agency should be undertaken at an early stage.
	• Any FRA should be carried out in line with the National Planning Policy Framework (NPPF); Flood Risk and Coastal Change Planning Practice Guidance (PPG); Uttlesford District Council's Local Plan Policies and Essex County Council's SuDS Guidance.
	• The development should be designed with mitigation measures in place where required.
	• Detailed modelling may be required to confirm Flood Zone and climate change extents for the Ordinary Watercourse close to the site's northern boundary as part of a site-specific FRA. The Environment Agency and LLFA should be consulted at the time of the flood risk assessment to advise on requirements.
	• Climate change should be assessed using recommended climate change allowances at the time of the assessment (Flood risk assessments: climate change allowances - GOV.UK (www.gov.uk)) for the type of development and level of risk. The current allowances were published in May 2022 but may be subject to change in the future.
	• Trash screens on culverts downstream of sites can build up with debris and increase flood risk. Additionally, Parish Councils can seek access improvements for trash screens and the ownership of the screen may be unknown.
	• If any culverts or flood risk infrastructure are found to be under the required conditions, then the new development must not compromise assets downstream, and if there is scope, then improvements should be sought to bring the assets up to condition.
	• Compensatory flood storage should be provided where development is proposed within the 1 in 100-year (1% AEP) flood extent, including

	an appropriate allowance for climate change. Ideally, proposed developments should have a net gain of floodplain storage to reduce the risk of flooding, on site and elsewhere.
	
	Guidance for site design and making development safe:
	
	• The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).
	• The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates.
	• Planning permission is required to surface more than 5 square metres of unpaved ground using a material that cannot absorb water.
	• Arrangements for safe access and egress will need to be demonstrated for the 1% AEP surface water event with an appropriate allowance for climate change, using the depth, velocity, and hazard outputs. As safe access and egress may not be possible to the southwest of the site during a 1% surface water event, if this is the preferred access route for the site, a Flood Warning and Evacuation Plan will be required.
	• Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
	    ○ set finished floor levels to 300mm above the 1% AEP flood level, including an appropriate allowance for climate change.
	    ○ include property flood resistance and resilience measures.
	• Other examples of flood resistance and resilience measures include:
	    ○ using flood resistant materials that have low permeability to at least 300mm above the estimated flood level.
	    ○ making sure any doors, windows or other openings are flood resistant to at least 300mm above the estimated flood level.
	    ○ raising all sensitive electrical equipment, wiring and sockets to at least 300mm above the estimated flood level.
	    ○ The EA advises that minimum flood floor level for 'More Vulnerable' development such as residential properties should be set 600mm above the 1% AEP fluvial plus climate change peak flood level, where the appropriate new climate change allowances have been used. Therefore, if the vulnerability of the site increases then the minimum flood floor level would have to increase.

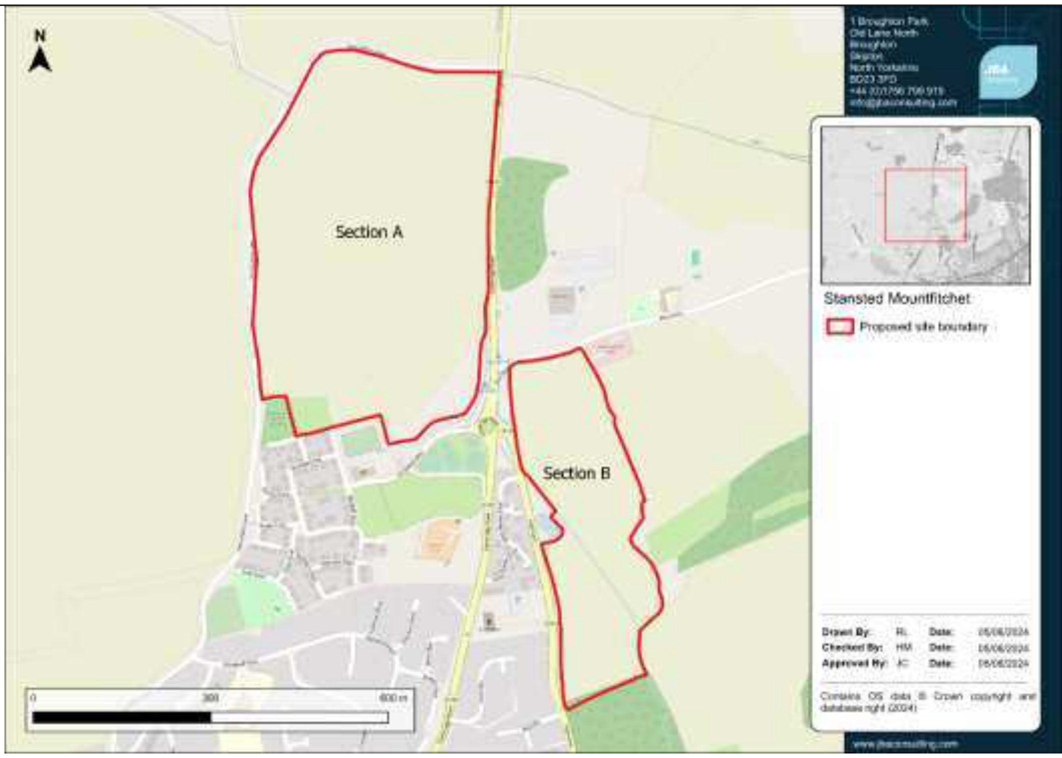
Key messages	
Development is likely to be able to proceed if:	

- Development is steered away from the area of surface water along the western boundary and the northern and eastern site boundaries where surface water risk abuts the site. Any flow paths should be incorporated and considered within the development design.
- Fluvial flood risk impacts from the ordinary watercourse parallel with the site's northern boundary will need to be investigated and confirmed as part of a site-specific Flood Risk Assessment, which may require a detailed hydraulic model. It is unlikely looking at the topography, RoFfSW extents and that the site is largely raised out of the floodplain, that the site would be affected by fluvial risk; though potentially at the most northerly tip when looking at the 0.1% AEP surface water mapping as an indication of climate change.
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site.
- Safe access and egress can be demonstrated in the fluvial and surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere.
- A site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas.
- If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another).

Mapping Information	
Flood Zones	Flood Zones 2 and 3 have been taken from the EA Flood Map for Planning mapping. As the risk of fluvial flooding from Ordinary Watercourses on the site is not represented in the Flood Map for Planning, the ROFfSW mapping has been used as a proxy dataset and identifies fluvial flood risk at the southeastern and southern boundaries of the site.
Climate change	A detailed fluvial hydraulic model is not available for this site, and therefore the impacts of climate change cannot be assessed in detail. Instead, the ROFfSW mapping has been used as a proxy for fluvial and surface water flooding in the 3.3% AEP + climate change and the 1% AEP + climate change events.
Fluvial depth, velocity and hazard mapping	Depth, velocity, and hazard data was derived from the EA ROFfSW mapping, in the absence of a detailed fluvial hydraulic model.
Surface Water	The EA ROFfSW dataset has been used for this assessment. The latest climate change allowances (updated May 2022) have also been applied to the Risk of Flooding from Surface Water map to indicate the impact on pluvial flood risk.
Surface water depth, velocity and hazard mapping	The surface water depth, velocity, and hazard mapping for the 3.3%, 1% and 0.1% AEP events (considered to be high, medium, and low risk) have been taken from EA ROFfSW mapping.
Groundwater	Groundwater data was derived from JBA's Groundwater Emergence maps.
Sewer	Uttlesford's sewers are managed by both Thames Water (for catchments flowing south) and Anglian Water (for catchments flowing north). Data for sewer flooding was provided by Thames Water. Sewer flooding data was requested from Anglian Water but not received within the study timeframe.

Reservoir	The EA ‘Dry Day’ and ‘Wet Day’ Reservoir flood maps have been used in this assessment.

	Uttlesford District Council **Level 2 Strategic Flood Risk Assessment** **Detailed Site Summary Table**
Site details	
Site Code	**Stansted Mountfitchet**
Address	Land east of High Lane, Stansted Mountfitchet
Area	32.0 ha
Current land use	Greenfield (Arable)
Proposed land use	Residential
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The proposed development site is located in the centre of the small Ugley Brook catchment, on either side of the watercourse, which is a tributary of the Stansted Brook catchment, which drains an area of 25 km2. The site has two sections: Section A, located west of Cambridge Road and bounded by Pennington Lane to the west; and Section B, east of High Lane and south of Alsa Street.
Topography	Section A is lowest in east of the site (76m AOD) and highest in the west at 90.9m AOD. The site is located across a slight valley, with the Ugley Brook along the eastern perimeter of Section A, extending north to south, with a bend to the southeast through Section B. Section B is highest in the northeastern edge of the site at 87.8m AOD, and lowest in the centre of the site at 72.4m AOD, where the Ugley Brook flows through.

	
Existing drainage features	Ugley Brook runs parallel north to south along the eastern border of Section A, and from the northwest to southeast of Section B through the centre of this land parcel. There appears to be a small cut channel running west to east at the centre of Section A, and another in its southwestern corner. Ugley Brook flows into Stansted Brook approximately 970m south of the site; Stansted Brook flows north east to south west, joining the River Stort west of Stansted Mountfitchet, 1.5km downstream of the Ugley Brook – Stansted Brook confluence.
Fluvial	**The proportion of site as a whole at risk FMFP:** FZ3 – 6.9% FZ2 – 7.9% FZ1 – 92.1% **Fluvial model outputs:** 2% AEP fluvial event – 0.31%* 1.33% AEP fluvial event – 0.38%* 1% AEP fluvial event – 0.44%* 0.1% AEP fluvial event – 0.72%* *It is important to note that these reported %s of modelled risk are not a reflection of flood risk to the 'entire site'; the detailed model data only commences 150m from the site's Section B southern boundary, and so this information should be used more as an indication of differences between the respective flood events, rather than the relative %s themselves. See 'available data' below. **Available Data:** Flood Zones are determined from the Environment Agency's Flood Map for Planning (FMFP). This represents the undefended scenario. The Environment Agency's 1D-2D ISIS-TUFLOW Stansted Mountfitchet (2015) hydraulic model is a more accurate representation of the flood risk to this site. However, this model does not cover the entire reach of the Ugley Brook through the site; it commences 150m from the site's southern

	boundary in Section B. Therefore, the EA's FMfP has been used in the absence of detailed modelling through the rest of Section B and Section A. **Flood characteristics:** Flood Zone 2 and 3 of the EA's FMfP are present along the site's eastern boundary, encroaching into the site. Given the rising topography away from the Brook, it is likely the FMfP shows a slightly conservative picture of flood risk which may be refined through detailed modelling. The majority of this Section A is developable, if steered away from Cambridge Road and the ordinary watercourse. Until a detailed FZ3b is modelled, this is to be assumed as equivalent to FZ3a. The Flood Map is misaligned in the south-eastern corner of Section A , as structures are not modelled and the flood extents are shown to follow lower topography across the roundabout junction, whereas the watercourse continues its straight alignment to the west of the roundabout before entering culvert under Hornbeam Way, partially re-emerging as open channel between the B1383 and the B1351, before entering a culvert under the B1351 and re-appearing in Section B to flow south-east through the centre of the site, and out towards Gall End Lane. Section B is more at risk with the watercourse flowing through the centre and bisecting this land parcel. Where the detailed model commences, Flood Zone 3b (2% AEP in the absence of 3.3% AEP) is confined to the channel. FZ3a is slightly narrower than the FMfP but generally similar in width at approximately 25m, hence the FMfP is a good indication of flood extents in the absence of detailed modelling, but this will be refined at the FRA stage. In order for this site to progress, detailed hydraulic modelling will be required as part of a site-specific Flood Risk Assessment, to confirm Flood Zones and impacts of climate change.
Surface Water	**Proportion of site at risk (RoFfSW):** **3.3% AEP – 4.6%** Max depth – 0.9-1.2m Max velocity – >2m/s **1% AEP – 7.8%** Max depth – >1.2m Max velocity – >2m/s **0.1% AEP – 17.0%** Max depth – >1.2m Max velocity – >2m/s **Available data:** The Environment Agency's Risk of Flooding from Surface Water (RoFSW) map has been used within this assessment. **Description of surface water flow paths:** RoFSW mapping shows flow paths generated on the site within the 3.3%, 1% and 0.1% AEP events. For the 3.3% AEP event, the majority of surface water flooding occurs within the Ugley Brook channel and immediate floodplain through both site

	sections, with localised areas of ponding in the northwest of Section A. Flooding across both sections has a maximum depth and velocity of 1.2m and >2m/s respectively. This corresponds to a maximum hazard level of 'danger for all', in the southeast of Section B. In the 1% AEP event, the extent of flooding within the central channel expands laterally but is similar to the 3.3% AEP event. Channels running through the centre and southwest of Section A are expected to receive depths of up to 0.6m and 0.3m, respectively. The localised ponding in the northwest of Site A is expected to expand but remain relatively minor. The 1% AEP event is expected to generate a maximum depth and velocity of >1.2m and >2m/s respectively across the two sections, with the maximum hazard level of 'danger for all' also including the eastern perimeter of Section A. In the 0.1% AEP event, the previously isolated flow path to the north of Section A connects to Ugley Brook, flowing west to east. Two other parallel west to east flow paths are activated from the high ground west of Pennington Lane, flowing through the centre of Section A to the Ugley Brook and in the south-western corner to Bluebell Drive and Hornbeam Way to meet the Ugley brook between the two land parcels. Section A receives depths and velocities of up to 0.6m and >2m/s. The 0.1% AEP event is expected to generate a maximum depth and velocity across the sections in excess of 1.2m and 2m/s respectively. The maximum hazard level on site of 'danger for all' is expected along most of the Ugley Brook channel. Section B extents are largely confined to the floodplain, getting wider in each event. The 0.1% AEP extents are larger than the fluvial FZ2 extents.
Reservoir	The site is not expected to be at risk from reservoir flooding in the 'dry day' or 'wet day' scenario.
Groundwater	The JBA Groundwater Emergence map shows groundwater risk is variable across the site, ranging from negligible risk to the potential for groundwater to emerge at significant rates and flow overland or pond within any topographic low spots. Section A is expected to have more variable groundwater risk than Section B. While the east of Section A is deemed to have a negligible risk from groundwater flooding due to the nature of the local geological deposits, groundwater is expected to be shallower in the central northern section, where levels are between 0.025m and 0.5m below the ground surface. Within this zone, there is a risk of groundwater flooding to both surface and subsurface assets, and the possibility of groundwater emerging at the surface locally. Localised sections of this area are expected to have groundwater either at or very near (within 0.025m of) the ground surface. Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots. Finally, the southern portion of the site is anticipated to have groundwater levels between 0.5m and 5m below the ground surface. Here, there is a risk of flooding to subsurface assets but surface manifestation of groundwater is unlikely. The majority of Section B is expected to have groundwater levels between 0.5m and 5m below the ground surface. Here, there is a risk of flooding to subsurface assets but surface manifestation of groundwater is unlikely.

	There is considered to be a negligible risk from groundwater flooding in the northwest of Section B due to the nature of the local geological deposits.
Sewers	Sewer flooding records for Uttlesford district provided by Thames Water showed 13 instances of sewer flooding events in the CM24 8 postcode. The site is located within the Thames sewer catchment. While Uttlesford is not identified as a flood priority catchment in Thames Water's Drainage and Wastewater Management Plan (DWMP), developers should consult Thames Water as part of any development proposal to ensure development does not exacerbate existing issues and maximise opportunities for development to deliver benefits to Thames Water's strategic aims.
Flood history	The Environment Agency's Historic Flood Map shows no records of flooding on the site. However, the Environment Agency have reported fluvial and surface water flooding in the vicinity of the site.
Flood risk management infrastructure	
Defences	The Environment Agency (EA) AIMS dataset shows that the site is not protected by formal flood defences.
Residual risk	There are a number of structures where the Ugley Brook flows beneath in the vicinity of the site: Pennington Lane at its junction with Cambridge Road into Section A, Hornbeam Way leaving Section A, and the B1351 into Section B. In the event of a blockage of these structures during a flood event, flood risk could be exacerbated in the localised areas near the structures, by backing up, ponding or increasing overland flow routes. The potential impacts of blockage should be confirmed using detailed hydraulic modelling in a FRA at site-specific assessment stage.
Emergency planning	
Flood warning	None of the site is covered by a Flood Alert. A Flood Warning covers 9.9% of the site, along the banks of the Ugley Brook – to the east of Section A and diagonally northwest to southeast across Section B.
Access and egress	Vehicular access to Section A is currently possible via Hornbeam Way and Bluebell Drive to the south, Cambridge Road to the east, and Pennington Lane to the north and west. For all modelled surface water flooding scenarios, all current access routes to Section A are expected to become inundated, and thus the site may not be accessible by vehicle. Hornbeam Way and Bluebell Drive to the south form a conduit for a surface water flow path. Pennington Lane just has isolated crossings mainly in the 0.1% AEP event where the surface water overland flow routes cross from the hills west to east, at depths of up to 0.9m flowing at >2m/s. Cambridge Road is parallel with the Ugley Brook and hence due to topography, is shown to be inundated in both fluvial and surface water events. Vehicular access to Section B is possible from the north via Alsa Street which remains free of flood risk (except for a small stretch in the 0.1% AEP where it meets Snakes Lane), and Cambridge Road/High Lane to the west. Again, for all modelled scenarios, all current access routes to the west are expected to become inundated, and so may not be accessible by vehicle in certain conditions. High Lane (B1351) has clear stretches then parts where flow paths cross (>1.2 m deep and velocities exceeding 2m/s in the 0.1% AEP event), but further south at the Lower Street, Chapel Hill/ Water Lane

	junction, there are surface water flow paths in all AEP events. Access on foot may remain possible, even for the 0.1% AEP event, via Alsa Street's connection with May Walk. Development must be able to demonstrate safe access and egress in the fluvial and surface water plus climate change events. This likely includes measures to reduce flood risk along these routes such as raising access, but floodwater should not be displaced elsewhere. In particular, access needs to be considered with respect to Section B of the site being bisected, and how both sides of this land parcel can gain safe access/egress in the event of a flood.
Dry Islands	The site is not located on a dry island.
Climate change	
Implications for the site	**Management Catchment:** Upper Lee **Fluvial:** There is no detailed model coverage to assess the impacts of climate change on fluvial risk, except in the most southerly 150m of the Section B site. In the absence of detailed modelling, FZ2 can be used as a proxy for fluvial flooding with climate change. However, it is recommended that a detailed hydraulic model of the Ugley Brook (or extension to the existing model) on the site is developed, as part of a site-specific FRA to confirm the impacts of climate change. The FZ3a extent has been used as a proxy for the 3.33% AEP (FZ3b) + climate change fluvial event. FZ3a shows only a minor expansion may be expected in flood extent between the 3.3% and 3.3%+CC AEP events, which suggests that climate change is not expected to have a significant impact on the extent of flooding. The FZ2 extent has been used as a proxy for the 1% AEP and 0.1% AEP + climate change fluvial events. Again, there is only a minimal increase in extent, suggesting the site is relatively insensitive to the effects of climate change on fluvial flooding. **Surface Water:** The 3.3% AEP + climate change event shows a similar extent to the baseline 1% AEP event, including the presence of the flow paths in Section A and an expansion to the left bank of the Ordinary Watercourse in Section B. While this shows that climate change is expected to increase the risk of surface water to the site at the 3.3% level, flood depths remain largely shallow (<0.3 m) outside of the main channel, which continues to contain most of the water. The 1% AEP + climate change event exhibits a similar extent to the baseline 0.1% AEP event. This mapping indicates that the surface water flooding is no longer contained within channels, and there is an expansion to the flow paths flowing from the farmland east of Section A. Development proposals at the site must address the potential changes associated with climate change and be designed to be safe for the intended lifetime. The provisions for safe access and egress must also address the potential increase in severity and frequency of flooding.
Requirements for surface water drainage and integrated flood risk management	

Broad-scale assessment of potential SuDS	**Geology & Soils** The site sits on a bedrock of London Clay Formation, consisting of clay, silt and sand. This is overlain by a superficial layer of sedimentary head (clay, silt, sand and gravel) in the channel, and glaciofluvial (sand and gravel) and diamicton of the Lowestoft Formation on the surrounding banks. **Sustainable Drainage Systems (SuDS)** • Groundwater levels are indicated to be between 0.5 and 5m below ground level and there is a risk of flooding to subsurface assets and below ground development such as basements. Groundwater monitoring is recommended to determine the seasonal variability of groundwater levels, as this may affect the design of the surface water drainage system. • BGS data indicates that the underlying geology is London Clay Formation, overlain with superficial deposits of various sedimentary layers, and is likely to have varying drainage. Any proposed use of infiltration should be supported by infiltration testing. Off-site discharge in accordance with the SuDS hierarchy is required to discharge surface water runoff. • The site is located within a Groundwater Source Protection Zone. Infiltration techniques may not be suitable and should only be used following the granting of any required environmental permits from the Environment Agency for Zones 2, 3 and 4 although it is possible that infiltration may not be permitted. Proposed SuDS should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible opportunities and constraints. • The site is designated in one Nitrate Vulnerable Zones (NVZs) o Surface Water - "Surface Water S443 – LEE NVZ" • The site is not located within a historic landfill site. • Use of infiltration SuDS not appropriate if the site is located on contaminated ground. • Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques. • The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 0.1% AEP event. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space. • If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner. • Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality,

	amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such as filter strips, filter drains and bioretention areas must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site. • The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.
Opportunities for wider sustainability benefits and integrated flood risk management	• The use of Natural Flood Resilience (NFM) measures on the Ordinary Watercourses which affect the site should be investigated, where suitable, to manage runoff and help mitigate flood events downstream in Stansted Mountfitchet and the wider Stansted Brook/ River Stort catchment. • There has been previous exploration into NFM in the upper reaches of the Ugley Brook catchment but it did not progress. There is an opportunity for this to be included and explored in the site allocation. • Opportunities for using source control SuDS to manage runoff rates and volumes, contributing to the reduction of flood peaks on the Ordinary Watercourses surrounding the site and the Pincey Brook downstream, as well as existing surface water flow paths leaving the site. • Waterside areas, or areas along known flow routes, can act as blue green infrastructure, being used for recreation, amenity, and environmental purposes, allowing the preservation of flow routes and flood storage, and at the same time providing valuable social and environmental benefits contributing to other sustainability objectives.
NPPF and planning implications	
Exception Test requirements	The Local Authority will need to confirm that the Sequential Test has been carried out in line with national guidelines. The Sequential Test will need to be passed before the Exception Test is applied. The NPPF classifies residential development as ‘More Vulnerable’.

	The Exception Test is required for this site because there is significant fluvial and surface water flood risk within all Flood Zones along the Ugley Brook running within the eastern boundary of Section A and through the centre of Section B. 'More Vulnerable' development is not permitted within Flood Zone 3b.

Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:**
	• At the planning application stage, a site-specific FRA will be required as the proposed development site is:
	    ○ Within fluvial flood zones 2, 3a, and 3b
	    ○ Greater than one hectare
	    ○ At risk of other sources of flooding (surface water, groundwater and fluvial)
	• All sources of flooding should be considered as part of a site-specific FRA.
	• Consultation with the Local Authority, Lead Local Flood Authority, Water Company, and the Environment Agency should be undertaken at an early stage.
	• Any FRA should be carried out in line with the National Planning Policy Framework (NPPF); Flood Risk and Coastal Change Planning Practice Guidance (PPG); Uttlesford District Council's Local Plan Policies and Essex County Council's SuDS Guidance.
	• The development should be designed with mitigation measures in place where required.
	• Detailed modelling will be required to confirm Flood Zone and climate change extents for the Ordinary Watercourses at the site as part of a site-specific FRA, to determine the flood extents, climate change and flood 1 in 1000-year flood level (0.1% AEP) The Environment Agency and LLFA should be consulted at the time of the flood risk assessment. They will advise as to whether existing detailed models are available, and if so, whether they need to be updated.Climate change should be assessed using recommended climate change allowances at the time of the assessment (Flood risk assessments: climate change allowances - GOV.UK (www.gov.uk)) for the type of development and level of risk. The current allowances were published in May 2022 but may be subject to change in the future.
	• Blockage scenario modelling should be conducted to assess the residual risk associated with potential blockage of the culverts on the Ugley Brook in the vicinity of the site.
	• Trash screens on culverts downstream of sites can build up with debris and increase flood risk. Additionally, Parish Councils can seek access improvements for trash screens and the ownership of the screen may be unknown.
	• If any culverts or flood risk infrastructure are found to be under the required conditions, then the new development must not compromise assets downstream, and if there is scope, then improvements should be sought to bring the assets up to condition.
	• Compensatory flood storage should be provided where development is proposed within the 1 in 100-year (1% AEP) flood extent, including an appropriate allowance for climate change. Ideally, proposed

developments should have a net gain of floodplain storage to reduce the risk of flooding, on site and elsewhere.

Guidance for site design and making development safe:

- The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).
- The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates.
- Planning permission is required to surface more than 5 square metres of unpaved ground using a material that cannot absorb water.
- Arrangements for safe access and egress will need to be demonstrated for the 1% AEP surface water events with an appropriate allowance for climate change, using the depth, velocity, and hazard outputs. As access and egress to some sections of the site will not be possible during the 0.1% AEP event, a Flood Warning and evacuation Plan will be required.
- An environmental permit for flood risk activities may be required for work in, under, over or within 8m from a fluvial main river and from any flood defence structure or culvert.
- Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
    - raise them as much as possible.
    - include extra flood resistance and resilience measures.
- Other examples of flood resistance and resilience measures include:
    - using flood resistant materials that have low permeability to at least 600mm above the estimated flood level.
    - making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level.
    - by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages

Development is likely to be able to proceed if:

- Detailed modelling must be undertaken for the site to progress at detailed site-specific FRA stage, to confirm Flood Zone and climate change extents for the Ugley Brook through the sites.
- The area close to the Ugley Brook channel and floodplain is left undeveloped. Development should be steered away from the area of fluvial flood risk in the eastern side

of Section A and along the central watercourse floodplain in Section B, as well as the flow paths/areas of surface water ponding in Section A are incorporated and considered within the development design.

- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site.
- Safe access and egress can be demonstrated in the fluvial and surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere. Access needs to be considered with respect to Section B of the site being bisected, and how both sides of this land parcel can gain safe access/egress in the event of a flood.
- A site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas.
- If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another).

Mapping Information	
Flood Zones	Flood Zones 2 and 3 have been taken from the EA Flood Map for Planning mapping. Where the detailed Stansted Brook 1D-2D hydraulic model is present, in the lower 150m of the Section B site, this has been used in preference.
Climate change	Where the detailed Stansted Brook hydraulic model is present, in the lower 150m of the Section B site, this has been used in preference. Otherwise, Flood Zone 2 has been used as a proxy for fluvial climate change. The RoFSW mapping has been upscaled for surface water flooding in the 3.3% AEP + climate change and the 1% AEP + climate change events, upper end scenarios.
Fluvial depth, velocity and hazard mapping	The Environment Agency’s Stansted Mountfitchet (2015) hydraulic model begins in the lower 150m of Section B and contains scenarios for 2%, 1.3%, 1% and 0.1% AEP events. These data were used to indicate fluvial depth, velocity, and hazard for the area they covered. For the remainder of the site not covered by a hydraulic model, the EA's FMfP FZ2 and 3a were used to indicate flood extent.
Surface Water	The EA RoFSW dataset has been used for this assessment. The latest climate change allowances (updated May 2022) have also been applied to the Risk of Flooding from Surface Water map to indicate the impact on pluvial flood risk.
Surface water depth, velocity and hazard mapping	The surface water depth, velocity, and hazard mapping for the 3.3%, 1% and 0.1% AEP events (considered to be high, medium, and low risk) have been taken from EA RoFSW mapping.

	Uttlesford District Council **Level 2 Strategic Flood Risk Assessment** **Detailed Site Summary Table**
Site details	
Site Code	**Land behind Weston Homes Office Park**
Address	Land behind Weston Homes Office Park
Area	2.55ha
Current land use	Field, cark park and industrial estate
Proposed land use	Employment
Flood Risk Vulnerability	Less Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located in between the Pincey Brook and River Roding catchments but falls topographically in the northern end of the Pincey Brook catchment, to the north of Takeley. The site as a whole is bounded by a field to the north, Prior's Wood to the east, a residential area to the south and Weston Homes Office Park to the west. A small tributary of the Pincey Brook is located 180m south of the southern site boundary, which is in and out of culvert in Takeley, flowing in a north-westerly direction leading into the Pincey Brook around the airport carpark.
Topography	The site is relatively flat with a maximum elevation of 101.0m AOD in the east of the site and a minimum elevation of 99.2m AOD in the west of the site.
Existing drainage features	There appears to be the presence of one small Ordinary Watercourse along the site's northern boundary; this leads from Prior's Wood past the site, into culvert until Parsonage Road and then south parallel with the road into a tributary of the Pincey Brook.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 0% FZ2 – 0% FZ1 – 100% **Fluvial model outputs:** 3.3% AEP fluvial event – N/A 1% AEP fluvial event – N/A 0.1% AEP fluvial event – N/A **Available data:**

	The EA Flood Map for Planning Rivers and Sea Flood Zone shows available data for fluvial flood risk of Main Rivers. The Ordinary Watercourses on the site have a catchment area less than 3km2, and therefore are not covered by hydraulic modelling used to define the Flood Map for Planning. In the absence of Flood Zone mapping, the Risk of Flooding from Surface Water (ROFfSW) mapping has been used as a proxy for the risk of fluvial flooding from the Ordinary Watercourses. **Flood characteristics:** The EA Flood Map for Planning indicates that the site is located in Flood Zone 1 and therefore has a very low risk of fluvial flooding from Main Rivers. However, as the Flood Zone maps only identify fluvial flood risk from Main Rivers, and therefore do not represent the risk of flooding form the Ordinary Watercourses near the site, the ROFfSW mapping has been used as a proxy for the risk of fluvial flooding of this watercourse. The mapping indicates that flood risk is contained in the ditch along the northern boundary. Similarly, along the western boundary where there are short reaches of narrow open channel, containing flood risk locally. Whilst the risk is anticipated to be low given the confined topography, the risk posed by the Ordinary Watercourse should be investigated in a site-specific Flood Risk Assessment which may require detailed hydraulic modelling.
Surface Water	**Proportion of site at risk (RoFfSW):** **3.3% AEP** – 0.3% Max depth – 0.60-0.90m Max velocity – 0.25-0.50m/s **1% AEP** – 0.5% Max depth – 0.60-0.90m Max velocity – 0.25-0.50m/s **0.1% AEP** – 2.0% Max depth – 0.60-0.90m Max velocity – 0.50-1.00m/s **Available data:** The Environment Agency's Risk of Flooding from Surface Water (ROFfSW) map has been used within this assessment. **Description of surface water flow paths:** ROFfSW mapping shows minor flow paths generated around the site boundary in the 3.3%, 1% and 0.1% AEP events, predominantly along the alignment of topographic depressions due to the Ordinary Watercourse. The majority of the site itself is not at risk. For the 3.3% and 1% AEP events, there is a small extent of surface water flooding in the southeastern corner of the site, although this appears to all be contained in a topographic depression. This flooding has a maximum depth and velocity of 0.90m and 0.50m/s respectively. The 1% AEP event also follows the site's northern boundary. In the 0.1% AEP event the surface water flooding in the southeast of the site increases in extent and is no longer entirely contained in the topographic depression. There is also a small extent of flooding along the northern

	boundary. This flooding has a maximum depth and velocity of 0.90m and 1.00m/s respectively.
Reservoir	This site is not shown to be at risk of reservoir flooding from either the 'dry day' or 'wet day' extents.
Groundwater	Using JBA's Groundwater Emergence map, this site is not considered to be susceptible to groundwater flooding, due to the nature of the local geological conditions.
Sewers	According to the Thames Water Flood Data, there are 3 incidents of flooding in the CM22 6 postcode area. The site is located within the Thames sewer catchment. While Uttlesford is not identified as a flood priority catchment in Thames Water's Drainage and Wastewater Management Plan (DWMP), developers should consult Thames Water as part of any development proposal to ensure development does not exacerbate existing issues and maximise opportunities for development to deliver benefits to Thames Water's strategic aims.
Flood history	The EA Historic Flooding Map shows that the site has not previously been affected by fluvial flooding from Main Rivers. The nearest EA historic flood extent is located approximately 2,254m southeast of the southeastern boundary. This relates to flooding from the River Roding in 1974, due to the channel capacity being exceeded. Historic flooding data provided by Essex County Council also showed no historic flood incidents for this site. There are no published Section 19 Flood Investigations for Takeley and no Parish Flood Risk Survey information.
Flood risk management infrastructure	
Defences	The site is not currently protected by any formal flood defences.
Residual risk	The Ordinary Watercourse has several small structures along its course. The risk anticipated from the blockage of these structures would be low given the size of the drain and confined topography, but it could increase out of bank flooding in the developable area of the site to the north and west, so this should be considered in a Flood Risk Assessment, which may require detailed hydraulic modelling.
Emergency planning	
Flood warning	The site is not covered by modelled data in the Environment Agency's Flood Warning Service, nor the Flood Alert Service.
Access and egress	Vehicular access to the site is possible via an access road off Parsonage Road, on the western boundary (it may be that other access points are proposed in future master planning). Access and egress at the site are unaffected in all surface water events; however, in the wider vicinity along Parsonage Road, there are sections impacted in all AEP events in alignment with the topography of watercourses, with maximum depths and velocity of 0.90m and 2.00m/s to the north and south of the site. The 3.3% and 1% surface water plus climate change (SW+CC) model shows that Parsonage Road is flooded to a maximum depth and velocity of 0.66m and 1.70m/s respectively, which is not conducive with safe access

	and egress. Parsonage road floods to the north of the site when it is transected by the A120. Surface water flooding associated with the floodplain of an ordinary water course cuts across Parsonage Road to the south of the site, adjacent to Roseacres Road.
Dry Islands	The site is not located on a dry island.
Climate change	
Implications for the site	**Management Catchment:** Upper Lee **Fluvial:** There is no detailed model coverage to assess the impacts of climate change on fluvial risk. However, there is an Ordinary Watercourse present along the site's northern and western boundary, and the ROFfSW mapping can provide an indication on fluvial flooding with climate change. The 1% AEP ROFfSW extent has been used as a proxy for the 3.3% AEP + climate change fluvial event. The ROFfSW mapping shows a slight difference in flood extent between the 3.3% and 1% AEP events, which suggests that climate change is not expected to have a significant impact on the extent of flooding from the Ordinary Watercourse during a 3.3% AEP event. The 0.1% ROFfSW AEP extent has been used as a proxy for the 1% AEP + climate change fluvial event. The increase in flood extent in the ROFfSW mapping indicates that climate change may increase the extent of fluvial flooding, mainly in the southeastern corner of the site. The impacts of climate change on fluvial flood risk from the ordinary watercourse should be investigated as part of a site-specific FRA, which may require hydraulic modelling to confirm risk. **Surface Water:** The RoFfSW 3.3% AEP and 1% AEP models have been upscaled and run for climate change using the Upper End allowance. The 3.3% SW+CC AEP model shows a similar extent, depth and velocity of flooding to the 1% surface water AEP event. The maximum depth and velocity of this flooding is 0.66m and 0.60m/s respectively, meaning it is a 'hazard for most'. The 1% SW+CC AEP model shows a similar extent, depth and velocity of flooding to the 0.1% surface water AEP event. The maximum depth and velocity of this flooding is 0.71m and 0.81m/s respectively, meaning it is a 'hazard for all'. Therefore, this site is vulnerable to the impacts of climate change. Development proposals at the site must address the potential changes associated with climate change and be designed to be safe for the intended lifetime. The provisions for safe access and egress must also address the potential increase in severity and frequency of flooding.
Requirements for surface water drainage and integrated flood risk management	
Broad-scale assessment of potential SuDS	**Geology & Soils** • The bedrock geology is 'London Clay Formation – clay, silt and sand'. ○ Relatively impermeable, improved slightly by the presence of sand and flint gravel.

- The superficial deposit is ‘Lowestoft Formation – Diamicton’ which is composed of sheets of chalky till, with outwash sands and gravels, silts and clays.
  - This mixture of characteristics means that the drainage of the area will vary. Sands, gravel and chalk facilitate water permeation, however, silts and clays make the ground impermeable.
  - The composition of these soils will influence the drainage of the site.

Sustainable Drainage Systems (SuDS)

- The site is not considered to be susceptible to groundwater flooding, due to the nature of the local geological conditions. This should be confirmed through additional site investigation work.
- BGS data indicates that the underlying geology is London Clay Formation, overlain with superficial deposits of mainly Lowestoft Formation Diamicton and is likely to have varying drainage. Any proposed use of infiltration should be supported by infiltration testing. Off-site discharge in accordance with the SuDS hierarchy is required to discharge surface water runoff.
- The site is not located within a historic landfill site.
- Use of infiltration SuDS not appropriate if the site is located on contaminated ground.
- Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques.
- The ROFfSW mapping indicates the presence of surface water flow paths on the site during the 0.1% AEP event. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space.
- If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.
- Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints.
- Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development.
- Opportunities to incorporate filtration techniques such as filter strips, filter drains and bioretention areas must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies.

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The Exception Test is not required for this development as the site is classified as ‘Less Vulnerable’ (Employment and not present in the Flood Zones). However, there is still fluvial flood risk from the Ordinary Watercourse on the site’s boundary which needs to be investigated in more detail and confirmed in a FRA, with development steered away from areas of flood risk.</td></tr>
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Greater than one hectare
At risk of other sources of flooding (surface water)
All sources of flooding should be considered as part of a site-specific FRA.
Consultation with the Local Authority, Lead Local Flood Authority, Water Company, and the Environment Agency should be undertaken at an early stage.
Any FRA should be carried out in line with the National Planning Policy Framework (NPPF); Flood Risk and Coastal Change Planning Practice Guidance (PPG); Uttlesford District Council’s Local Plan Policies and Essex County Council’s SuDS Guidance.
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	flood 1 in 1000-year flood level (0.1% AEP) The Environment Agency and LLFA should be consulted at the time of the flood risk assessment. They will advise as to whether existing detailed models are available, and if so, whether they need to be updated. Climate change should be assessed using recommended climate change allowances at the time of the assessment (Flood risk assessments: climate change allowances - GOV.UK (www.gov.uk)) for the type of development and level of risk. The current allowances were published in May 2022 but may be subject to change in the future. • Blockage modelling may be required to assess the residual risk associated with potential blockage of the culverts on the unnamed Ordinary Watercourse. • Trash screens on culverts downstream of sites can build up with debris and increase flood risk. Additionally, Parish Councils can seek access improvements for trash screens and the ownership of the screen may be unknown. • If any culverts or flood risk infrastructure are found to be under the required conditions, then the new development must not compromise assets downstream, and if there is scope, then improvements should be sought to bring the assets up to condition. • Compensatory flood storage should be provided where development is proposed within the 1 in 100-year (1% AEP) flood extent, including an appropriate allowance for climate change. Ideally, proposed developments should have a net gain of floodplain storage to reduce the risk of flooding, on site and elsewhere. **Guidance for site design and making development safe:** • The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG). • The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates. • Planning permission is required to surface more than 5 square metres of unpaved ground using a material that cannot absorb water. • Arrangements for safe access and egress will need to be demonstrated for the 1% AEP surface water event with an appropriate allowance for climate change, using the depth, velocity, and hazard outputs. As safe access and egress may not be possible during the 0.1% AEP event, a Flood Warning and Evacuation Plan will be required. • Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere. o set finished floor levels to 300mm above the 1% AEP flood level, including an appropriate allowance for climate change

	○ include property flood resistance and resilience measures. • Other examples of flood resistance and resilience measures include: ○ using flood resistant materials that have low permeability to at least 300mm above the estimated flood level ○ making sure any doors, windows or other openings are flood resistant to at least 300mm above the estimated flood level ○ raising all sensitive electrical equipment, wiring and sockets to at least 300mm above the estimated flood level. ○ The EA advises that minimum flood floor level for 'More Vulnerable' development such as residential properties should be set 600mm above the 1% AEP fluvial plus climate change peak flood level, where the appropriate new climate change allowances have been used. Therefore, if the vulnerability of the site increases then the minimum flood floor level would have to increase.

Key messages

Development is likely to be able to proceed if:

- Development is steered away from areas at fluvial and surface water flood risk along the northern boundary and south-eastern corner of the site.
- Fluvial flood risk impacts will need to be investigated and confirmed as part of a site-specific Flood Risk Assessment, which may require a detailed hydraulic model.
- A site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas.
- The flow paths and areas of surface water ponding should be incorporated and considered within the development design.
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site.
- Safe access and egress can be demonstrated in the fluvial and surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere.
- A site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas.
- If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another).

Mapping Information

Flood Zones	Flood Zones 2 and 3 have been taken from the EA Flood Map for Planning mapping. As the risk of fluvial flooding from Ordinary Watercourses on the site is not represented in the Flood Map for Planning, the ROFfSW mapping has been used as a proxy dataset and identifies fluvial flood risk at the southeastern and southern boundaries of the site.
Climate change	A detailed fluvial hydraulic model is not available for this site, and therefore the impacts of climate change cannot be assessed in detail. Instead, the

	ROFfSW mapping has been used as a proxy for fluvial and surface water flooding in the 3.3% AEP + climate change and the 1% AEP + climate change events.
Fluvial depth, velocity and hazard mapping	Depth, velocity, and hazard data was derived from the EA ROFfSW mapping, in the absence of a detailed fluvial hydraulic model.
Surface Water	The EA ROFfSW dataset has been used for this assessment. The latest climate change allowances (updated May 2022) have also been applied to the Risk of Flooding from Surface Water map to indicate the impact on pluvial flood risk.
Surface water depth, velocity and hazard mapping	The surface water depth, velocity, and hazard mapping for the 3.3%, 1% and 0.1% AEP events (considered to be high, medium, and low risk) have been taken from EA ROFfSW mapping.
Groundwater	Groundwater data was derived from JBA's Groundwater Emergence maps.
Sewer	Uttlesford's sewers are managed by both Thames Water (for catchments flowing south) and Anglian Water (for catchments flowing north). Data for sewer flooding was provided by Thames Water. Sewer flooding data was requested from Anglian Water but not received within the study timeframe.
Reservoir	The EA 'Dry Day' and 'Wet Day' Reservoir flood maps have been used in this assessment.

	Uttlesford District Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Table
Site details	
Site Code	**7**
Address	Land at Warrens farm, Little Canfield
Area	121.41ha
Current land use	Fields
Proposed land use	Residential
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site consists of several land parcels and is located in between the Pincey Brook and River Roding catchments, in the northerly end of their catchments, to the north of Takeley. The site is comprised of three main land parcels named hereafter as Section A: to the west of Smiths Green Lane (Pincey Brook catchment), Section B: to the east of Smiths Green Lane and Section C: to the south of Section B to Stortford Road(B1256) (Sections B and C lie in the Roding catchment). The site as a whole is bounded by A120 to the north, Bambers Green Road to the east, a residential area of Takeley and the B1256 (Stortford Road) to the south and a residential area and fields around Prior's Wood to the west. The eastern boundary is located 280m from the River Roding and the western boundary is located 77m from Pincey Brook.
Topography	Section A has a maximum elevation of 104.5m AOD in the south of the site and a minimum elevation of 95.6m AOD in the north of the site, sloping south to north. Section B has a maximum elevation of 103.9m AOD in the west of the site and a minimum elevation of 87.9m AOD in the east of the site, sloping west to east. Section C has a maximum elevation of 96.3m AOD in the west of the site and a minimum elevation of 87.8m AOD in the east of the site, sloping west to east.
Existing drainage features	There are a number of depressed channels in the ground elevation data running from west to east through the site, which are small drains or ordinary watercourses following field boundaries and hedgerows. These are around Parker's Farm to the southern boundary of Section B and north to south along a portion of the eastern boundary. All these small drains lead to the Roding close to Maynards. Section A appears to have a very short reach of the source of an Ordinary Watercourse which appears to go into culvert beneath the A120 at the

	northern boundary, leading into the Pincey Brook catchment around the airport carpark.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 0% FZ2 – 0% FZ1 – 100% **Fluvial model outputs:** 3.3% AEP fluvial event – N/A 1% AEP fluvial event – N/A 0.1% AEP fluvial event – N/A **Available data:** The EA Flood Map for Planning Rivers and Sea Flood Zone shows available data for fluvial flood risk of Main Rivers. The Ordinary Watercourses on the site have a catchment area less than 3km2, and therefore are not covered by hydraulic modelling used to define the Flood Map for Planning. In the absence of Flood Zone mapping, the Risk of Flooding from Surface Water (ROFfSW) mapping has been used as a proxy to infer risk of fluvial flooding from the Ordinary Watercourses. **Flood characteristics:** The EA Flood Map for Planning indicates that the site is located in Flood Zone 1 and therefore has a very low risk of fluvial flooding from Main Rivers. However, as the Flood Zone maps only identify fluvial flood risk from Main Rivers with catchments >3km2, and therefore do not represent the risk of flooding from the Ordinary Watercourses on the site, the ROFfSW mapping has been used as a proxy to infer the risk of fluvial flooding of this watercourse. The ROFfSW mapping indicates that the majority of the flood risk is contained in the drains themselves; however, some out of bank flooding occurs in the 0.1% AEP event, affecting the north of Section A. The north and eastern boundary as well as the area surrounding the Ordinary Watercourses of Section B is also more widely inundated. Surface water flood depths reach up to >1.20m in the area surrounding the ordinary watercourse of Section B, with velocities reaching > 2.00m/s. This may be different to fluvial risk but offers an indication of where out of bank flows may have the biggest impact. Whilst the risk is anticipated to be low given the topography and alignment along field boundaries, the risk posed by the Ordinary Watercourses should be investigated in a site-specific Flood Risk Assessment which may require detailed hydraulic modelling.
Surface Water	**Proportion of site at risk (RoFfSW):** **3.3% AEP** – 1.1% Max depth – 0.90-1.20m Max velocity – 1.00-2.00m/s **1% AEP** – 1.8% Max depth – >1.20m Max velocity – 1.00-2.00m/s **0.1% AEP** – 5.8% Max depth – >1.20m

	Max velocity – >2.00m/s **Available data:** The Environment Agency's Risk of Flooding from Surface Water (ROFfSW) map has been used within this assessment. **Description of surface water flow paths:** ROFfSW mapping shows flow paths generated on the site in the 3.3%, 1% and 0.1% AEP events. Overall, risk in the 3.3% and 1% AEP events is low. The 0.1% AEP event widens in extent but the majority of the risk is in the same locations as the lower order events <u>Section A</u> For the 3.3% and 1% AEP events there is surface water ponding in several locations across the site, but this is largely contained in topographic ditches. The only exception is to the north of the site, along the boundary where surface water flooding is ponding against the A120, associated with the source of an Ordinary Watercourse which appears to go into culvert beneath the A120. This has a maximum depth and velocity of 0.90m and 1.00m/s respectively. In the 0.1% AEP event, the extent of surface water flooding increases slightly with additional ponding appearing in numerous locations across the site, the most extensive being in the northwestern corner of the site. A flow path also appears in the centre of the site, flowing from south to north. This has a maximum depth and velocity of 1.20m and 2.00m/s respectively. <u>Section B</u> For the 3.3% and 1% AEP events there is surface water ponding in several locations across the site, largely contained in topographic ditches. The only exception is to the southeast of the site. This ponding occurs to the south of an unnamed Ordinary Watercourse flow path, which is contained in a ditch. The ditch bisects the site west to east. The ponding has a maximum depth and velocity of >1.20m and 2.00m/s respectively. In the 0.1% AEP event, the extent of surface water flooding increases with flow paths emerging along the northern and eastern boundary of the site, associated with an unnamed Ordinary Watercourse that runs along the site boundary. These flow paths have a maximum depth and velocity of >1.20m and >2.00m/s respectively. The flow path present in the 3.3% and 1% AEP events increases in extent and is no longer contained by the ditch. <u>Section C</u> For the 3.3% and 1% AEP events there is surface water ponding and flow paths in several locations across the site, largely contained in ditches. The ponding has a maximum depth and velocity of 0.90m and 2.00m/s respectively. In the 0.1% AEP event, the extent of surface water flooding increases with flow paths no longer being fully contained by ditches. These flow paths have a maximum depth and velocity of 1.20m and >2.00m/s respectively.

Reservoir	This site is not shown to be at risk of reservoir flooding from either the 'dry day' or 'wet day' extents.
Groundwater	Using JBA's Groundwater Emergence map, Sections A and B are not considered to be susceptible to groundwater flooding, due to the nature of the local geological conditions. Section C is largely not considered to be susceptible to groundwater flooding. However, in small section of the eastern boundary there is a risk of flooding to subsurface assets, but surface manifestation of groundwater is unlikely. Groundwater levels are between 0.5m and 5m below the groundwater surface.
Sewers	According to the Thames Water Flood Data, there are 11 incidents of sewer flooding in the CM6 1 postcode area and 3 incidents of sewer flooding in the CM22 6 postcode area. The site is located within the Thames sewer catchment. While Uttlesford is not identified as a flood priority catchment in Thames Water's Drainage and Wastewater Management Plan (DWMP), developers should consult Thames Water as part of any development proposal to ensure development does not exacerbate existing issues and maximise opportunities for development to deliver benefits to Thames Water's strategic aims.
Flood history	The EA Historic Flooding Map shows that the site has not previously been affected by fluvial flooding from Main Rivers. The nearest EA historic flood extent is located approximately 280m east of the eastern boundary of Section C. This relates to flooding from the River Roding in 1974, due to the channel capacity being exceeded. Historic flooding data provided by Essex County Council also showed no historic flood incidents for this site. There are no published Section 19 Flood Investigations for Takeley and no Parish Flood Risk Survey information.
Flood risk management infrastructure	
Defences	The site is not currently protected by any formal flood defences.
Residual risk	There is a culvert on the northern boundary of Section A, taking an unnamed Ordinary Watercourse under the A120, for a distance of approximately 115m. If this structure were to block at the site's northern boundary, water could back up and flood further into the northern part of Section A, as shown in the ponding in the RoFfSW mapping as an indication. The Ordinary Watercourse in Section B has several small structures to enable access to Parker's farm. The risk anticipated from the blockage of these structures would be low given the size of the drain along vegetated field boundaries, but it could increase out of bank flooding in the developable area of the site, so this should be considered in a Flood Risk Assessment. It is recommended that the residual risk to the site due to a blockage of these structures is assessed at site-specific FRA stage, which may require detailed hydraulic modelling.
Emergency planning	
Flood warning	The site is not covered by modelled data in the Environment Agency's Flood Warning Service, nor the Flood Alert Service.

Access and egress	Vehicular access of Section A is possible via an access road off Smiths Green Lane, on the eastern boundary. Vehicular access to Section B is possible via an access road off Smiths Green Lane on the western site boundary (it may be that other access points are proposed in future master planning). Part of Section B may need to be accessed from Bambers Green Road to the east and Stortford Road to the south due to the Ordinary Watercourse bisecting the site west to east. Despite the presence of flows parallel to Smiths Green Lane, within the site boundary in all AEP events, these are not at depths or velocities which will impede access and egress. Therefore, access and egress are not significantly impacted in any of the surface water AEP events. Although the 3.3% surface water plus climate change (SW+CC) AEP model shows flooding on Smiths Green Lane, this is not at a depth or velocity which would impede access or egress. The 1% SW+CC model shows access and egress may be impacted with maximum depths of 0.25m and maximum velocities of 1.04m. Vehicular access and egress to Section C are possible via an access road in the south of the site, off the B1256, via Thornton Road and via Bambers Green Road to the east. Access and egress are impacted in all of the surface water AEP events. Surface water crosses the road in alignment with nearby water courses to a maximum depth and velocity of >1.20m and >2.00m/s. The 3.3% and 1% SW+CC models show that access and egress are impacted, with a maximum depth and velocity of 1.60m and 2.27m/s.
Dry Islands	The site is not located on a dry island.
Climate change	
Implications for the site	**Management Catchment:** Roding, Beam and Ingrebourne and Upper Lee (Smiths Green Lane acts as the boundary) **Fluvial:** There is no detailed model coverage to assess the impacts of climate change on fluvial risk. However, there are Ordinary Watercourses present on the site, and the ROFfSW mapping can provide an indication of fluvial flooding with climate change. The 1% AEP ROFfSW extent has been used as a proxy for the 3.3% AEP + climate change fluvial event. The ROFfSW mapping shows a slight difference in flood extent between the 3.3% and 1% AEP events, which suggests that climate change is not expected to have a significant impact on the extent of flooding from the Ordinary Watercourse during a 3.3% AEP event. The 0.1% ROFfSW AEP extent has been used as a proxy for the 1% AEP + climate change fluvial event. The increase in flood extent in the ROFfSW mapping indicates that climate change may increase the extent of fluvial flooding across the site, usually focussed around the site boundary. The impacts of climate change on fluvial flood risk from the ordinary watercourses should be investigated as part of a site-specific FRA, which may require hydraulic modelling to confirm risk. **Surface Water:**

	The RoFfSW 3.3% AEP and 1% AEP models have been upscaled and run for climate change using the Upper End allowance. The 3.3% surface water plus climate change AEP model is very similar in extent, depth and velocity to the 0.1% surface water AEP event. The maximum depth and velocity of this flooding is 1.30m and 1.99m/s respectively, located in the south of Section B. These depths and velocities are a 'hazard for all'. This shows that the site is sensitive to climate change during more frequent flood events. The 1% surface water plus climate change AEP model shows the emergence of flow paths from northeast to southwest in the centre of the site. The extent of the flooding in the north of the site also increases to a flow path flowing from north to south. The maximum depth and velocity of this flooding is 1.37m and 2.91m/s respectively, in the south of Section B, meaning the flooding is a 'hazard for all'. Development proposals at the site must address the potential changes associated with climate change and be designed to be safe for the intended lifetime. The provisions for safe access and egress must also address the potential increase in severity and frequency of flooding.
Requirements for surface water drainage and integrated flood risk management	

Broad-scale assessment of potential SuDS	**Geology & Soils**
	• The bedrock geology is 'London Clay Formation – clay, silt and sand'.
	    o Relatively impermeable, improved slightly by the presence of sand and flint gravel.
	• The superficial deposit is largely 'Lowestoft Formation – Diamicton' which is composed of sheets of chalky till, with outwash sands and gravels, silts and clays.
	    o This mixture of characteristics means that the drainage of the area will vary. Sands, gravel and chalk facilitate water permeation; however, silts and clays make the ground impermeable.
	    o The composition of these soils will influence the drainage of the site.
	• A very small proportion of section C has Kesgrave Catchment Subgroup – sand and gravel and Head- clay, silt, sand and gravel as the superficial deposit. These are present along the western boundary and are likely to have varying drainage sue to varying characteristics.
	
	Sustainable Drainage Systems (SuDS)
	• The site is not considered to be susceptible to groundwater flooding, due to the nature of the local geological conditions. This should be confirmed through additional site investigation work.
	• BGS data indicates that the underlying geology is London Clay Formation, overlain with superficial deposits of mainly Lowestoft Formation Diamicton and is likely to have varying drainage. Any proposed use of infiltration should be supported by infiltration testing. Off-site discharge in accordance with the SuDS hierarchy is required to discharge surface water runoff.
	• The site is not located within a historic landfill site.
	• Use of infiltration SuDS not appropriate if the site is located on contaminated ground.

	• Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques. • The ROFfSW mapping indicates the presence of surface water flow paths on the site during the 3.3%, 1% and 0.1% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space. • If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner. • Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such as filter strips, filter drains and bioretention areas must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site. • The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.
Opportunities for wider sustainability benefits and integrated flood risk management	• The use of Natural Flood Resilience (NFM) measures on the Ordinary Watercourses which affect the site should be investigated, where suitable, to manage runoff and help mitigate flood events downstream in the Roding catchment and the wider Pincey Brook catchment. • Opportunities should be taken to open (or 'daylight') the culverted ordinary watercourse beyond the northern boundary of the site, to enhance biodiversity and reduce the risk of blockage to the structure. • Opportunities for using source control SuDS to manage runoff rates and volumes, contributing to the reduction of flood peaks on the Ordinary Watercourses on the site and the Pincey Brook downstream, as well as existing surface water flow paths leaving the site. • Waterside areas, or areas along known flow routes, can act as blue green infrastructure, being used for recreation, amenity, and environmental purposes, allowing the preservation of flow routes and

	flood storage, and at the same time providing valuable social and environmental benefits contributing to other sustainability objectives.
NPPF and planning implications	
Exception Test requirements	The Local Authority will need to confirm that the Sequential Test has been carried out in line with national guidelines. The Sequential Test will need to be passed before the Exception Test is applied. The NPPF classifies residential development as 'More Vulnerable'. Whilst the site is shown to be in Flood Zone 1, there are Ordinary Watercourses present and therefore surface water mapping has been used to infer risk in the absence of fluvial data. If detailed modelling at site-specific FRA stage shows that parts of the site lie with FZ2/3, the Exception test will need to be applied. 'More Vulnerable' development is not permitted within Flood Zone 3b; this extent will need to be confirmed at site-specific FRA stage and development steered away from any areas of flood risk.

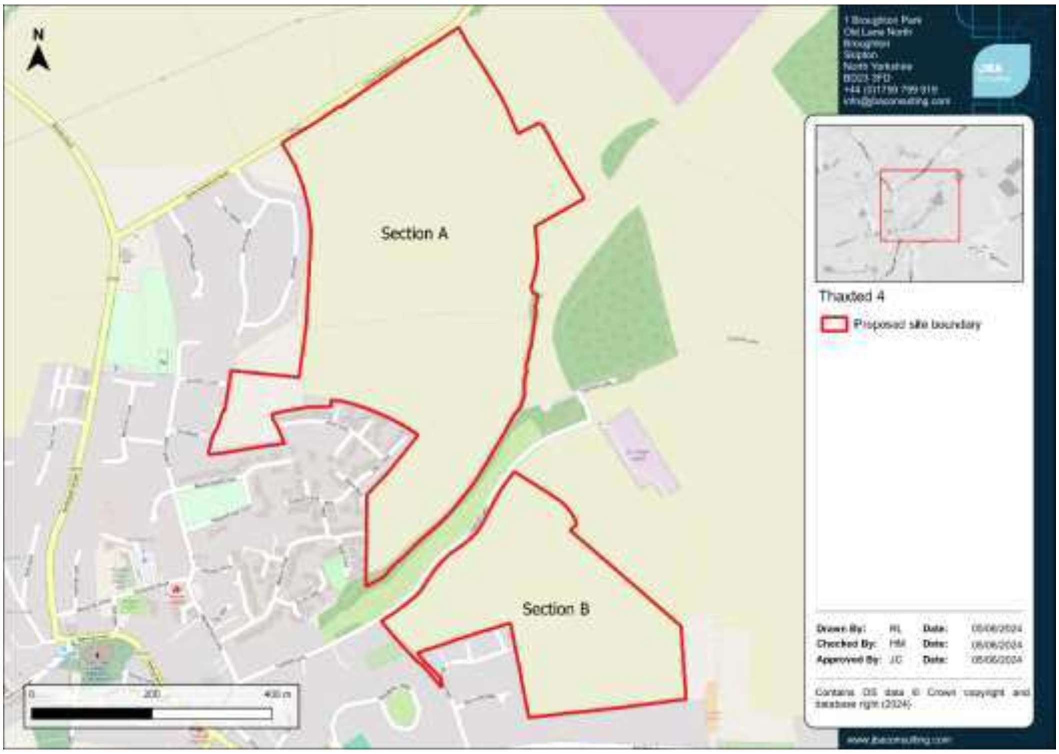
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:**
	• At the planning application stage, a site-specific FRA will be required as the proposed development site is:
	    o Greater than one hectare
	    o At risk from Ordinary Watercourses through the site
	    o At risk of other sources of flooding (surface water)
	• All sources of flooding should be considered as part of a site-specific FRA.
	• Consultation with the Local Authority, Lead Local Flood Authority, Water Company, and the Environment Agency should be undertaken at an early stage.
	• Any FRA should be carried out in line with the National Planning Policy Framework (NPPF); Flood Risk and Coastal Change Planning Practice Guidance (PPG); Uttlesford District Council's Local Plan Policies and Essex County Council's SuDS Guidance.
	• The development should be designed with mitigation measures in place where required.
	• Detailed modelling will be required to confirm Flood Zone and climate change extents for the Ordinary Watercourses at the site as part of a site-specific FRA, to determine the flood extents, climate change and flood 1 in 1000-year flood level (0.1% AEP) The Environment Agency and LLFA should be consulted at the time of the flood risk assessment. They will advise as to whether existing detailed models are available, and if so, whether they need to be updated.Climate change should be assessed using recommended climate change allowances at the time of the assessment (Flood risk assessments: climate change allowances - GOV.UK (www.gov.uk)) for the type of development and level of risk. The current allowances were published in May 2022 but may be subject to change in the future.
	• Blockage modelling may be required to assess the residual risk associated with potential blockage of the culverts on the unnamed Ordinary Watercourses.
	• Trash screens on culverts downstream of sites can build up with debris and increase flood risk. Additionally, Parish Councils can seek

	access improvements for trash screens and the ownership of the screen may be unknown.
	• If any culverts or flood risk infrastructure are found to be under the required conditions, then the new development must not compromise assets downstream, and if there is scope, then improvements should be sought to bring the assets up to condition.
	• Compensatory flood storage should be provided where development is proposed within the 1 in 100-year (1% AEP) flood extent, including an appropriate allowance for climate change. Ideally, proposed developments should have a net gain of floodplain storage to reduce the risk of flooding, on site and elsewhere.
	Guidance for site design and making development safe:
	• The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).
	• The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates.
	• Planning permission is required to surface more than 5 square metres of unpaved ground using a material that cannot absorb water.
	• Arrangements for safe access and egress will need to be demonstrated for the 1% AEP surface water event with an appropriate allowance for climate change, using the depth, velocity, and hazard outputs. As safe access and egress may not be possible to the south of the site during a 1% surface water event, if this is the preferred access route for the site, a Flood Warning and Evacuation Plan will be required.
	• Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
	  ○ set finished floor levels to 600mm above the 1% AEP flood level, including an appropriate allowance for climate change
	  ○ include property flood resistance and resilience measures.
	• Other examples of flood resistance and resilience measures include:
	  ○ using flood resistant materials that have low permeability to at least 600mm above the estimated flood level
	  ○ making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level
	  ○ raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages	
Development is likely to be able to proceed if:	

- Development is steered away from areas at fluvial and surface water flood risk. Fluvial flood risk impacts will need to be investigated and confirmed as part of a site-specific Flood Risk Assessment, which may require a detailed hydraulic model.
- A site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas.
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site.
- Safe access and egress can be demonstrated in the fluvial and surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere. Consideration will be needed where the Ordinary Watercourse crosses Section B west to east, bisecting it.
- If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another).

Mapping Information	
Flood Zones	Flood Zones 2 and 3 have been taken from the EA Flood Map for Planning mapping. As the risk of fluvial flooding from Ordinary Watercourses on the site is not represented in the Flood Map for Planning, the ROFfSW mapping has been used as a proxy dataset and identifies fluvial flood risk at the southeastern and southern boundaries of the site.
Climate change	A detailed fluvial hydraulic model is not available for this site, and therefore the impacts of climate change cannot be assessed in detail. Instead, the ROFfSW mapping has been used as a proxy for fluvial and surface water flooding in the 3.3% AEP + climate change and the 1% AEP + climate change events.
Fluvial depth, velocity and hazard mapping	Depth, velocity, and hazard data was derived from the EA ROFfSW mapping, in the absence of a detailed fluvial hydraulic model.
Surface Water	The EA ROFfSW dataset has been used for this assessment. The latest climate change allowances (updated May 2022) have also been applied to the Risk of Flooding from Surface Water map to indicate the impact on pluvial flood risk.
Surface water depth, velocity and hazard mapping	The surface water depth, velocity, and hazard mapping for the 3.3%, 1% and 0.1% AEP events (considered to be high, medium, and low risk) have been taken from EA ROFfSW mapping.
Groundwater	Groundwater data was derived from JBA's Groundwater Emergence maps.
Sewer	Uttlesford's sewers are managed by both Thames Water (for catchments flowing south) and Anglian Water (for catchments flowing north). Data for sewer flooding was provided by Thames Water. Sewer flooding data was requested from Anglian Water but not received within the study timeframe.
Reservoir	The EA 'Dry Day' and 'Wet Day' Reservoir flood maps have been used in this assessment.

	Uttlesford District Council **Level 2 Strategic Flood Risk Assessment** **Detailed Site Summary Table**
Site details	
Site Code	**Thaxted 4**
Address	Land at Barnards Fields, Thaxted
Area	36.92ha
Current land use	Agricultural Land
Proposed land use	Residential
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located in the east of the River Chelmer catchment and is located northeast of Thaxted. The site is split into two land parcels. The northern parcel will be referred to as Section A and the southern parcel Section B. Section A is bounded by the B1051 (Great Sampford Road) on its northern boundary, Copthall Lane on its southern boundary, agricultural land to the east and the residential areas of Moscotts and Holst Lane to the west. Section B is bounded by Copthall Lane on its northern boundary, agricultural land to its east, and the residential area of Barnards Field to its south and west. The River Chelmer is located approximately 650m west of the site. 

Topography	For Section A, EA LiDAR 1m DTM indicates that the site slopes southwards, from an elevation of approximately 108m AOD in the northeast of the site, to approximately 88m AOD in the southwest. Transecting the middle of the site from east to west there is a depression with an elevation of approximately 90m AOD, which appears to be a field boundary ditch. For Section B, EA LiDAR 1m DTM indicates that the northwest of the site has an elevation of approximately 195m AOD, reducing to 180m AOD in the south and along the eastern boundary. The majority of both land parcels are situated on high ground, excepting the land close to the boundaries by Copthall Lane.
Existing drainage features	The Environment Agency's Statutory Main River Map indicates that there are no Main Rivers within the site boundary. The nearest main river is the River Chelmer, located approximately 650m to the west of the western boundary. In Section A, an unnamed Ordinary Watercourse flows along the southeastern boundary of the site, and is met by a second Ordinary Watercourse, before flowing in a south-westerly direction along the southern boundary of the site. The watercourse is a tributary of the River Chelmer, which is located approximately 650m west of the site. The unnamed watercourse is culverted for approximately 800m, from Brook View beyond the southwest corner of the site, to the southern edge of Thaxted along Park Lane, where it then flows southwest to meet the Chelmer.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 0% FZ2 – 0% FZ1 – 100% **Fluvial model outputs:** 3.3% AEP fluvial event – N/A 1% AEP fluvial event – N/A 0.1% AEP fluvial event – N/A **Available data:** The EA Flood Map for Planning Rivers and Sea Flood Zone shows available data for fluvial flood risk of Main Rivers. Ordinary Watercourses which have a catchment area less than $3km^2$, are not covered by hydraulic modelling used to define the Flood Map for Planning. In the absence of Flood Zone mapping, the Risk of Flooding from Surface Water (RoFfSW) mapping has been used as a proxy for the risk of fluvial flooding from the Ordinary Watercourses. **Flood characteristics:** The EA Flood Map for Planning indicates that the site is located in Flood Zone 1 and therefore has a very low risk of fluvial flooding from Main Rivers. However, there is unmodelled/ unmapped flood risk associated with the Ordinary Watercourse along the southern boundary of Section A and the northern boundary of Section B. <u>Section A</u> The RoFfSW mapping indicates that out of bank flooding occurs in the 0.1% AEP event, affecting the southeast and southern boundaries of Section A. Flood depths reach up to 0.60m in the southeast of the site, with velocities reaching up to 2.00m/s.

	<u>Section B</u> The RoFfSW mapping indicates that there is limited flood risk along the northern boundary in the 0.1% AEP event. This flooding comes up to the site boundary but does not encroach onto the site. It is recommended that a detailed hydraulic model is developed to assess the risk of fluvial flooding from the ordinary watercourse at the site, as part of a site-specific FRA, in consultation with the EA and the LLFA.
Surface Water	**Proportion of site at risk (RoFfSW):** **3.3% AEP** – 0.6% Max depth – 0.0 - >1.20m Max velocity – 0.00 - 2.00m/s **1% AEP** – 0.9% Max depth – 0.0 - >1.20m Max velocity – 0.0 – 2.00m/s **0.1% AEP** – 4.4% Max depth – 0.0 - >1.20m Max velocity – 0.00 - 2.00m/s **Available data:** The Environment Agency's Risk of Flooding from Surface Water (RoFfSW) map has been used within this assessment. **Description of surface water flow paths:** RoFfSW mapping shows flow paths generated on the site within the 3.3%, 1% and 0.1% AEP events. <u>Section A</u> For all AEPs, the majority of mapped surface water flood risk relates to the floodplain of the Ordinary Watercourses at the southern and eastern boundaries of the site. The maximum flood depth of the floodplain is predicted to reach 0.60m with a maximum velocity of 2.00m/s. For the 3.3% AEP, a small surface water flow path forms in the west of the site, which relates to an existing ditch. A flow path is also predicted to form in the southeast of the site and drains into the Ordinary Watercourse at the southern boundary. Flood depths in the flow paths remain shallow (up to 0.15m) and velocities are low (0.00 – 0.50 m/s). For the 1% AEP event, the extent of surface water flooding increases within the existing ditch in the west of the site, and the flow path in the southeast of the site. Flood depths reach up to 0.60 – 0.90m, and velocities reach up to 1.00 – 2.00m/s. The extent of flooding at the southern and eastern boundaries of the site, relating to the Ordinary Watercourses, also increase. For the 0.1% AEP event, additional flow paths form in the centre, south and northeast of the site, and drain into the Ordinary Watercourses at the southeast and south of the site. The flow paths are shallow, with approximate depths of between 0.00 – 0.15m and velocities reach between 0.50 – 2.00m/s. The flow paths in the centre of the site, as well as the northern and northeast boundaries of the site, appear to relate to existing ditches. The areas of surface water flood risk in the west and southeast of the site, which are present in the 3.3% and 1% AEPs cover a larger proportion of the

	site in the 0.1% AEP and also increase in depth, with depths ranging from 0.00 - 1.20m. However, the extent of flooding is predicted to remain within the existing western ditch. The velocity of the ditch flow path in the west of the site ranges between 0.00 – 1.00m/s, whereas the flow path in the southeast of the site has a velocity between 0.50 – 2.00m/s. <u>Section B</u> For the 3.3 and 1% AEP events, there is a very small extent of surface water flooding along the northern boundary. Flood depths in the flow paths remain shallow (up to 0.30m) and velocities are low (0.00 – 0.50 m/s). For the 0.1% AEP event, flow paths emerge along the northern and southern boundary with a narrow strip of ponding in the centre of the site, associated with a topographic depression. The maximum depth and velocity are 0.60m and 2.00m/s giving it a hazard score of 'Danger to All'. There is also surface water flooding along the northwestern boundary, following Coptall Road, although this does not encroach onto the site.
Reservoir	This site is not shown to be at risk of reservoir flooding in either the 'dry day' or 'wet day' scenarios.
Groundwater	Using JBA's Groundwater Emergence map, it shows that the site is not considered to be susceptible to groundwater flooding, due to the nature of the local geological conditions. However, this should be confirmed through additional site investigation work within a site-specific FRA.
Sewers	According to the Thames Water Flood Data, there are no incidents of sewer flooding in the CM6 2 postcode area. The site is located within the Thames sewer catchment. While Uttlesford is not identified as a flood priority catchment in Thames Water's Drainage and Wastewater Management Plan (DWMP), developers should consult Thames Water as part of any development proposal to ensure development does not exacerbate existing issues and maximise opportunities for development to deliver benefits to Thames Water's strategic aims.
Flood history	The EA Historic Flooding Map shows that the site has not previously been affected by fluvial flooding from Main Rivers. The nearest EA historic flood extent is located approximately 400m north of the site and relates to flooding from the River Chelmer in 1947. Historic flooding data provided by Essex County Council also showed no historic flood incidents for this site. There are no published Section 19 Flood Investigations for Thaxted and no Parish Flood Risk Survey information.
Flood risk management infrastructure	
Defences	The site is not currently protected by any formal flood defences.
Residual risk	The Ordinary Watercourse on the southern border of Section A appears to enter a culvert at Brook View, beyond the southwest corner of the site. This culvert runs for approximately 800m, to the southern boundary of Thaxted. If this culvert were to become blocked, then water could back up and increase the flood extent in the southwestern corner of Section A. It is recommended that the residual risk to the site of a blockage to this culvert is assessed within a detailed hydraulic model, as part of a site-specific FRA.
Emergency planning	

Flood warning	The site is not covered by any EA Flood Warning Areas, or Flood Alert Areas.
Access and egress	Section A Currently, the only vehicular access to the site is from the B1051, at the northern site boundary (it may be that other access points are proposed in future Master planning). This road is at very low risk of surface water and fluvial flood risk. Additional access routes may be created off Copthall Road, beyond the southern boundary of the site. Copthall Road is at high risk of surface water flooding in a 3.3% AEP and greater rainfall events, and the risk of flooding increases to the southwest, towards Mill End and Park Street. Flood depths on Copthall Road are predicted to reach up to 0.90 to >1.20m during a 0.1% AEP event, with velocities reaching 1.00 – 2.00m/s. It is recommended this route is avoided due to the widespread flood extents down its entire reach in the 0.1% AEP event and the ordinary watercourse flowing along the southern boundary. Section B Currently, the only vehicular access to the site is from Barnards Farm, on the western site boundary (it may be that other access points are proposed in future Masterplanning). Barnards Farm comes off Bardfield Road. These roads are at very low risk of fluvial flooding. In the 3.3% AEP event, surface water flooding on these roads only reaches 0.15m depth; however, it has a velocity of 2.00m/s which could impede access and egress. This increases to a depth and velocity of 0.30m and 2.00m/s respectively in the 1% AEP event and 0.90m >2.00m/s in the 0.1% AEP event. These depths and velocities may be challenging for safe access and egress.
Dry Islands	The site is not located on a dry island.
Climate change	
Implications for the site	**Management Catchment:** Combined Essex Management Catchment **Fluvial:** The site is located in the EA's FMfP Flood Zone 1 and there is no detailed model coverage to assess the impacts of climate change on fluvial risk. However, there are Ordinary Watercourses along the site boundary, and the RoFfSW mapping can provide an indication on fluvial flooding with climate change. It is recommended that a detailed hydraulic model of the Ordinary Watercourses at the site is developed, as part of a site-specific FRA, to assess the impacts of climate change. The 1% AEP RoFfSW extent has been used as a proxy for the 3.3% AEP + climate change fluvial event. The RoFfSW mapping shows very little difference in flood extent between the 3.3% and 1% AEP events, which suggests that climate change is not expected to have a significant impact on the extent of flooding from the Ordinary Watercourse during a 3.3% AEP event. The 0.1% RoFfSW AEP extent has been used as a proxy for the 1% AEP + climate change fluvial event. The increase in flood extent in the RoFfSW mapping indicates that climate change may increase the extent of fluvial flooding in the south and southeastern areas of Section A.

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Surface Water:
The RoFfSW 3.3% AEP and 1% AEP models have been upscaled and run for climate change using the Upper End allowance.

<u>Section A</u>

The 3.3% SW+CC AEP model is similar in extent to the 1% surface water AEP event. However, depths and velocities are much greater than even the 0.1% AEP event, at 3.00m and 4.00m/s respectively, along the southeastern boundary.

The 1% SW+CC AEP model is similar in extent to the 0.1% surface water AEP event. However, depths and velocities are much greater than even the 0.1% AEP event, at 3.04m and 4.00m/s respectively, along the southeastern boundary, meaning it is a ‘hazard for all’. This shows that the site is very vulnerable to the impacts of climate change.

<u>Section B</u>

The 3.3% SW+CC AEP model is similar in extent and depth to the 1% AEP event. However, the velocity is greater at 1.40m/s.

The 1% SW+CC AEP model is similar in extent to the 0.1% AEP event. However, depths and velocities are much greater than even the 0.1% AEP event, at 0.55m and 1.70m/s respectively, in the northern corner of the site, meaning it is a ‘hazard for most’. This shows that the site is very vulnerable to the impacts of climate change.

Development proposals at the site must address the potential changes associated with climate change and be designed to be safe for the intended lifetime. The provisions for safe access and egress must also address the potential increase in severity and frequency of flooding.

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<tr><td colspan="2">Requirements for surface water drainage and integrated flood risk management</td></tr>
<tr><td>Broad-scale assessment of potential SuDS</td><td>

Geology & Soils

- The bedrock geology is ‘London Clay Formation – clay, silt and sand’.
  - Relatively impermeable, improved slightly by the presence of sand and flint gravel.
- The superficial deposit is ‘Lowestoft Formation – Diamicton’ which is composed of sheets of chalky till, with outwash sands and gravels, silts and clays.
  - This mixture of characteristics means that the drainage of the area will vary. Sands, gravel and chalk facilitate water permeation; however, silts and clays make the ground impermeable.
  - The composition of these soils will influence the drainage of the site.

Sustainable Drainage Systems (SuDS)

- BGS data indicates that the underlying geology is London Clay Formation, overlain with superficial deposits of Lowestoft Formation Diamicton and is likely to be poorly draining. Any proposed use of infiltration should be supported by infiltration testing. Off-site discharge in accordance with the SuDS hierarchy is required to discharge surface water runoff.
- The site is not located within a historic landfill site.

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	• Use of infiltration SuDS not appropriate if the site is located on contaminated ground. • Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques. • The RoFfSW mapping indicates the presence of surface water flow paths on the site during the 3.3%, 1% and 0.1% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space. • If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner. • Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such as filter strips, filter drains and bioretention areas must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site. • The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.
Opportunities for wider sustainability benefits and integrated flood risk management	• The use of Natural Flood Resilience (NFM) measures on the Ordinary Watercourses which affect the site should be investigated, where suitable, to manage runoff and help mitigate flood events downstream in Thaxted and the wider River Chelmer catchment. • Opportunities should be taken to open (or 'daylight') the culverted ordinary watercourse beyond the south west boundary of the site, to enhance biodiversity and reduce the risk of blockage to the structure. • Opportunities for using source control SuDS to manage runoff rates and volumes, contributing to the reduction of flood peaks on the Ordinary Watercourses on the site and the River Chelmer downstream, as well as existing surface water flow paths leaving the site. • Waterside areas, or areas along known flow routes, can act as blue green infrastructure, being used for recreation, amenity, and

	environmental purposes, allowing the preservation of flow routes and flood storage, and at the same time providing valuable social and environmental benefits contributing to other sustainability objectives.
NPPF and planning implications	
Exception Test requirements	The Local Authority will need to confirm that the Sequential Test has been carried out, in line with national guidelines. The Sequential Test will need to be passed before the Exception Test is applied. The NPPF classifies residential development as 'More Vulnerable'. The Exception Test is required for this site because although the site is in Flood Zone 1, the site is at risk of surface water flooding during the 3.3% AEP and greater events. There will still be fluvial flood risk from the Ordinary Watercourse that needs to be modelled and should the site be at risk in Flood Zone 3 and 2, the Exception test will need to be passed. The fluvial flood risk from Ordinary Watercourses at the site is not represented in the EA Flood Zones, and therefore RoFfSW mapping has been used as a proxy. This indicates that the southeast and south of the Section A is also at risk from fluvial flooding. However, the majority of the site remains at low fluvial and surface water risk, and there are opportunities to ensure that the development will be safe for its lifetime and flood risk can be managed through a sequential approach to design.

Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:**
	• At the planning application stage, a site-specific FRA will be required, as the proposed development site is:
	  ○ Greater than one hectare
	  ○ At risk from Ordinary Watercourses through the site
	  ○ At risk of other sources of flooding (surface water)
	• All sources of flooding should be considered as part of a site-specific FRA.
	• Consultation with the Local Authority, Lead Local Flood Authority, Water Company, and the Environment Agency should be undertaken at an early stage.
	• Any FRA should be carried out in line with the National Planning Policy Framework (NPPF); Flood Risk and Coastal Change Planning Practice Guidance (PPG); Uttlesford District Council's Local Plan Policies and Essex County Council's SuDS Guidance.
	• The development should be designed with mitigation measures in place where required.
	• Detailed modelling will be required to confirm Flood Zone and climate change extents for the Ordinary Watercourses at the site as part of a site-specific FRA, to determine the flood extents, climate change and flood 1 in 1000-year flood level (0.1% AEP) The Environment Agency and LLFA should be consulted at the time of the flood risk assessment. They will advise as to whether existing detailed models are available, and if so, whether they need to be updated.Climate change should be assessed using recommended climate change allowances at the time of the assessment (Flood risk assessments: climate change allowances - GOV.UK (www.gov.uk)) for the type of development and level of risk. The current allowances were published in May 2022 but may be subject to change in the future.
	• Blockage modelling should be conducted to assess the residual risk associated with potential blockage of the culvert on the unnamed Ordinary Watercourse, beyond the southwest boundary of the site.

- Trash screens on culverts downstream of sites can build up with debris and increase flood risk. Additionally, Parish Councils can seek access improvements for trash screens and the ownership of the screen may be unknown.
- If any culverts or flood risk infrastructure are found to be under the required conditions, then the new development must not compromise assets downstream, and if there is scope, then improvements should be sought to bring the assets up to condition.
- Compensatory flood storage should be provided where development is proposed within the 1 in 100-year (1% AEP) flood extent, including an appropriate allowance for climate change. Ideally, proposed developments should have a net gain of floodplain storage to reduce the risk of flooding, on site and elsewhere.

Guidance for site design and making development safe:

- The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).
- The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates.
- Planning permission is required to surface more than 5 square metres of unpaved ground using a material that cannot absorb water.
- Arrangements for safe access and egress will need to be demonstrated for the 1% AEP surface water event with an appropriate allowance for climate change, using the depth, velocity, and hazard outputs. As safe access and egress may not be possible to the south of the site during a 1% surface water event, if this is the preferred access route for the site, a Flood Warning and Evacuation Plan will be required.
- Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
    - set finished floor levels to 600mm above the 1% AEP flood level, including an appropriate allowance for climate change
    - include property flood resistance and resilience measures.
- Other examples of flood resistance and resilience measures include:
    - using flood resistant materials that have low permeability to at least 600mm above the estimated flood level
    - making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level
    - raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages

Development is likely to be able to proceed if:

- Fluvial flood risk is confirmed through hydraulic modelling in a site-specific FRA.
- Development is steered away from the area of predicted fluvial flood risk in the southern and southeastern boundaries of the Section A.
- Existing surface water flow paths on the site are incorporated and considered within the development design.
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water and fluvial flooding across the site.
- A site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water or fluvial flooding on the site and to neighbouring areas.
- If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another).
- Safe access and egress can be demonstrated in the 1% AEP plus climate change events. This includes measures to reduce flood risk along these routes, such as raising access, but not displacing floodwater elsewhere.

Mapping Information

Flood Zones	Flood Zones 2 and 3 have been taken from the EA Flood Map for Planning mapping. As the risk of fluvial flooding from Ordinary Watercourses on the site is not represented in the Flood Map for Planning, the RoFfSW mapping has been used as a proxy dataset.
Climate change	A detailed fluvial hydraulic model is not available for this site, and therefore the impacts of climate change cannot be assessed in detail. Instead the RoFfSW mapping has been used as a proxy for fluvial and surface water flooding in the 3.3% AEP + climate change and the 1% AEP + climate change events.
Fluvial depth, velocity and hazard mapping	Depth, velocity, and hazard data was derived from the EA RoFfSW mapping, in the absence of a detailed fluvial hydraulic model.
Surface Water	The EA RoFfSW dataset has been used for this assessment. The latest climate change allowances (updated May 2022) have also been applied to the Risk of Flooding from Surface Water map to indicate the impact on pluvial flood risk.
Surface water depth, velocity and hazard mapping	The surface water depth, velocity, and hazard mapping for the 3.3%, 1% and 0.1% AEP events (considered to be high, medium, and low risk) have been taken from EA RoFfSW mapping.
Groundwater	Groundwater data was derived from JBA's Groundwater Emergence maps.
Sewer	Uttlesford's sewers are managed by both Thames Water (for catchments flowing south) and Anglian Water (for catchments flowing north). Data for sewer flooding was provided by Thames Water.
Reservoir	The EA 'Dry Day' and 'Wet Day' Reservoir flood maps have been used in this assessment.

	Uttlesford District Council **Level 2 Strategic Flood Risk Assessment** **Detailed Site Summary Table**
Site details	
Site Code	**Takeley C**
Address	North Takeley Street
Area	27.34ha
Current land use	Agricultural Land
Proposed land use	Employment
Flood Risk Vulnerability	Less Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located to the west of the Pincey Brook, in the very north of its catchment, to the west of Takeley. It is bounded by the A120 (also known as Thremhall Avenue) to the north, agricultural land to the east, the B1256 (also known as Dunmow Road) to the south and Priory Wood to the west. The eastern boundary is located approximately 550m away from the Main River, Pincey Brook.
Topography	The ground has a maximum elevation of 180m AOD. The boundary of each field has an elevation of a minimum of 75m AOD, mostly on the site boundary. Running from north to south, in the centre of the site there are two depressed channels which are Ordinary Watercourses.
Existing drainage features	There is an Ordinary Watercourse, called the Shermore Brook, which flows north to south bisecting the site, from the northern site boundary, under Dunmow Road and continues south through Hatfield Forest and into the Pincey Brook approximately 2.8km downstream. Another parallel depression is present in the ground terrain data slightly to the east, from the northern boundary to Taylor's Farm, which in some OS mapping (OpenMap Local Raster) is shown to be an Ordinary Watercourse (but not present in other mapping sources e.g. Open Street Map), with a footpath in the same alignment, around the perimeter of Taylor's Farm.
Fluvial and tidal	**The proportion of site at risk FMFP:** FZ3 – 0% FZ2 – 0% FZ1 – 100% **Fluvial model outputs:** 3.3% AEP fluvial event – N/A 1% AEP fluvial event – N/A 0.1% AEP fluvial event – N/A **Available data:**

	The EA Flood Map for Planning Rivers and Sea Flood Zone shows available data for tidal flood risk and fluvial flood risk of Main Rivers. However, there is no available data for Ordinary watercourses with catchments smaller than 3km2, therefore the Risk of Flooding from Surface Water dataset has been used as a proxy to infer risk. It is recommended that developers investigate the risk from the Ordinary Watercourses as part of a site-specific FRA, which may require a new localised hydraulic model to confirm the risk to the site. **Flood characteristics:** The EA's Flood Map for Flood Zones indicates that the site is not at risk from fluvial flooding. However, this is only the case because it does not model or map catchments smaller than 3km2, and the sources of the Ordinary Watercourses start at the site's northern boundary. Two Ordinary Watercourses flow through the centre of the site from north to south. As a result, the surface water flood risk 1-in30, 1-in-100 and 1-in-1,000 return period events have been used as a proxy for fluvial flooding to infer risk. Both of the Ordinary Watercourses have a steep elevation of up to 227mAOD to the east of the watercourse and so if fluvial flooding were to occur, it is likely this would be pushed to the west of the watercourses. As the sources start along the site's northern boundary, it is likely risk will be fairly confined along the watercourse. Depths of surface water flooding (and hence potential out of bank fluvial floodplain depths) are outlined in the surface water section below. Additionally, the Ordinary Watercourse that runs along part of the southern boundary has a steep elevation of up to 240mAOD to the south of the watercourse. Therefore, if fluvial flooding occurred then this would likely spill into the site. It is recommended that developers investigate the risk from the Ordinary Watercourses, and indeed their exact alignment where it is unclear in OS mapping, as part of a site-specific FRA, which may require a new localised hydraulic model to confirm the risk to the site.
Surface Water	**Proportion of site at risk (RoFfSW):** **3.3% AEP** – 2.9% Max depth – 0.60-0.90 Max velocity – 0.25-0.50m/s **1% AEP** – 4.6% Max depth – 0.90-1.20m Max velocity – 0.50-1.00m/s **0.1% AEP** – 11.7% Max depth – >1.20m Max velocity – 1.00-2.00m/s **Available data:** The Environment Agency's Risk of Flooding from Surface Water (ROFfSW) map has been used within this assessment. **Description of surface water flow paths:**

	ROFfSW mapping shows flow paths generated on the site within the 3.3%, 1% and 0.1% AEP events. For all AEPs, the majority of mapped surface water flood risk aligns with the courses of the Ordinary Watercourses in the southern central portion of the site. The maximum flood depth is predicted to reach >1.20m where the Ordinary Watercourse meets the B1256, reducing to between 0.00 – 0.15m towards the centre of the site. This flow path is flowing in a southerly direction into Pincey Brook. The extents appear conservatively wide in this area considering the narrow floodplain of the Ordinary Watercourse, suggesting a large topographic depression for the water to pond in, and that a refinement may be possible with more detailed modelling. The west, north and east of the site are largely free from surface water risk. For the 3.3% AEP, a circular area of ponding forms in the centre of the southern boundary, just west of Taylor's Farm where the Ordinary Watercourse meets the B1256. Flood depths in the flow paths remain deep (up to 0.90m) with medium a velocity (0.25 – 0.50 m/s). For the 1% AEP event, the extent of surface water flooding increases slightly in the south of the site, with a few additional spots of ponding in the centre of the site. Flood depths reach up to 1.20m, and velocities reach up to 1.00 – 2.00m/s. For the 0.1% AEP event, the extent of the flow path has significantly increased, incorporating the ponding in previous AEP events and spreading further into the central portion of the site and along the south-western boundary. The flow path is deep at the confluence of the ordinary watercourse and the B1256, with approximate depths of >1.20m and velocities reach between 0.00 – 2.00m/s.
Reservoir	This site is not shown to be at risk of reservoir flooding from either the dry or wet day extents.
Groundwater	The site is not considered to be susceptible to groundwater emergence flooding, due to the nature of the local geological conditions. This should be confirmed through additional site investigation work.
Sewers	According to the Thames Water Flood Data, there are no incidents of sewer flooding in the CM24 1 postcode area. The site is located within the Thames sewer catchment. While Uttlesford is not identified as a flood priority catchment in Thames Water's Drainage and Wastewater Management Plan (DWMP), developers should consult Thames Water as part of any development proposal to ensure development does not exacerbate existing issues and maximise opportunities for development to deliver benefits to Thames Water's strategic aims.
Flood history	The EA Historic Flooding Map shows that the site has not previously been affected by fluvial flooding from Main Rivers. The nearest EA historic flood extent is located approximately 2.3km south of the site, and relates to flooding from the Pincey Brook in 1947, due to the channel capacity being exceeded. Historic flooding data provided by Essex County Council also showed no historic flood incidents for this site. There are no published Section 19 Flood Investigations for Takeley and no Parish Flood Risk Survey information.
Flood risk management infrastructure	

Defences	The site is not currently protected by any formal flood defences.
Residual risk	There are approximately five culverts present on the site, with more downstream of the Ordinary Watercourses. The Ordinary Watercourses across the site are flowing in a southerly direction and so if downstream culverts were to become blocked then water could back up and flood the southern part of the site. It is recommended that the residual risk to the site of a blockage to this culvert is assessed within a detailed hydraulic model, as part of a site-specific FRA.
Emergency planning	
Flood warning	The site is not covered by the Environment Agency's Flood Warning Service, nor the Flood Alert Service.
Access and egress	Currently, vehicular access and egress to and from the site is from the B1256 Dunmow Road, halfway along the southern boundary by Taylor's Farm (it may be that other access points are proposed in future Master planning). In the 0.1% surface water AEP event, there is a risk of surface water flooding in this area to a maximum depth of 0.15m. The maximum velocity is 0.50-1.00m/s which could impede access and egress. In the 3.3% and 1% AEP events, there are isolated pockets or stretches of flooding along the B1256 east and west of the site, with the main risk between the Shermore Brook and Taylor's Farm. This has a maximum depth and velocity of 1.20m and 1.00m/s respectively. This has a hazard score of 'Danger to All'. The 3.3% and 1% SW+CC model shows the same isolated pockets along the B1256 with a maximum depth and velocity of 1.24m and 1.38m/s. This has a hazard score of 'Danger to All' and not conducive to safe access and egress. Consideration will be needed for where the site is bisected by the Ordinary Watercourses, in terms of how people may access different parts of the site should flood waters create isolated 'parcels', but it is recommended that all access is directed south the B1256.
Dry Islands	The site is not located on a dry island.
Climate change	
Implications for the site	**Management Catchment:** Roding, Beam and Ingleburn **Fluvial:** The site is located in Flood Zone 1 and there is no detailed model coverage to assess the impacts of climate change on fluvial risk. However, there are Ordinary Watercourses on the site, and the ROFfSW mapping can provide an indication on fluvial flooding with climate change. However, it is recommended that a detailed hydraulic model of the Ordinary Watercourses on the site is developed as part of a site-specific FRA, with climate change allowances modelled to confirm risk. The 1% AEP ROFfSW extent has been used as a proxy for the 3.3% AEP + climate change fluvial event. The ROFfSW mapping shows a slight difference in flood extent between the 3.3% and 1% AEP events, which

	suggests that climate change is not expected to have a significant impact on the extent of flooding from the Ordinary Watercourse during a 3.3% AEP event. The 0.1% ROFfSW AEP extent has been used as a proxy for the 1% AEP + climate change fluvial event. The increase in flood extent in the ROFfSW mapping indicates that climate change may increase the extent of fluvial flooding in the south of the site. **Surface Water:** The 3.3% SW+CC AEP model is similar in extent to the 1% surface water with no climate change AEP event. However, depths and velocities are more similar to the 3.3% AEP event, at 1.00m and 0.67m/s respectively. The 1% SW+CC AEP model is similar in depth and velocity to the 3.3% surface water and no climate change AEP event. The maximum depth and velocity of this flooding is 1.18m and 0.78m/s respectively, meaning it is a ‘hazard for some’. This shows that the site is not very vulnerable to the impacts of climate change. Development proposals at the site must address the potential changes associated with climate change and be designed to be safe for the intended lifetime. The provisions for safe access and egress must also address the potential increase in severity and frequency of flooding.
Requirements for surface water drainage and integrated flood risk management	

Broad-scale assessment of potential SuDS	**Geology & Soils**
	• The bedrock geology is ‘London Clay Formation – clay, silt and sand’.
	    ○ Relatively impermeable, improved slightly by the presence of sand and flint gravel.
	
	• The superficial deposit is ‘Lowestoft Formation – Diamicton’ which is composed of sheets of chalky till, with outwash sands and gravels, silts and clays.
	    ○ This mixture of characteristics means that the drainage of the area will vary. Sands, gravel and chalk facilitate water permeation; however, silts and clays make the ground impermeable.
	    ○ The composition of these soils will influence the drainage of the site.
	
	Sustainable Drainage Systems (SuDS)
	• The site is not considered to be susceptible to groundwater flooding, due to the nature of the local geological conditions. This should be confirmed through additional site investigation work.
	• BGS data indicates that the underlying geology is London Clay Formation, overlain with superficial deposits of Lowestoft Formation Diamicton and is likely to have varying drainage. Any proposed use of infiltration should be supported by infiltration testing. Off-site discharge in accordance with the SuDS hierarchy is required to discharge surface water runoff.
	• The site is not located within a historic landfill site.
	• Use of infiltration SuDS not appropriate if the site is located on contaminated ground.
	• Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce

	discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques. • The ROFfSW mapping indicates the presence of surface water flow paths on the site during the 3.3%, 1% and 0.1% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space. • If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner. • Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such as filter strips, filter drains and bioretention areas must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site. • The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.
Opportunities for wider sustainability benefits and integrated flood risk management	• The use of Natural Flood Resilience (NFM) measures on the Ordinary Watercourses which affect the site should be investigated, where suitable, to manage runoff and help mitigate flood events downstream in Takeley and the wider Pincey Brook catchment. • Opportunities should be taken to open (or 'daylight') the culverted ordinary watercourse beyond the south west boundary of the site, to enhance biodiversity and reduce the risk of blockage to the structure. • Opportunities for using source control SuDS to manage runoff rates and volumes, contributing to the reduction of flood peaks on the Ordinary Watercourses on the site and the Pincey Brook downstream, as well as existing surface water flow paths leaving the site. • Waterside areas, or areas along known flow routes, can act as blue green infrastructure, being used for recreation, amenity, and environmental purposes, allowing the preservation of flow routes and flood storage, and at the same time providing valuable social and environmental benefits contributing to other sustainability objectives.

NPPF and planning implications	
Exception Test requirements	The Local Authority will need to confirm that the Sequential Test has been carried out in line with national guidelines. The Exception Test is not required for this development as the site is classified as 'Less Vulnerable' (Employment and not present in the Flood Zones). However, there is still fluvial flood risk from the Ordinary Watercourses which needs to be investigated in more detail and confirmed in a FRA.

Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:**
	• At the planning application stage, a site-specific FRA will be required as the proposed development site is:
	    ○ Greater than one hectare
	    ○ At risk from Ordinary Watercourses through the site
	    ○ At risk of other sources of flooding (surface water)
	• All sources of flooding should be considered as part of a site-specific FRA.
	• Consultation with the Local Authority, Lead Local Flood Authority, Water Company, and the Environment Agency should be undertaken at an early stage.
	• Any FRA should be carried out in line with the National Planning Policy Framework (NPPF); Flood Risk and Coastal Change Planning Practice Guidance (PPG); Uttlesford District Council's Local Plan Policies and Essex County Council's SuDS Guidance.
	• The development should be designed with mitigation measures in place where required.
	• Detailed modelling will be required to confirm Flood Zone and climate change extents for the Ordinary Watercourses at the site as part of a site-specific FRA, to determine the flood extents, climate change and flood 1 in 1000-year flood level (0.1% AEP) The Environment Agency and LLFA should be consulted at the time of the flood risk assessment. They will advise as to whether existing detailed models are available, and if so, whether they need to be updated.Climate change should be assessed using recommended climate change allowances at the time of the assessment (Flood risk assessments: climate change allowances - GOV.UK (www.gov.uk)) for the type of development and level of risk. The current allowances were published in May 2022 but may be subject to change in the future.
	• Blockage scenario modelling should be conducted to assess the residual risk associated with potential blockage of the small culverts on the unnamed Ordinary Watercourses.
	• Trash screens on culverts downstream of sites can build up with debris and increase flood risk. Additionally, Parish Councils can seek access improvements for trash screens and the ownership of the screen may be unknown.
	• If any culverts or flood risk infrastructure are found to be under the required conditions, then the new development must not compromise assets downstream, and if there is scope, then improvements should be sought to bring the assets up to condition.
	
	Compensatory flood storage should be provided where development is proposed within the 1 in 100-year (1% AEP) flood extent, including an appropriate allowance for climate change. Ideally, proposed developments

	should have a net gain of floodplain storage to reduce the risk of flooding, on site and elsewhere.
	Guidance for site design and making development safe:
	• The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).
	• The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates.
	• Planning permission is required to surface more than 5 square metres of unpaved ground using a material that cannot absorb water.
	• Arrangements for safe access and egress will need to be demonstrated for the 1% AEP surface water event with an appropriate allowance for climate change, using the depth, velocity, and hazard outputs. As safe access and egress may not be possible to the south of the site during a 1% surface water event, if this is the preferred access route for the site, a Flood Warning and Evacuation Plan will be required.
	• Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
	  ○ set finished floor levels to 300mm above the 1% AEP flood level, including an appropriate allowance for climate change.
	  ○ include property flood resistance and resilience measures.
	• Other examples of flood resistance and resilience measures include:
	  ○ using flood resistant materials that have low permeability to at least 300mm above the estimated flood level.
	  ○ making sure any doors, windows or other openings are flood resistant to at least 300mm above the estimated flood level.
	  ○ raising all sensitive electrical equipment, wiring and sockets to at least 300mm above the estimated flood level.
	  ○ The EA advises that minimum flood floor level for 'More Vulnerable' development such as residential properties should be set 600mm above the 1% AEP fluvial plus climate change peak flood level, where the appropriate new climate change allowances have been used. Therefore, if the vulnerability of the site increases then the minimum flood floor level would have to increase.

Key messages	
Development is likely to be able to proceed if:	

- Fluvial flood risk is confirmed through hydraulic modelling in a site-specific FRA, and development is steered away from the areas of fluvial and surface water flooding in the site.
- Surface water flow paths and areas of surface water ponding should be incorporated and considered within the development design.
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site.
- Safe access and egress can be demonstrated in the fluvial and surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere. Consideration needs to be given to the site being bisected by Ordinary Watercourses, which may impede safe access/ egress from certain parts of the site.
- A site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas.
- If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another).

Mapping Information	
Flood Zones	Flood Zones 2 and 3 have been taken from the EA Flood Map for Planning mapping. As the risk of fluvial flooding from Ordinary Watercourses on the site is not represented in the Flood Map for Planning, the ROFfSW mapping has been used as a proxy dataset and identifies fluvial flood risk at the southeastern and southern boundaries of the site.
Climate change	A detailed fluvial hydraulic model is not available for this site, and therefore the impacts of climate change cannot be assessed in detail. Instead, the ROFfSW mapping has been used as a proxy for fluvial and surface water flooding in the 3.3% AEP + climate change and the 1% AEP + climate change events.
Fluvial depth, velocity and hazard mapping	Depth, velocity, and hazard data was derived from the EA ROFfSW mapping, in the absence of a detailed fluvial hydraulic model.
Surface Water	The EA ROFfSW dataset has been used for this assessment. The latest climate change allowances (updated May 2022) have also been applied to the Risk of Flooding from Surface Water map to indicate the impact on pluvial flood risk.
Surface water depth, velocity and hazard mapping	The surface water depth, velocity, and hazard mapping for the 3.3%, 1% and 0.1% AEP events (considered to be high, medium, and low risk) have been taken from EA ROFfSW mapping.
Groundwater	Groundwater data was derived from JBA's Groundwater Emergence maps.
Sewer	Uttlesford's sewers are managed by both Thames Water (for catchments flowing south) and Anglian Water (for catchments flowing north). Data for sewer flooding was provided by Thames Water. Sewer flooding data was requested from Anglian Water but not received within the study timeframe.
Reservoir	The EA 'Dry Day' and 'Wet Day' Reservoir flood maps have been used in this assessment.