Climate Change Risk Assessment

Lanwades Woodland Park

Client: Lochailort Kentford Ltd
Author: Robert Holbrook

www.environmental-economics.co.uk

Revision History

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1	17/04/2025	Robert Holbrook BSc MSc	Tim James C.Eng MCIBSE BSc MSc

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- *Overheating - TM59 dynamic modelling*
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- *Life cycle carbon assessments*
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Environmental Economics Ltd
8 Cardiff Road
Luton
Bedfordshire
LU1 1PP

T: 01582 544250
E: rob.holbrook@ee-ltd.co.uk
W: www.environmental-economics.co.uk

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1. Introduction

1.1.1. Environmental Economics Ltd has been commissioned by Lochailort Kentford Ltd to prepare a climate change risk assessment for the proposed development Lanwades Woodland Park.

1.1.2. The proposed development incorporates approximately 860 residential units, along with a retail unit, care home, employment hub and a school. A range of types, sizes and tenures will be provided, including the provision of affordable housing, associated car parking, garages, access, landscaping, open space and drainage provision.

1.1.3. The proposed development is located within the application site under the jurisdiction of West Suffolk Council.

1.1.4. Further details on the proposed development can be found in the ES Part One Report.

1.1.5. The report sets out the potential climate change risks and effects which will be used to inform the preparation of the Environmental Statement (ES), other relevant Technical Papers and design development. This assessment has been completed on an iterative basis in liaison with the project design team and other environmental disciplines, by considering the climate projections for the geographical location and timeframe of the proposed development.

2. Policy Context and Guidance

2.1. International/ National Context

2.1.1. This section aims to provide a review of relevant policy, guidance and technical evidence regarding potential risks associated with climate change and delivering climate change adaptation and resilience as relevant to the proposed development.

Climate Change Act 2008 (as amended in 2019)

2.1.2. The Climate Change Act 2008 established the context for Government action and incorporated the requirement to undertake Climate Change Risk Assessments and to develop a National Adaptation Programme (NAP) to address opportunities and risks from climate change.

National Planning Policy Framework (December 2024)

2.1.3. The National Planning Policy Framework sets out planning policy for England. It states that the purpose of the planning system is to contribute to the achievement of sustainable development and that he planning system has three overarching objectives, one of which (Paragraph 8C) is an environmental objective:

"to protect and enhance our natural, built and historic environment; including making effective use of land, improving biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating an adapting to climate change, including moving to a low carbon economy".

2.1.4. Paragraph 11 states:

"Plans and decisions should apply a presumption in favour of sustainable development. For plan-making this means that:

> *All plans should promote a sustainable pattern of development that seeks to: meet the development needs of their area; align growth and infrastructure; improve the environment; mitigate climate change (including by making effective use of land in urban areas and adapt to its effects."*

2.1.5. Part 14 of the Framework is entitled "Meeting the challenges of climate change, flooding and coastal change" and sets out the strategy for minimising the climate change effects of new development. It acknowledges that:

"The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that··· minimise vulnerability and improve resilience".

UK Climate Change Risk Assessment

2.1.6. First published in 2012, the UK Climate Change Risk Assessments (CCRAs) set out the main risks and opportunities to the UK from climate change, providing an overview of the main risks in and across sectors to help identify appropriate adaptation measures.

2.1.7. The third UK CCRA was published in 2022 to provide updated advice on climate change risks and opportunities to various sectors, including building and infrastructure. The assessment covers a five-year period in accordance with the requirement in the Climate Change Act 2008 to report regularly on UK progress on adaptation.

UK Climate Change Risk Assessment (2022)

2.1.8. The UK Government is required by the Climate Change Act 2008 to conduct a Climate Change Risk Assessment (CCRA) every five years to inform the National Adaptation Plans for England, Scotland, Wales and Northern Ireland. The third such national assessment was published in June 2022 and marks the second time the Government ha asked its independent advisors, the Climate Change Committee to prepare the initial Independent Assessment.

2.1.9. The CCRA 2022 sets out 'urgency categories' used to assess each of the 61 individual climate risks and opportunities considered in the Evidence Report. These include risks and opportunities categorised under National Environment (Ne), Infrastructure (In), People and the Built Environment (PB), and Business and Industry (Bu).

2.1.10. For the purpose of this project specific CCRA, the urgent categories and climate risks from the UK CCRA are drawn upon, but tailored to a local level, to develop a local-level framework. The CCRA 2022 also defines sensitive receptors, which have also been applied to the application site for the proposed development.

Environment Act 2021

2.1.11. The Environment Act became law in November 2021. This aims to improve air and water quality, tackle waste, increase recycling, halt the decline of species, and improve the country's natural environment to make it more resilient to climate shocks.

Environmental Improvement Plan 2023

2.1.12. The Environmental Improvement Plan (EIP) 2023 for England is the first revision of the 25 Year Environmental Plan (25YEP) published in 2018. It build upon the 25YEP vision with a new plan setting out how Government will work with landowners, communities and businesses to deliver 10 goals for improving the environment, matched with interim target to measure progress.

2.1.13. Goal 7, mitigating and adapting to climate change includes the following key policies and actions to adapt to the impacts of climate change:

- *'Continue our role as a global leader in tackling climate change and biodiversity loss;*
- *Fund the restoration of over 35,000 hectares of peatlands in England by 2025 through the Nature for Climate Peatland Grant Scheme;*
- *Publish our next National Adaptation Programme, setting out actions government and others will take to build climate resilience.'*

2.2. Local Context

The West Suffolk Council Joint Development Management Policies Document (adopted 24 February 2015)

2.2.1. The Council adopted the West Suffolk Council Joint Development Management Policies Document in February 2015, which details the development and growth strategies for the local area up to 2031. Some key policies which directly tie into this climate change risk assessment is discussed below:

2.2.2. Policies DM6, DM7 and DM8 set out the strategic approach to sustainable design and construction. Strategies to ensure this is achieved include avoiding unacceptable flood risks, incorporating climate resilient design, promoting efficient use of resources such as energy and water, and providing opportunities for enhancing biodiversity. All major developments will be required to incorporate on-site renewable energy generation.

The West Suffolk Council Emerging Local Plan

2.2.3. Whilst not yet officially adopted, there are several policies within the West Suffolk Council Emerging Local Plan which are relevant to this document including SP1 and LP1.

3. Assessment of Risk Methodology

3.1. Assessment Methodology

3.1.1. This section sets out the methodology for identifying potential climate impacts and assessing their severity which can be summarised into the following steps:

1. *Identifying potential climate change risks to the application site;*
2. *Assessing the likelihood and magnitude of potential risks (identifying the most severe); and*
3. *Risk assessment, including consideration of mitigation actions, such as design measures or management frameworks to reduce the impact of the identified risks on the proposed development.*

3.1.2. Climate change is anticipated to have a substantial impact on UK weather, leading to more frequent periods of weather extremes, including higher peak and average temperatures, increased winter rainfall and decreased summer rainfall.

Representative Concentration Pathways

3.1.3. Given it is not possible to predict future climate with 100% certainty, the Met Office UK Climate Projections (UKCP18) make assumptions about the economic, social and physical changes to our environment which will influence climate change.

3.1.4. Representative Concentration Pathways (RCPs) are a method for capturing those assumptions within a set of scenarios. The RCPs specify concentrations of greenhouse gases that will result in total radiative forcing increasing by a target amount by the year 2100 relative to pre-industrial levels which then have a resultant change in global temperature as outlined in Table 1:

Table 1 - Summary of RSP scenarios (Met Office, 2018)

RCP	Change in Temperature (°C) by 2081-2100
RCP 2.6	1.6 (0.9-2.3)
RCP 4.5	2.4 (1.7-3.2)
RCP 6.0	2.8 (2.0-3.7)
RCP 8.5	**4.3 (3.2-5.4)**

3.1.5. To avoid under-estimating future climate risks, the Institute of Environmental Management and Assessment (IEMA) recommends the use of RSP 8.5 scenario (50th percentile) within the climate change risk assessment as it provides a suitably conservative approach to climate assessment; it is the median, or the value at which 50% of the data values fall at or below it.

3.1.6. The following methodology has been used to determine the potential level of risk resulting from climate hazards. The criteria adopted for this assessment have been developed based on the application of professional judgement. This section provides a summary of how the level of climate change risk has been assessed with relation to the proposed development.

Likelihood of Climate Risk

3.1.7. The likelihood of climate risk is based upon exposure, measured by the probability and frequency of occurrence, as defined in Table 2:

Table 2 - Likelihood of Risk

Likelihood Category	Description (probability and frequency of occurrence)
Very High	The event occurs multiple times during the lifetime of the project (60 years) e.g. at least annually, typically 60 events or more
High	The event occurs several times during the lifetime of the project (60 years) e.g. approximately once every five years, typically 12 events
Medium	The event occurs limited times during the lifetime of the project (60 years) e.g. approximately once every 15 years, typically 4 events
Low	The event occurs during the lifetime of the project (60 years) e.g. once in 60 years
Very Low	The event may occur once during the lifetime of the project (60 years)

Severity of Climate Risk

3.1.8. The severity of climate risk is based upon the sensitivity of receptors, measured by the ability to adapt, tolerate and recover from physical or chemical change (also known as adaptive capacity) and the value of the resource i.e. distinctiveness, rarity and character.

Sensitivity of Receptors

3.1.9. All receptors will exhibit a greater or lesser degree of sensitivity to the changes brought about by the proposed development, and defining receptor sensitivity as part of the definition of the baseline environment helps us to ensure that the subsequent assessment is transparent and robust.

3.1.10. In order to define the sensitivity of a receptor, the guidelines presented in Table 3 have been adopted in the Climate Change Risk Assessment, informed by the definition and presence of receptors in other topics (e.g. ecology) and conclusions reached regarding the sensitivity of receptors are presented in Section 4.

Table 3 - Receptor sensitivity guidelines

Sensitivity/Value	Description
Very High	Receptor has very limited or no capacity to accommodate physical or chemical changes or influences. Receptor possesses fundamental characteristics which contribute significantly to the distinctiveness, rarity and character of the resources, is of very high importance and rarity that is of international scale (e.g. designated sites such as SACs, SPAs, Ramsar Sites, World Heritage Sites, Geological Conservation Review Sites, and Habitats Directive Annex II species), and has very limited potential for substitution / replacement.
High	Receptor has a limited capacity to accommodate physical or chemical changes or influences. Receptor possesses key characteristics which contribute significantly to the distinctiveness, rarity and character of the resource, is of high importance and rarity that is of national scale (e.g. designated sites such as SSSIs, NNRs, UK Biodiversity Action Plan (BAP) notable habitats and species defined in the ecology chapter, Areas of Outstanding Natural Beauty, Heritage Coasts, Scheduled Monuments, Grade I and II Listed Buildings, Conservation Areas, etc.), and has limited potential for substitution / replacement.
Medium	Receptor has a limited capacity to accommodate physical or chemical changes or influences. Receptor possesses key characteristics which contribute to the distinctiveness and character of the resource, is of medium importance and rarity that is regional in scale (e.g. designated sites such as Country Wildlife Sites (CWSs), Regionally Important Geological Sites, Grade II Listed Buildings, Local BAP etc.), and has limited potential for substitution / replacement.
Low	Receptor has a moderate capacity to accommodate physical or chemical changes or influences. Receptor possesses characteristics which are locally distinctive only, are of low to medium importance and rarity that is local in scale (e.g. designated sites such as Local Nature Reserves), and potentially can be substituted / replaced.
Very Low	Receptor is generally tolerant of and can accommodate physical or chemical changes or influences. Receptor characteristics do not make a significant contribution to local character or distinctiveness, and are of very low importance and rarity, are not designated, and are easily substituted / replaced.

4. Step 1: Identifying Potential Climate Change Risks to the Application Site

4.1.1. For the purposes of the Environmental Assessment, the following timescales are assumed, which represent a precautionary approach:

- *Start on site (enabling works, Proposed Residential Site) - 2027*
- *Assume 3-5 years construction period, therefore complete by 2032*

4.1.2. Decommissioning of the proposed development is not relevant to this reports, given the end use being for residential purposes.

4.2. Baseline Climatic Conditions

4.2.1. The observed Met Office climate data for Brooms Barn (roughly 3 miles from development site) for the most recent 30-year climate period between 1991-2020 is outlined in Table 4. The highest observed values are provided for maximum and minimum temperatures and all other metrics are taken from mean data.

Table 4 - Climate Data

Month	Max temp (°C)	Min temp (°C)	Days of air frost (days)	Sunshine (hour)	Rainfall (mm)	Days of rainfall ≥ 1mm (days)
January	7.07	1.86	8.53	62.12	51.60	10.90
February	7.77	1.76	8.81	76.43	41.67	9.97
March	10.47	3.17	4.58	121.33	39.76	9.23
April	13.78	4.75	2.30	170.51	40.03	8.69
May	17.03	7.63	0.31	207.59	48.33	8.02
June	19.94	10.46	0.00	198.05	56.90	9.12
July	22.59	12.66	0.00	208.09	54.59	8.99
August	22.34	12.74	0.00	194.56	65.70	9.57
September	19.14	10.60	0.00	152.39	49.91	8.63
October	14.70	7.92	0.50	114.54	61.01	10.54
November	10.26	4.58	2.97	69.98	60.23	11.57
December	7.47	2.25	8.50	57.48	57.60	11.53
Annual (average)	14.41	6.73	36.50	1633.07	627.33	116.76

4.2.2. Met Office records of extreme weather events in the past decade have been reviewed in relation to the application site to aid the assessment of risk. These include, but are not limited to:

- *Severe storm and wind events such as Storm Isha in January 2024 which brought strong winds and heavy rain across the UK. Storm events have been recorded annually for the past decade.*
- *The most recently recorded heavy rainfall event was that in October 2023, however other extreme rainfall events are recorded in 2021, multiple events between 2019 and 2015.*
- *Summer heatwaves, most recently in early September 2023, where locations in the UK reached around 30°C and the mid-summer heatwave in July 2022 where the UK set its first record above 40°C. Other summer heatwaves have been recorded in 2020, 2019, 2016 and 2015.*
- *Low winter temperatures, most notably in the December 2022 cold spell which saw the most significant low winter temperatures since 2010. Other extreme cold snaps have been noted in 2021 and 2018.*

4.3. Future Climatic Conditions

4.3.1. Using the Met Office's latest UK climate projects (UKCP18), prediction of future baseline conditions can be established. These are detailed in Table 5 and based on the data for the East Anglia region of England from 2010-2099 for RCP scenario 8.5.

Table 5 - UKCP18 key results 2010-2099

	Climate Variables				
Climate Period	**Increase in mean annual temperatures (°C)**	**Increase in mean summer temperatures (°C)**	**Increase in mean winter temperatures (°C)**	**Decrease in mean summer rainfall (%)**	**Increase in mean winter rainfall (%)**
2010-2029	0.8	1.0	0.7	-5	3
2020-2039	1.0	1.1	1.0	-6	4
2030-2049	1.3	1.5	1.3	-8	5
2040-2059	1.7	2.1	1.6	-16	7
2050-2069	2.1	2.5	2.0	-21	9
2060-2079	2.7	3.2	2.4	-25	11
2070-2089	3.3	4.0	2.9	-28	14
2080-2099	3.9	4.9	3.5	-32	16

4.3.2. The key climate risks at the application site during the proposed development's operation phase are summarised as:

- *Increases in both annual and summer temperatures.*
- *Drier summers due to a decrease in summer precipitation, whilst winters may experience increased flooding due to increased winter rainfall.*

4.4. Summary of Anticipated Risks

4.4.1. As highlighted in Table 5, changes to summer and winter temperatures and precipitation levels are significant. Based upon this, key climate drivers and physical risks likely to impact sensitive receptors across the proposed development will be detailed in the following sections and include:

- *Prolonged periods of high, dry temperatures which may cause wildfires and overheating in the buildings of the proposed development;*
- *Reduced summer rainfall which may cause droughts, reduced water availability at the site, reduce ground permeability and increase the possibility of soil erosion;*
- *Increased winter rainfall which will cause ground saturation and therefore increase surface water runoff, pluvial flooding and soil erosion;*
- *It is also expected that wind storms will increase in the future, which may also lead to soil erosion.*

4.4.2. The sensitive receptor groups at the proposed development that are considered to be affected by at least one of the above physical risks during operation include:

- *Residents;*
- *Employees;*
- *Buildings and infrastructure;*
- *Habitats and species,*
- *Business operations.*

4.4.3. The sensitivity of receptor groups is detailed in Table 6 below. The level of sensitivity attributed to each is considered as a factor within the project risk assessment in Section 6.

Table 6 - Receptor group sensitivity

Sensitive Receptor Groups	Sensitivity
Residents	Medium – the receptor is important at a local or sub-regional level, however, vulnerable residents have a limited capacity to accommodate physical or chemical changes or influences, therefore raising the sensitivity level to medium.
Employees	Low – as the receptor is important at a local or sub-regional level and employees are likely to have a moderate capacity to accommodate physical or chemical changes or influences.
Buildings and Infrastructure	Low – as the receptor is important at a local or sub-regional scale and has a moderate capacity to accommodate physical or chemical changes or influences.
Habitats and Species	Low – species and habitats present on-site are assigned as valuable of site, local or borough level of importance (see the Ecology Chapter for further details).
Business Operations	Low – as the receptor is important at a local or sub-regional level and is likely to have a moderate capacity to accommodate physical or chemical changes or influences.

5. Step 2: Assessing the Likelihood and Magnitude of Potential Risks

5.1. Drought

5.1.1. The proposed development is situated near Kentford, where properties are served by Anglian Water. All water companies are required to produce a drought plan, which sets out actions to maintain water supply during prolonged periods of exceptionally low rainfall.

5.1.2. The Anglian Water Drought Plan 2022 covers the actions which will be taken in the case of a drought event. These include:

- ***Options to reduce water demand**, which range from campaigns to urge customers to consume less water; apply temporary restrictions such as hosepipe bans; implementing drought orders to restrict non-essential water use such as cleaning cars; activate an emergency drought order.*
- ***Options to increase water supply**, which may include supply-side drought orders and permits; ordinary supply-side options; Winter Drought Permits or inter-company bulk transfers to an alternative source.*

5.1.3. Every five years Anglian Water produce a Water Resource Management Plan which sets out how a reliable and sustainable supply of water will be provided to the region. It helps to identify areas of current and future risk to ensure that adequate measures are enacted or are in place in preparation to secure future water resources.

5.1.4. Sensitive receptors which may be affected include:

- ***Residents –** Temporary bans and non-essential water use may impact day-to-day life for residents of the development.*
- ***Habitats and Species –** Prolonged drought may cause habitat loss or degradation as well as the migration of local species and subsequent biodiversity loss.*
- ***Business Operations –** If the commercial use for the proposed development is reliant on water supply, a prolonged drought will impact services and may prevent operations.*

5.2. Ground Movement and Subsidence

5.2.1. Subsidence can occur in any location, however certain soil types are more susceptible. These include clay, silt, sand and gravel soils.

5.2.2. Clay and silt are 'cohesive' soils, which means that their volume is variable dependent on moisture content. These soils will increase in volume with increased moisture and decrease in volume with decreased moisture. As many as 75% of UK ground subsidence cases are caused by soil shrinkage and as the UK climate warms, soils will be at an increased risk of shrinkage.

5.2.3. Sand and gravel soils are 'non-cohesive', which means that they do not vary in size based on moisture content. These soils can, however, be washed away by water flow. This puts these soils at high risk during periods of increased rainfall or flooding. Risks are also increased if located near a large body of water.

5.2.4. Information from the UK Soil Observatory mapping from the British Geological Survey (BGS) labels the soilscape for the application site as '*freely draining sandy Breckland soils'* and *'shallow lime-rich soils over chalk or limestone'.*

5.2.5. As discussed above, sandy soils are 'non-cohesive' soils, meaning that soils can be washed away by water, particularly during periods of increased rainfall and flooding.

5.2.6. Receptors sensitive to ground movement and subsidence include:

- ***Buildings and Infrastructure –*** *Ground Movement / subsidence based on soil types may have an impact on building foundations and structures causing physical damage.*

5.3. Heatwaves

5.3.1. In newly built developments, overheating in the summertime is becoming increasingly of concern and a more frequent issue, which can impact on the health and wellbeing of building occupants while simultaneously increasing energy requirements.

5.3.2. Infrastructure operators are working on efforts to ensure future resilience to extreme weather events including temperature extremes. The majority of Distribution Network Operators (DNOs) have well-progressed adaptation plans in place or in preparation. UK Power Networks are the electricity distributor for the application site. During the 2022 summer heatwaves energy distributors identified challenges with pole-mounted transformers and overhead lines overheating, leading to power cuts for customers.

5.3.3. Sensitive receptors which may be affected include:

- ***Residents –*** *Heat waves will impact the internal thermal environment of homes across the site which has the potential to impact the health and wellbeing of the occupant(s).*
- ***Employees –*** *Heat waves will impact the internal thermal environment of employment spaces across the site requiring additional cooling measures, increased energy demand, and may impact the well-being of employees.*
- ***Habitats and Species –*** *Heat waves will impact the habitats of local species, reducing the availability of water and potentially leading to the loss of species.*
- ***Building Operations –*** *Increased temperatures will result in a higher cooling demand which will increase the energy demand of the building, or if there is no active cooling the building may become uninhabitable.*
- ***Buildings and Infrastructure –*** *Heat waves will impact the operational capacity of local energy infrastructure, which could lead to power cuts.*

5.4. Wildfires

5.4.1. Wildfire data published by the Forestry Commission England indicates that wildfire incidents are comparatively low in the East of England compared to the rest of the UK. Between 2009-2021 there were around 39,288 wildfires, which gives an occurrence density of 2-3 per km^2 during the study period.

5.4.2. Data from the UKCP18 Probabilistic dataset for RCP8.5 the Met Office Fire Danger predicts an increase in wildfire danger days of 210% between 2024 and 2080. This shows that through the lifetime of the proposed development, wildfire occurrences could reach a high threshold in the region.

5.4.3. Sensitive receptors which may be affected include:

- ***Residents –*** *Wildfire has the potential to spread to the built environment and therefore poses a danger to any residents within proximity of the wildfire event.*
- ***Employees –*** *Wildfire has the potential to spread to the built environment and therefore poses a danger to any employees within proximity of the wildfire event.*
- ***Habitats and Species –*** *Wildfires could destroy habitats while simultaneously displacing or killing local species.*
- ***Buildings and Infrastructure –*** *Wildfires have the potential to spread to the built environment and thereby damage buildings and infrastructure.*
- ***Business Operations –*** *If a wildfire took place in close proximity to the site, access may be restricted to the commercial buildings at the site and, business dependent, may cause operations to be halted.*

5.5. Extreme Precipitation

5.5.1. Increased extreme precipitation events have the potential to increase occurrences of flooding.

5.5.2. Flooding can affect substations and damage electrical equipment. UK Power Networks have worked to assess and monitor risks of flooding, and have contributed toward flood defence upgrades to help protect against flooding from surface water, rivers and seas.

5.5.3. Any potential interaction of drainage / flow paths, power distribution and access and movement strategies for the site must be a key consideration during the planning activities to ensure that the site is not locked into an approach that could increase flood risk and cause failures to infrastructure networks.

Surface Water Flooding

5.5.4. The DEFRA Flood Risk Assessments Climate Change Allowance Guidance provides technical guidance on the anticipated change for a range of parameters, including Peak Rainfall Intensity. Peak rainfall allowances are provided for use by management catchment to inform the preparation of flood risk assessments and surface water drainage strategies.

Fluvial Flood Risk

5.5.5. The site is situated in Flood Zone 1, and all residential development and buildings will be situated in Flood Zone 1. Flood Zone 1 is defined as area with less than 1 in 1000 annual probability of river or sea flooding and is seen as the most sustainable option for development land.

5.5.6. Sensitive receptors to surface water flooding include:

- ***Habitats and Species –*** *Flooding can destroy / disturb habitats and displace or kill species.*
- ***Buildings and Infrastructure –*** *Flooding can damage buildings and could limit access to areas around the site, as well as having the potential to damage local energy infrastructure cause loss of energy supply.*
- ***Business Operations –*** *Flooding can cause restricted access to the site, limiting access to the commercial buildings which could lead to reduced or halted business operations depending on the nature of the business.*

Soil Erosion (water)

5.5.7. The UKSO map includes information on the water erosion risk to bare soil. The application site lies within low to moderate risk brackets, with sediment rarely seen to move across most of the site with some smaller areas showing signs of sediment in runoff during very wet periods.

5.5.8. Sensitive receptors to soil erosion from water include:

- ***Habitats and Species –*** *Soil erosion can decrease soil fertility and can increase pollution and sedimentation in streams and rivers, both of which can affect species.*

5.6. Storm and Wind Events

High Winds and Lightning Storms

5.6.1. In the UK, most wind-driven rain is associated with winter storms where intense rainfall is combined with strong wind storms of which the intensity and frequency is expected to increase, which will lead to an increased risk of wind-driven rain impacts.

5.6.2. Projections for wind speed are not clearly defined in the UKCP18 data, however an increase in wind-driven rain should be considered as this increases the risk of water penetration of vertical structures in both buildings and energy infrastructure across the site.

5.6.3. Within the UK Power Networks' Climate Resilience Strategy, they are ensuring that works are undertaken in the future to *'strengthen overhead networks to increase storm resilience',* which will reduce the impacts associated with wind events such as power cuts from fallen lines or disrupted services due to signal loss. Falling trees and windborne debris can damage powerlines, which is why UK Power Networks invest millions of pounds each year on tree maintenance to help manage and mitigate against this risk.

5.6.4. Sensitive receptors to strong wind and storm events include:

- ***Residents –*** *Falling trees or driving rain may damage homes or endanger livelihood in extreme cases.*
- ***Habitats and Species –*** *Strong winds, heavy rain and subsequent flooding could damage habitats and threaten local species.*
- ***Buildings and Infrastructure –*** *Driving rain can cause damage to homes and strong winds may bring down trees and damage buildings and infrastructure on the site.*

6. Step 3: Project Risk Assessment

6.1.1. Table 7 sets out a summary of the future climate change risks specific to the application site and the likely sensitive receptor(s) to identify risks and opportunities. This draws upon up-to-date existing mitigation within the proposed development and regulation and / or policy measures the proposed development will need to adhere to and so considered as embedded within to the site. Given the application is at outline planning stage, additional recommended actions for each risk are considered to be those which could be implemented during detailed design of the proposed development.

6.1.2. The operational phase will only be considered due to construction phase being short term and therefore the significant impacts of intensifying climate change would be unlikely to cause significant impact during this timeframe. It is also anticipated that any potential impacts are likely to be mitigated through the use of a Construction Environmental Management Plan (CEMP) which will incorporate best practice measures to account for potential climate change impacts on workers, such as heatwaves.

Table 7 - Future Climate Change Risk Assessment

Climate Change Effect	Risk	Receptor(s)	Likelihood of Risk	Embedded Measures (via policy / regulation or topic specific mitigation / assessments)	Commentary / Recommended Adaptation Measures for Detailed Design
Increased summer mean and daily maximum temperature	Declining species and natural habitats from changing climate	Habitats and species *(Low)*	Medium	A Landscape Strategy has been produced for the site. This includes measures such as the retention of existing trees and hedges where possible, including field boundaries and green-blue corridors, and the inclusion of native woodland planting throughout the site. BNG of at least 10% will be targeted on-site against the baseline for linear, watercourse and area habitats.	As the detail of the landscape strategy and BNG plan develops, ensure the selection of plant species are resilient to the future UK climate outlined in this report, such as planting that is more tolerant to drought.
	Overheating impacts health and well-being during operation	Residents *(Medium)* Employees *(Low)*	High	For residential units - adherence to the Building Regulations Part O informed by overheating assessments to inform design and ensure sufficient mitigation against future issues. For employment units – adhere to the summer and winter operative temperature ranges as set out in CIBSE Guide A.	Consider additional climate adaptation measures for overheating, such as green infrastructure, solar shading and consideration of window orientation and open ability. Highways and pedestrian links throughout the site should incorporate shading to encourage active travel during incidents of increased temperature. For residential units - Undertake CIBSE TM59 methodology to ensure internal thermal comfort levels can be maintained throughout the developments lifetime. For employment units – undertake CIBSE TM52 methodology to ensure internal thermal comfort levels can be maintained.

Climate Change Effect	Risk	Receptor(s)	Likelihood of Risk	Embedded Measures (via policy / regulation or topic specific mitigation / assessments)	Commentary / Recommended Adaptation Measures for Detailed Design
	Damage caused by wildfire	Buildings and Infrastructure *(Low)* Habitats and Species *(Low)* Business Operations *(Low)*	Low	N/A at this stage.	Reduce the impact of a wildfire by planning for hard landscaping, such as paths, around buildings and keeping any grassland or open spaces well maintained. This will be covered during the detailed design stage in a Habitat Management and Monitoring Plan.
	Increased energy demand from increased cooling requirements	Buildings and Infrastructure *(Low)*	Medium	The proposed development will be designed in accordance with the following regulations and / or policy requirements which will ensure aspects such as energy demand, overheating and incorporated into the design: Building Regulations Part O Building Regulations Part L Local Policies DM6, DM7 and DM8 Emerging Local Policies SP1 and LP1	Incorporate passive design strategies into the building and increase energy efficiency of building systems to reduce the energy demand which may be required. Incorporate on-site energy generation, such as through PV panels, to accommodate increased energy demands and reduce reliance on the national power grid that may experience outages or cascading failure.
	Stress to energy infrastructure due to increased temperature	Buildings and Infrastructure *(Low)*	Medium		

Climate Change Effect	Risk	Receptor(s)	Likelihood of Risk	Embedded Measures (via policy / regulation or topic specific mitigation / assessments)	Commentary / Recommended Adaptation Measures for Detailed Design
Increased summer mean and daily maximum temperature and decreased rainfall	Reduced water availability during operation	Residents *(Medium)* Habitats and Species *(Low)* Buildings and Infrastructure *(Low)*	Medium	The proposed development will be designed in accordance with Approved Document G higher standard (water use of 110 litres/person/day). The management of the site including landscaped areas and newly created habitats, such as open water, will be covered by a comprehensive long-term management plan to be produced at detailed design stage.	Water-efficient, low-flow fittings will be considered and designed into the development to reduce overall water consumption during operation and minimise the development's impact on water security. As the detail of the landscape strategy and BNG plan develops, ensure the selection of plant species that are resilient to the future UK climate outlined in this report, such as planting that is more tolerant to drought. The long-term landscape design should not include large areas of exposed soil that could erode in hot dry weather, impacting water quality on site. For residential units - rainwater harvesting should be considered and integrated where feasible to store and collect water which could be used if any supply disruption occurred. For employment units – if business operations require a high-water consumption, a drought plan should be in place, as well as ways to minimise water consumption where possible from the outset.
	Poor water quality or supply interruptions	Residents *(Medium)* Business Operations *(Low)*	Medium		

Climate Change Effect	Risk	Receptor(s)	Likelihood of Risk	Embedded Measures (via policy / regulation or topic specific mitigation / assessments)	Commentary / Recommended Adaptation Measures for Detailed Design
	Ground movement and differential settlement	Habitats and Species *(Low)* Buildings and Infrastructure *(Low)*	Low	N/A at this stage	Ensure the strength of structures used for both buildings and infrastructure are designed to resist potential ground movements.
Increase in winter rainfall	Increased river flow and risk of fluvial flooding	Habitats and Species *(Low)* Buildings and Infrastructure *(Low)*	Medium	No development will take place on land within Flood Zone 2 or 3, or water storage areas, other than the lowering of existing ground levels to provide additional flood compensation storage. The drainage strategy developed at detailed design stage will ensure any overland flow is accommodated / maintained. Finished flood levels of the buildings should be set at a minimum of 600mm above the design flood level, which is based on the 1 in 100 year + 23% climate change flood event. The 23% is the central peak river flow climate change allowance to the 2080s. Surface water drainage will be designed to contain the 1 in 100 year + 45% climate change storm event within the site. The 45% is the upper end rainfall climate change allowance to the 2070s.	A mix of green infrastructure and on-site sustainable urban drainage systems (SuDS) should be utilised to manage surface water flooding. This can reduce the risk of overflowing drains and burst pipes as well, Provide flood compensation storage that is sequenced, in order to mitigate the impact of flooding both on-site and downstream of the site.
	Surface water flooding / drainage	Habitats and Species *(Low)* Buildings and Infrastructure *(Low)* Business Operations *(Low)*	Medium		

Climate Change Effect	Risk	Receptor(s)	Likelihood of Risk	Embedded Measures (via policy / regulation or topic specific mitigation / assessments)	Commentary / Recommended Adaptation Measures for Detailed Design
	Ground movement or subsidence	Buildings and Infrastructure *(Low)*	Low	N/A at this stage	To avoid waterlogging, appropriate drainage will be designed, especially around embankments, so that runoff is collected and stored before being released to infiltrate after a storm has passed.
Changes in extreme weather patterns and severity	Wind and storm events or driving rain causing damage to buildings or occupants.	Residents *(Medium)* Habitats and Species *(Low)* Residents *(Medium)*	Low	A Tree Survey and Arboriculture Impact Assessment has been undertaken that will ensure the development is planned in accordance with the location of any large and / or unstable trees.	The development should ensure maintenance plans are in place to minimise the risk of vegetation debris impacting any infrastructure within the site. Careful siting of trees within the landscaping strategy around buildings and / or public realm. On-site energy infrastructure such as batteries and energy compounds (micro-grids) which may operate independently of the DNO to maximise resilience against infrastructure failure. It should be noted that UK Power Networks annually invests in pruning trees and managing vegetation near overhead cables, helping to reduce and manage the risk outside the site.
	Strong winds, loose debris or vegetation impacting energy infrastructure.	Residents *(Medium)* Employees *(Low)* Buildings and Infrastructure *(Low)*	Medium		

7. Summary

7.1.1. This Climate Change Project Risk Assessment supports and summarises advice issued to the project team during the design period and the preparation of the ES, identifying key risks to the proposed development as a result of climate change to inform the development at the application site.

7.1.2. The proposed development has considered a full range of current and future physical climate risks throughout the design process that has informed the planning application. A risk assessment for the application site and the proposed development has been carried out to inform the prioritisation of climate action and investment in adaptation.

7.1.3. A summary pf additional mitigation measures / recommendations which should be considered as part of the detailed design to ensure the proposed development implements mitigation measures to minimise adverse effects in respect of climate change risks is provided below:

- *As the detail of the landscape strategy and BNG plan develops, ensure it will futureproof the proposed development in terms of climate change as well as in terms of pests / /diseases by adhering to best practice. This could include diversifying planting species as much as possible, including drought tolerant species, whilst still having regard to the local character, and generally planting only native species.*
- *Incorporate passive design strategies into the building and increasing the energy efficiency of building systems to reduce energy demand.*
- *Incorporate on-site energy generation, such as through PV panels, to accommodate increased energy demands and reduce reliance on the national power grid that may experience outages or cascading failures.*
- *Consider additional climate adaptation measures for overheating, such as green infrastructure, solar shading and consideration of window orientation.*
- *The Public Right of Way network and supporting links through the site should incorporate shading to continue to encourage the use of active travel during times of heat stress.*
- *Incorporate a mix of green infrastructure and on-site sustainable urban drainage systems (SuDS) to manage surface water flooding.*
- *Water efficient, low-flow fittings to be utilised to reduce the development's consumption of water resources.*
- *Rainwater harvesting should be considered and integrated where feasible to allow for the collection, storage and re-use of rain water to safeguard against interruptions to water supply.*

7.1.4. It will not be possible to eliminate every risk associated with climate change, but through intelligent design, preparation and responsible construction, these risks will be minimised. Discussion and recommendations have detailed reducing these risks in key areas such as overheating, flooding and extreme weather, which has taken into consideration not only the health and safety of the users of the proposed development but the resilience of the development itself.

7.1.5. The significance of the mitigation measures suggested in this appendix are assessed and concluded in the main Technical Chapter (Chapter X - Climate Change).