Hydrock

Himley Village

Future Climate Change Statement

For *Cala Homes*

Date *9 May 2023*

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Himley Village, Bicester

This report provides a future climate change statement for the proposed Himley Village development. This will cover the anticipated impact of climate change at the proposed site, alongside a overheating assessment to categorise the overheating risk at the site.

1. Introduction

1.1 Purpose of the report

Cala Homes has appointed Hydrock to provide a future climate change statement for the proposed Himley Village development that includes for 500 residential units.

The report has been produced to discharge Condition 13 of the Reserved Matters Application:

> *Each reserved matters application that includes the construction of any new buildings shall be accompanied by a statement setting out how the design of buildings and the layout has taken account of future climate impacts, as identified in TSB research 'Future Climate Change Risks for NW Bicester', or any more recent assessment that has been published, and how the proposed development will be resilient to overheating, changing rainfall patterns and higher intensity storm events.*

Please note, because the TSB research 'Future Climate Change Risks for NW Bicester' was published in 2013, Hydrock have decided to base the report on the more recent guidance **"UK Climate Change Risk Assessment 2022"** (UK CCRA 2022).

The UK Climate Change Risk Assessment 2022 sets out the main risks and opportunities arising from climate change over the coming years, identifying a number of priority areas for further action[1], which have been used to form this assessment.

This report provides the following:

» Climate Risk and Vulnerability assessment

» Overheating analysis based on CIBSE TM59 in compliance with Part O of the building regulations

1.2 Background and Context

As shown in Figure 1.1, since the early 1900s, increasing trends in temperature and precipitation have been seen.

As the climate continues to change, the UK is likely to see wetter winters and drier summers, with severe weather events occurring more frequently.

1.3 Climate risk and vulnerability assessment

The industry is now familiar with 'net zero' targets to reduce greenhouse gas emissions and limit future global warming. These actions fall under 'climate mitigation' and remain a priority for policy and regulation. However, the long lifespan of some greenhouse gases in the earth's atmosphere mean that climate impacts are predicted to continue for many decades, even where net zero targets are achieved.

Mitigation alone is now not enough to address current and short-term impacts of climate change and it is therefore crucial for new developments to design for adaptation measures that will prepare for, and reduce risks from, a changing climate.

The climate risk assessment will highlight any impacts the development will have on the climate resilience of the surrounding area and any adaptation measures that should be embedded within the design to negate this impact. Adaptation measures will also be proposed to improve the climate resilience of the development against greater incidences and severity of flooding, a higher likelihood of water scarcity and more intense, prolonged heatwaves.

1.4 Overheating analysis

Heat stress is identified in the Climate Risk assessment as a key risk for the proposed development. Therefore, an overheating analysis was performed using the Part O compliant Simplified Method, dynamic modelling and CIBSE TM59 analysis. This assessment will indicate whether the dwellings are likely to overheat.

1.5 Development details

The proposed Himley Village development consists of 500 dwellings and forms part of

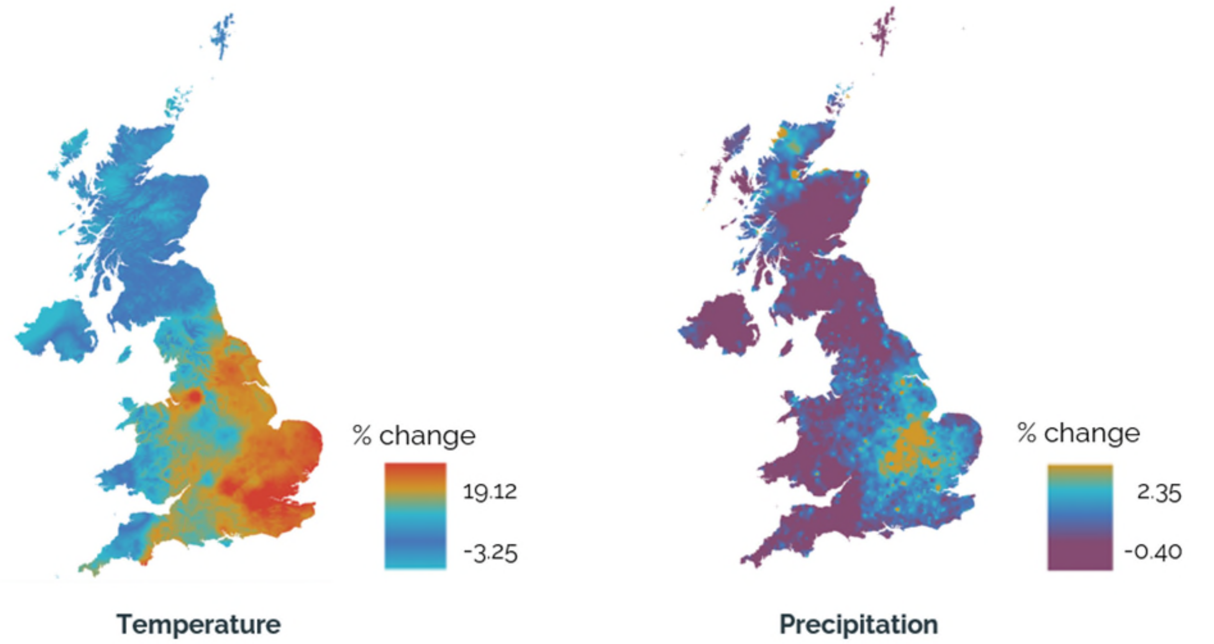

Figure 1 - Temperature and precipitation % change since 1900

[1] HM Government, (2022) 'UK Climate Change Risk Assessment' HM Government

the wider Himley Village masterplan. RMA for the 500 units are to be submitted in three Phases:

- Phase 2A - 150 units
- Phase 2B - 200 units
- Phase 2C - 150 units.

The wider masterplan will provide up to 1,700 homes, schools, and community facilities. The site itself is classified as an EcoTown and will seek to provide a zero-carbon ready development on the outskirts of Bicester.

The Himley Village site falls within the remit of Cherwell District Council (CDC).

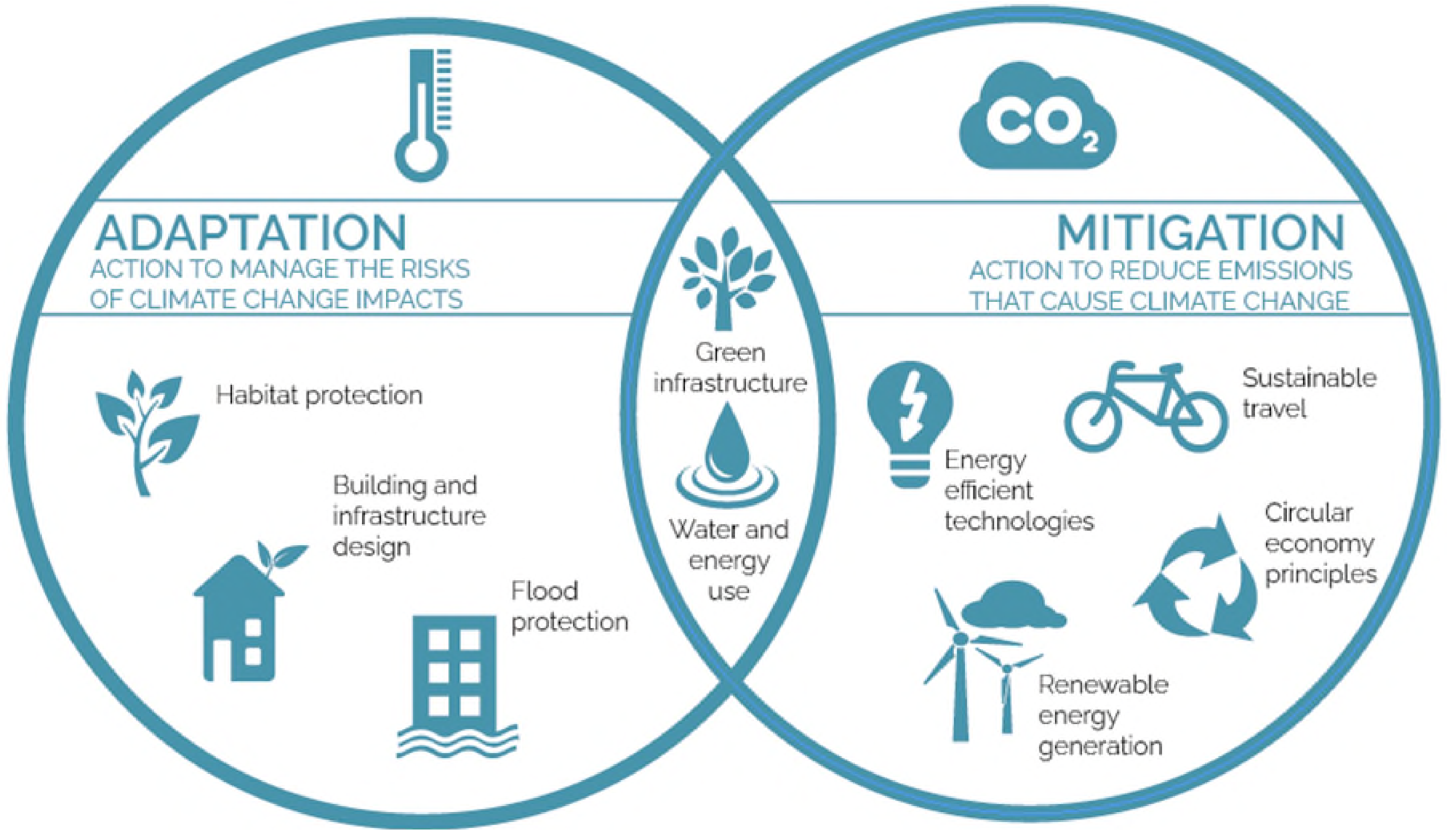

Figure 2 - Climate resilience venn diagram

Policy Context and Guidance

This section provides a review of relevant policy, guidance and technical evidence regarding potential impacts and risk associated with climate change relevant to the Proposed Development.

2. National Policy Context

2.1 Climate Change Act 2008[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.

2.2 UK Climate Change Risk Assessment

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 main risks in and across sectors to help identify appropriate adaptation measures.

The third UK CCRA was published in 2022 to provide updated advice on climate change risks and opportunities to various sectors, including the Buildings 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)

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 has asked its independent advisers, the Climate Change Committee to prepare the initial Independent Assessment.

The assessment will inform the Government's next National Adaptation Programme (NAP) for England, due to be published this year (2023).

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 in the Natural Environment (Ne), Infrastructure (In), People and the Built Environment (PB), and Business and Industry (Bu). In relation to the Proposed Development key risks and opportunities highlighted are set out in Table 1.

[2] Her Majesty's Stationery Office (2008) Climate Change Act 2008.

Table 1: Key Risks and Opportunities

Risk or Opportunity	Risk number and Receptor	Nature of risk/opportunity	Urgency Score
Natural Environment and Assets			
RISK	N1. Terrestrial species and habitats	Changing climatic conditions and extreme events, including temperature change, water scarcity, wildfire, flooding, wind, and altered hydrology (including flooding)	More action needed
RISK	N2. Terrestrial species and habitats	Pests, pathogens and invasive species	More action needed
RISK	N4. Soils	Changing climatic conditions, including seasonal aridity and wetness	More action needed
RISK & OPPORTUNITY	N18. Landscape character	Changing climatic conditions, including temperature change and water scarcity	Further investigation
OPPORTUNITY	N3. Terrestrial species and habitats	New species colonisations	Further investigation
Infrastructure			
RISK	I1. Infrastructure networks (water, energy, transport, ICT)	Cascading failures	More action needed
RISK	I2. Infrastructure services	River, surface water and groundwater flooding	More action needed
RISK	I5. Transport networks	Slope and embankment failure	More action needed
RISK	I7. Subterranean and surface infrastructure	Subsidence	Further investigation
RISK	I8. Public water supplies	Reduced water availability	More action needed
RISK	I10. Energy	High and low temperatures, high winds, lightning	Further investigation
RISK	I12. Transport	High and low temperatures, high winds, lightning	More action needed

Risk or Opportunity	Risk number and Receptor	Nature of risk/opportunity	Urgency Score
RISK	I13. Digital	High and low temperatures, high winds, lightning	Further investigation
Health, Communities and the Built Environment			
RISK	H1. Health and wellbeing	High temperatures	More action needed
RISK	H3. People, communities and buildings	Increase in flood risk	More action needed
RISK	H5. Building fabric	Moisture, wind and driving rain	Further investigation
RISK	H7. Health and wellbeing	Changes in indoor and outdoor air quality	Further investigation
RISK	H9. Food safety and food security	Higher temperatures (food safety) and extreme weather (food security)	Further investigation
RISK	H10. Health	Poor water quality and household water supply interruptions	Further investigation
RISK	H12. Health and social care delivery	Extreme weather	More action needed
RISK	H13. Delivery of Education services	Extreme weather	More action needed
RISK & OPPORTUNITY	H6. Household energy demand	Summer and winter temperature changes	More action needed
OPPORTUNITY	H2. Health and wellbeing	High temperatures	Further investigation
Business and Industry			
RISK	B5. Reduced employee productivity in businesses	Infrastructure disruption and higher temperatures in working environments	Further investigation
RISK	B6. Disruption to business supply chains and distribution networks	Extreme weather	More action needed
OPPORTUNITY	B7. Changes in demand for goods and services	Long-term climate change	Further investigation

The CCRA does not recommend the specific adaptation actions that are needed to reduce risk or take advantage of opportunities in the future. The report identifies specific areas where further action is felt to be needed most urgently, based on the available evidence, and it discusses the benefits of taking further action. However, an economic appraisal of different actions is out of scope of the assessment.

2.3 Environment Act 2021

The Environment Act, approved in November 2021, 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.

Specifically in relation to climate change, it introduces resource efficiency requirements and reporting obligations that include information about greenhouse gases emissions and makes an amendment of legislation on tree felling and planting.

2.4 Environmental Improvement Plan 2023

The Environmental Improvement Plan (EIP) 2023 for England is the first revision of the 25 Year Environmental Plan (25YEP) published in 2018. It builds on 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 targets to measure progress.

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;
- Publish our next National Adaptation Programme, setting out actions government and others will take to build climate resilience;
- Invest in farmers and land managers to mitigate flood risk and other climate-related impacts.

3. Local Policy

3.1 Local Plan (2011-2031)

Policy ESD 1: Mitigating and Adapting to Climate Change

To ensure new development is more resilient to climate change impacts the following will be taken into consideration:

- Demonstration of design approaches that are resilient to climate change impacts including the use of passive solar design for heating and cooling;
- Minimising the risk of flooding and making use of sustainable drainage methods, and;
- Reducing the effects of development on the microclimate (through the provision of green infrastructure including open space and water, planting, and green roofs).

Policy ESD 3: Sustainable Construction

All development proposals will be encouraged to include the following:

- Maximising passive solar lighting and natural ventilation;
- Making use of sustainable drainage methods;
- Maximising opportunities for cooling and shading (by the provision of open space and water, planting, and green roofs).

Cherwell District is in an area of water stress and as such the Council will seek a higher level of water efficiency than required in the Building Regulations, with developments achieving a limit of 110 litres/person/day.

Policy ESD 6: Sustainable Flood Risk Management

Flood risk assessments (if required) should assess all sources of flood risk and demonstrate that:

- There will be no increase in surface water discharge rates or volumes during storm events up to and including the 1 in 100 year storm event with an allowance for climate change (the design storm event);
- Developments will not flood from surface water up to and including the design storm event or any surface water flooding beyond the 1 in 30 year storm event, up to and including the design storm event will be safely contained on site.

Proposals should demonstrate that surface water will be managed effectively on site and that the development will not increase flood risk elsewhere, including sewer flooding.

Policy ESD 7: Sustainable Drainage Systems (SuDS)

All development will be required to use sustainable drainage systems (SuDS) for the management of surface water run-off. Where site specific Flood Risk Assessments are required in association with development proposals, they should be used to determine how SuDS can be used on particular sites and to design appropriate systems.

Where possible, SuDS should seek to reduce flood risk, reduce pollution and provide landscape and wildlife benefits. SuDS will require the approval of Oxfordshire County Council as LLFA and SuDS Approval Body, and proposals must include an agreement on the future management, maintenance and replacement of the SuDS features.

Policy Bicester 1: North West Bicester Eco-Town

- All new buildings designed to incorporate best practice on tackling overheating, taking account of the latest UKCIP climate predictions;
- Development that respects the landscape setting and that demonstrates enhancement, restoration or creation of wildlife corridors to achieve a net gain in biodiversity;
- Proposals should include a Flood Risk Assessment and take account of the Council's Strategic Flood Risk Assessment for the site;
- Provision of sustainable drainage in accordance with Policy ESD 7;
- Demonstration of climate change mitigation and adaptation measures including exemplary demonstration of compliance with the requirements of policies ESD 1 – 5
- A soil management plan may be required to be submitted with planning applications.

3.2 Eco Bicester – One Shared Vision (2010)

NW Bicester is to be a sustainable community that is resilient and well-adapted to future climate change. It should be planned to minimise future vulnerability in a changing climate, and with both mitigation and adaptation in mind. All new developments should be designed to take account of the climate they are likely to experience.

New development is to meet the standards on water, flooding, green infrastructure and biodiversity set out in this Vision, taking into account a changing climate for these, as well incorporating wider best practice on tackling overheating and impacts of a changing climate for the natural and built environment.

3.2.1 Water:

- Incorporate measures in the water cycle strategy for improving water quality and managing flooding;
- Incorporate sustainable drainage systems (SUDS) and avoid connection of surface water run-off into sewers (where feasible). A strategy for the long term maintenance, management and adoption of the SUDS will be required;
- Eco-Bicester should aspire to water neutrality, i.e. achieving development without increasing overall water use across a wider area.

In particular, the water cycle strategy should set out how:

- Development would be designed to limit the impact of that development on water use, and any plans for additional measures, e.g. within the existing building stock of the wider designated area, that would contribute towards water neutrality;

- New homes will be equipped to meet the water consumption requirement of Level 5 of the Code for Sustainable Homes.

3.2.2 Flooding

Development should not increase the risk of flooding elsewhere and should use opportunities to address and reduce existing flooding problems.

All built up areas at NW Bicester will be fully within Flood Zone 1 – the lowest risk. Flood Zone 2 (medium risk) should, as far as possible, be used for open spaces and informal recreational areas that can serve as multi-functional spaces, for example, those used for flood storage. There should be no built-up development in Flood Zone 3, with the exception of water-compatible development and, where absolutely necessary, essential infrastructure as defined in Table D.2 of PPS25: Development and Flood Risk.

3.2.3 Biodiversity

NW Bicester will need to demonstrate a net gain in local biodiversity. All new development should seek to achieve this. A strategy for preserving and enhancing local biodiversity is required to accompany any planning applications. Including appropriate mitigation and/or mitigation measures, required to minimise adverse effects on individual species and habitats of principle importance and to enhance local biodiversity over all.

3.2.4 Green infrastructure

40% of the total area of land at NW Bicester is to be allocated to green space of which at least half should be public. A network of well managed, high quality green/open spaces which are linked to the wider countryside should be provided including a range of types of green space, for example community forests, wetland areas and public parks. Green space should be multifunctional, e.g. accessible for recreation and support wildlife, urban cooling and flood management.

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Climate Risk Assessment Methodology

This section outlines the methodology used in the climate risk assessment.

4. Methodology

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

- Identifying potential climate change risks to the application site;
- Assessing the likelihood and consequence of potential risks (identifying the most severe) and;
- Consideration of mitigation and adaptations actions to reduce the impact of the identified risks.

4.1 Identifying potential climate change risks

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

A first step for assessing climate change is to set a baseline. Data relating to the current climatic conditions of the site have been collated from Met Office historical climate data for 1980-2022 and UKCP18 data to determine the baseline along with the current use of the site.

The projected future climate conditions are then established via greenhouse gas emission scenarios (RCP's) which will be used within the climate risk assessment to compare against the baseline and highlight any expected risks.

4.1.1 The UK Climate Projections 2018

Given it is not possible to exactly predict future climate, the Met Office UK Climate Projections (UKCP18) make assumptions about the economic, social and physical changes to our environment that will influence climate change. The UKCP18 data superseded UKCP09 and provides the best available information on UK climate projections out of available climate models.

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 temperature as outlined in **Table 2.**

In order to avoid under-estimating future climatic risks, the Institute of Environmental Management and Assessment (IEMA)[3] recommends the use of the RCP 8.5 scenario (worst case) for the 50th percentile within the climate change risk assessment as it provides a suitably conservative approach to climate assessment; the 50th percentile is the median, or the value at which 50% of the data values fall at or below it.

This assessment also considers RCP 4.5 as the current 'most likely' scenario in order to highlight suitable adaptation measures for the anticipated level of climate impact up to the period 2081-2100.

Table 2 Summary of RCP scenarios (Met Office, 2018)

RCP	Change in temperature (°C) by 2081-2100
RCP 2.6 (best case)	1.6 (0.9 - 2.3)
RCP 4.5 (most likely case)	**2.4 (1.7 - 3.2)**
RCP 6.0	2.8 (2.0 – 3.7)
RCP 8.5 (worst case)	**4.3 (3.2 – 5.4)**

4.2 Assessment of Climate Risk

Definitions of likelihood and magnitude are as per the approach determined on a quantitative basis where possible and described using terms common throughout the IEMA guidance for Climate Change Resilience & Adaptation Environmental Impact Assessment.

The following methodology has been used to determine the potential level of risk associated with the identified risks/effects. The criteria adopted for this assessment have been developed based on the application of professional judgement. The tables in this section provide a summary of how the level of climate change risk has been assessed with relation to the Proposed Development.

The future climate data is restricted to 2099, therefore the risk assessment has been produced based on the life span of the development up to 2099.

4.2.1 Likelihood of Climate Risk

The magnitude of an impact for climate change is also measured by its probability and frequency of occurrence, as defined within Table 3**.**

Table 3 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

[3] The Institute of Environmental Management and Assessment (2020) Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation, 1st Revision

Very Low	The event may occur once during the lifetime of the project (60 years*)

*60 years is the assumed lifetime for the Proposed Development to align with other assessments.

4.2.2 Measure of Consequence

The measure of consequence is informed by the degree of vulnerability of the site and surrounding areas, the classifications are defined in **Table 4**.

Table 4 Measure of Consequence

Consequence of Impact	Description
Very High	Extreme damage, including extensive loss of biodiversity, significant damage or complete loss of buildings and infrastructure, extreme impacts on local/regional economies and potential multiple fatalities.
High	Significant damage, including loss of biodiversity, major disruption and repairs for buildings and infrastructure, major impacts on local/regional economies and serious injury to people.
Moderate	Moderate damage where some remedial action may be required
Minor	Minor impacts that with no required remedial actions
Negligible	No adverse effects

4.2.3 Overall Risk Ratings

The likelihood and consequence of each physical hazard can be combined to determine the overall risk exhibited based on the below matrix. A classification of medium or above is considered significant and should be mitigated within the design proposals.

Table 5: Risk Rating Matrix

		Likelihood				
		Very High	**High**	**Medium**	**Low**	**Very Low**
Consequence	**Very High**	Very High	Very High	High	Medium	Medium
	High	Very High	High	Medium	Medium	Low
	Moderate	High	Medium	Medium	Low	Low
	Minor	Medium	Medium	Low	Low	Very Low
	Negligible	Medium	Low	Low	Very Low	Very Low

Baseline Assessment

This section of the report establishes the baseline (current and future) for the proposed development

5. Current Site Baseline

The site is currently greenfield and does not contain human or built environment receptors that may be sensitive to current climate impacts. However, the site is still vulnerable to climatic factors based on its current use.

The current primary risk to the site is from drought. The Cherwell Local Plan declares the Cherwell District to be an area of water stress.

The site is located within the Thames Water supply area, in the Swindon and Oxfordshire Water Resource zone. The Thames Water drought plan (2022) cites this zone to be sometimes vulnerable to shorter periods of below average rainfall due to the nature of underlying geology.

This is largely because the aquifer which feeds this region does not store as much groundwater and the throughput from recharge to baseflow is relatively rapid, as such the consequent recession under low rainfall conditions is rapid.

During periods of drought Thames Water's water supply becomes increasingly dependent upon groundwater in the major aquifers of the Thames catchment, thus putting this region at a greater vulnerability in these periods.

Furthermore, compared to other zones, this region has a smaller individual catchment area, thereby the yield from groundwater sources tends to reduce more rapidly with lowering water table levels.

Drought can decrease plant growth and the activities of organisms living in the soil. This in turn could influence carbon and nutrient cycling and may alter the capacity of ecosystems to sequester carbon, compromise stability of existing soil carbon stocks, and affect losses of carbon and nutrients into soil water.

Drought will also likely affect habitats and species, however, at this stage it is unconfirmed what habitats and species are located at the site, therefore it is not possible to determine how they may be vulnerable to this drought risk.

According to the Environmental Agency flood mapping tool, the site is located in Flood Zone 1; with primarily a very low risk to both fluvial and pluvial flooding. Therefore, at present flooding does not present a key risk for the site.

Additionally, the current geology of the ground based on the UK Soil Observatory mainly consists of 'freely draining lime rich loamy soils', providing inherent mitigation to flooding and subsidence.

5.1 Climatic Conditions

The observed Met Office climate data from Oxford weather station (the closes station) for the most recent 30 year climate period, 1991-2020 is outlined in **Table 6.**

There is no available data for wind conditions at the site, this is a limitation of the assessment when considering the risk from storm and wind events.

Month	Max temp (°C)	Min temp (°C)	Days of air frost (days)	Sunshine (hour)	Rainfall (mm)	Days of rainfall ≥1 mm (days)
January	7.98	2.38	8.4	63.39	59.57	12.07
February	8.63	2.32	7.5	81.9	46.77	9.4
March	11.29	3.64	3.8	118.16	43.16	9.1
April	14.41	5.29	1.43	165.6	48.65	8.87
May	17.68	8.17	0.1	200.27	56.91	9.63
June	20.71	11.14	0	197.09	49.69	8
July	23.06	13.09	0	211.99	52.5	8.3
August	22.5	13	0	193.28	61.66	9.04
September	19.44	10.65	0	145.3	51.87	8.63
October	15.09	7.95	0.73	110.15	73.18	10.87
November	10.88	4.85	3.17	70.75	71.47	12.15
December	8.23	2.59	8.6	57.6	66.12	11.61
Annual	15.02	7.12	33.73	1615.48	681.55	117.67

Table 6: Climate Data 1991-2020, Oxford

6. Future Baseline

There are a number of sources for future climatic conditions that are utilised within this assessment including Environmental Agency Future Flood Risk Maps, UK Climate Risk Indicators and UK Soil Observatory Maps. The primary data set is the Met Office UK Climate Projections 2018 (UKCP18).

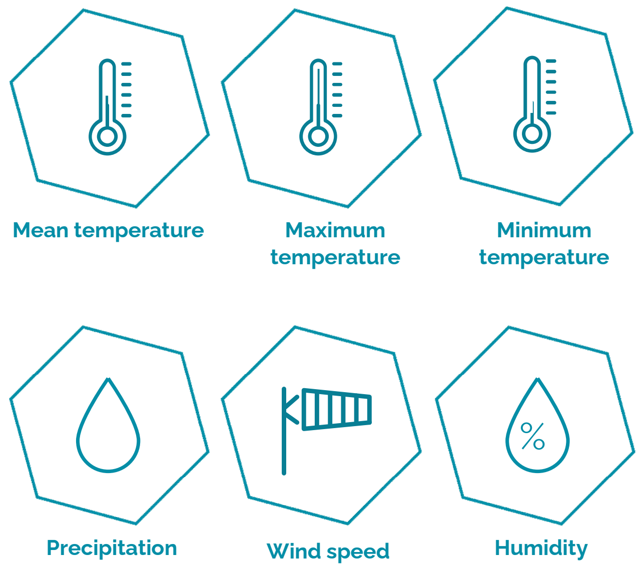

Figure 3 - Climate variables

6.1.1 Climatic Conditions -UKCP18

- A 5.8°C increase in summer mean temperature;
- An increase in frequency of warm temperature extremes (number of degree days exceeding CIBSE TM52/59 comfort criteria);
- A 41% overall decrease in summer precipitation increasing the frequency of droughts;
- A 26% increase in winter precipitation;
- An expected increase in near surface wind speeds (unquantified at this stage);
- A reduction in soil moisture; (unquantified at this stage);

Table 7: UKCP18 Key results 2010-2099, South East England, UK

Climate Period	Climate Variables									
	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 (%)	
	RCP		RCP		RCP		RCP		RCP	
	4.5	8.5	4.5	8.5	4.5	8.5	4.5	8.5	4.5	8.5
2010-2029	0.8	0.8	1.1	1.1	0.6	0.6	-2	-3	7	8
2020-2039	0.9	1.1	1.1	1.4	0.8	0.9	-5	-6	7	8
2030-2049	1.1	1.4	1.4	1.8	1	1.2	-9	-11	10	11
2040-2059	1.4	1.9	1.9	2.5	1.2	1.6	-13	-17	10	13
2050-2069	1.7	2.4	2.2	3.2	1.5	2	-14	-20	10	13
2060-2079	2	3	2.5	3.9	1.6	2.4	-17	-25	14	19
2070-2089	2.3	3.7	3.1	4.9	1.8	2.9	-22	-33	16	24
2080-2099	2.6	4.3	3.5	5.8	2.1	3.5	-28	-41	16	26

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7. Baseline Future Climate Risks

The following risks are considered most prevalent at the application site and are discussed in the following sections:

» Drought
» Heat Stress
» Wildfire
» Flooding

7.1 Drought and Water Availability

UKCP18 data shows a decrease in summer precipitation of 41%, with temperatures potentially increasing by 5.8 ˚C. Average drought severity is projected to increase for 3-, 6-, 12- and 36-month-long droughts. The largest changes in the severity of the 12-month drought are between −3 and +19% between 1.5 ˚C and 4 ˚C of warming and for 36-month drought between −2 and +54% between 1.5 ˚C and 4 ˚C of warming.

As mentioned previously, due to the geology of the catchment the site is located in it is vulnerable to shorter periods of below average rainfall, therefore putting it a greater risk of future drought risk.

The likelihood of drought and water availability impacting the site is therefore high, however if the site remains as greenfield the consequence will be minor, affecting only habitats and species.

Table 8: Drought/Water Availability Risk Rating

	Rating
Likelihood	High
Consequence	Minor
Overall Risk	**Medium**

7.2 Ground Movement/Subsidence

Subsidence can occur in any location, but certain soil types are more susceptible, including clay, silt, sand and gravel soils.

Clay and silt are 'cohesive' soils, which means that their volume will vary depending on their moisture content – they'll swell when wet and shrink when dry. As many as 75% of UK ground subsidence cases are caused by soil shrinkage and as the UK climate warms, these soils will be more at risk of shrinkage.

Sand and gravel are non-cohesive soils, which means that they don't vary in size depending on moisture content but can be washed away by water flow putting them at higher risk during periods of heavy rain or flooding, or if they are located near a body of water.

The underlying conditions of the sites are considered a strong indicator to determine their future vulnerability. The UK Soil Observatory (UKSO) mapping from the British Geological Society shows the site to consist of predominantly 'freely draining slightly acid loamy soils' it is therefore expected that there will be limited subsidence due to drought.

The British Geological Survey GeoClimate dataset shows potential change in subsidence due to changes in climate. This has been developed by combining the long-term UK Climate Projection scenarios for precipitation and temperature changes with the properties of the ground. The site is designated as subsidence being improbable, with clay shrink-swell unlikely to increase due to climate change.

Table 9: Subsidence Risk Rating

	Rating
Likelihood	Very Low
Consequence	Minor
Overall Risk	**Very Low**

7.3 Extreme or prolonged high temperatures (Heat Stress)

With the expected increase in summer temperatures of 3.5-5.8 ˚C, a max summer temperature of 26-29 ˚C would be exhibited with an increased likelihood of heatwaves and 30 ˚C+ temperatures. If the site were to remain undeveloped there is limited risk from heat stress, with a likelihood of medium and consequence negligible the risk is considered low.

Table 10: Heat Stress Risk rating

	Rating
Likelihood	High
Consequence	Minor
Overall Risk	**Low**

7.3.1 Wildfire

The number of wild/grassfires the Oxfordshire Fire and Rescue Service attends increases year on year, with a recorded 628 fires across July, August and September – a 78% increase from the 325 fires recorded in the same period in 2021.

The risk of fires in the open is affected by both the weather and the type of vegetation. Wildfires are of note due to the potential severity of the impact to both the natural and built environment where they cannot be controlled.

Utilising UKCP18 data for RCP 8.5, the Met Office Fire Severity Index predicts an increase in the wildfire danger days from 36.06 for 2021 to 123.92 by 2100, an increase in wildfire likelihood of 243.65%.

As the site in its current use is unmanaged land the likelihood of a wildfire starting and spreading is considered high. However, as it is only habitats and species that are affected the consequence is minor and the resulting risk factor medium.

Table 11: Wildfire Risk rating

	Rating
Likelihood	High
Consequence	Minor
Overall Risk	**Medium**

7.4 Fluvial Flooding

The site is considered to be entirely within Flood Zone 1 (Low Risk) as per the Environment Agency (EA) Flood Zone Mapping[4]. Flood Zone 1 (Low Risk) comprises land assessed as having a ≤0.1% Annual Exceedance Probability (AEP) of fluvial or tidal flooding in any given year, equivalent to the ≥1,000yr return period flood event (negligible).

The EA Zone mapping depicts the long-term flood risk for the site from fluvial and tidal sources to also be minimal.

The EA's Historic Flood Mapping does not show the Application Site and surrounding area to have been impacted by any previous flood events within the Environment Agency database since records began in 1946.

Additionally, the Flood Risk Assessment provided by the council for NW Bicester predicts the site to not be at risk of flooding during the development lifetime, including under the potential impacts of climate change.

The likelihood of fluvial flooding impacting the site is therefore very low and if the site remains as greenfield the consequence will be minor, affecting only habitats and species, resulting in a very low risk.

Table 12: Fluvial Flooding Risk rating

	Rating
Likelihood	Very Low
Consequence	Minor
Overall Risk	**Very Low**

[4] EA Flood Map for Planning (https://flood-map-for-planning.service.gov.uk/) (accessed January 2023)

7.5 Pluvial Flooding

The majority of the site is considered to be Very Low risk of surface water flooding as per the EA Flood Map for Surface Water[5]. A very low risk to surface water flooding is where each year the area has a chance of flooding of less than 1 in 1000 (<0.1%).

Therefore, if the site were to remain undeveloped there would be a very low likelihood of surface water flooding with a minor consequence due to only habitats and species being affected, this results in a very low risk rating.

Table 13: Risk rating

	Rating
Likelihood	Very Low
Consequence	Minor
Overall Risk	**Very Low**

[5] EA Long Term Flood Risk Map (https://www.gov.uk/check-long-term-flood-risk) (accessed January 2023)

Climate Risk Assessment

This section provides a summary of the climate risk assessment for the proposed development.

8. Overview

The development is to include 500 new dwellings. This is a significant change from the current conditions of the greenfield site and will impact the resilience of the surrounding areas to flooding, heat stress and drought.

As highlighted in section 6 changes to summer and winter temperatures and precipitation levels within South East England are anticipated to be significant. After 2080 the site could be subject to an increase in summer mean temperature of 5.8°C and an increase in winter precipitation of 26%, while summer precipitation decreases by 41%.

Based upon this, key climate drivers and physical risks that are likely to impact the Proposed Development include the below:

» Drought: Reduced water availability, ground movement/subsidence, soil erosion and reduced ground permeability

» Heatwaves: extreme of prolonged high temperatures, wildfires

» Extreme precipitation and Flooding: fluvial and pluvial flooding, surface water flooding, ground saturation (increased surface water run-off), soil erosion

» Storm events (high winds)

The following sections provide further detail on these impacts. As the typologies of the dwellings are similar, the level of vulnerability is expected to be the same or similar, therefore all the typologies are assessed together.

Figure 4: Proposed Masterplan

9. Drought

The impact of drought is largely experienced through the impact to blue and green infrastructure, and (resultant) effects on services. The direct impact of drought on people and buildings is deemed to be moderate.

The water supplier to the area, Thames Water, in the early stages of a drought will enforce a temporary use ban on sprinklers and hosepipes, and in the event of a severe drought will restrict non-essential water use, affecting commercial businesses.

These tighter water restrictions can exacerbate the drought effect on the region and its biodiversity; by further diminishing water supply to water courses and green infrastructure, leading to higher incidences of water courses drying up and plants/crops dying.

Additionally, the proposed development will impose further pressure on water supply in the region.

The development is to comprise of 500 dwellings. The average household uses 349 litres a day, therefore the proposed development alone is expected to lead to an estimated 174.5 kilolitres a day (174,500l/d) increase in water use for the local area before the rest of the development is considered.

This increased water demand will impact the local water supply in an already water stressed region. It is therefore important that the development is designed to incorporate water saving measures as detailed in Section 16.

Table 14: Development Drought Risk rating

	Rating
Likelihood	High
Consequence	High
Overall Risk	**High**

10. Extreme or prolonged high temperatures (Heat stress)

The Proposed Development is unlikely to further exacerbate extreme temperatures for surrounding areas, therefore the below risk is only determined for the development.

In newly built residential properties, the issue of overheating in summertime is particularly prevalent as air permeability and thermal transmittance are reduced to improve heat loss performance. The predicted rise in summer temperatures in Oxfordshire will only exacerbate this.

CIBSE TM59 requires that residential buildings do not exceed 26°C for 3% of occupied hours across the period May – September (5 days) for living areas and the operative temperature of bedrooms from 10pm – 7am shall not exceed 26°C for more than 1% of annual hours (32.85 hours). It is expected that during the life span of the development this could be exceeded regularly without mitigating design, therefore, the risk is considered high.

An overheating assessment has been carried out to determine this risk for the different dwelling typologies. Please see section 18 for this.

Table 15: Development Heat Stress Risk rating

	Rating
Likelihood	Very High
Consequence	High
Overall Risk	Very High

10.1 Wildfire

As discussed in Section 4, the site and surrounding areas are at risk to wildfire. The development utilises a significant proportion of the green field for hard development, it is expected that this limits the wildfires ability to spread as far due to a break in the vegetation which can benefit surroundings areas. However, due to the increased number of people in the area and the greenfield areas surrounding the site there is a higher likelihood of a wildfire being ignited.

Therefore, the risk expected from wildfire across the development's lifetime is medium and the same risk level as if the site remains undeveloped.

Table 16: Development Wildfire Risk rating

	Rating
Likelihood	Very High
Consequence	High
Overall Risk	Very High

11. Extreme Precipitation and Flooding

As detailed previously a reduction in summer precipitation and increase in winter precipitation are projected as the general trend, it is also predicted that extreme precipitation events (30mm< hr or 80mm < day) or 'rain bombs' will become a more common occurrence which would overwhelm existing drainage infrastructure leading to an increased likelihood and severity of flooding. Harder ground profiles due to regular droughts will also reduce the drainage and holding capacity of green spaces which further exacerbates the risk of flooding from extreme precipitation.

11.1 Fluvial and Tidal

It is expected that the proposed development will increase the likelihood and consequence of flooding but the risk from fluvial and tidal sources is still considered 'very low' resulting in a medium overall risk. Strategies to further reduce the risk and improve resilience to flooding are provided in section the site flood risk assessment.

Table 17: Development Fluvial/Tidal Flooding Risk rating

	Rating
Likelihood	Very Low
Consequence	Very High
Overall Risk	**Medium**

11.2 Pluvial (Surface Water)

It is expected that the proposed development will increase the likelihood and severity of surface water flooding due to an increase in hard standing area which reduces draining potential against the current conditions of a greenfield site, this is expected to impact both the surrounding areas and the development.

In accordance with the EA flood detailed flood risk assessments, developments would be expected to consider an increased allowance of up to 35-40% in precipitation for rainfall events therefore the development is considered to be a high risk to Pluvial flooding. This is an increase on the low risk of the site if it were to remain undeveloped, therefore risk reduction strategies should be proposed within the design and these are discussed in the site drainage strategy.

Table 18: Development Pluvial Risk rating

	Rating
Likelihood	Medium
Consequence	Very High
Overall Risk	**High**

12. Storm Events

12.1 High winds and lightning

In the UK, most wind-driven rain is associated with winter storms and the intensity and frequency of these are expected to increase leading to an increased risk of wind driven rain. Projections for wind-speeds and lightning are not currently defined within UKCP18, therefore granular future projections for storm and wind events are currently not possible to complete a full assessment.

An increase in wind-driven rain is however expected and should be considered within building designs due to the risk of increased water penetration of vertical structures, such as buildings and energy infrastructure which can lead to reduced building envelope durability and performance. Storms events were not considered on the undeveloped site due to the limited receptor impact exhibited.

The proposed development is not expected to intensify any impacts from storm events therefore the risk remains low and the proposed development has no significant impact.

Table 19: Storm Events Risk rating

	Rating
Likelihood	Low
Consequence	Moderate
Overall Risk	**Low**

Risk Reduction Strategies

This section sets out the adaptation and mitigation strategies that are being considered in the proposed design to reduce the climate risks identified in the previous section.

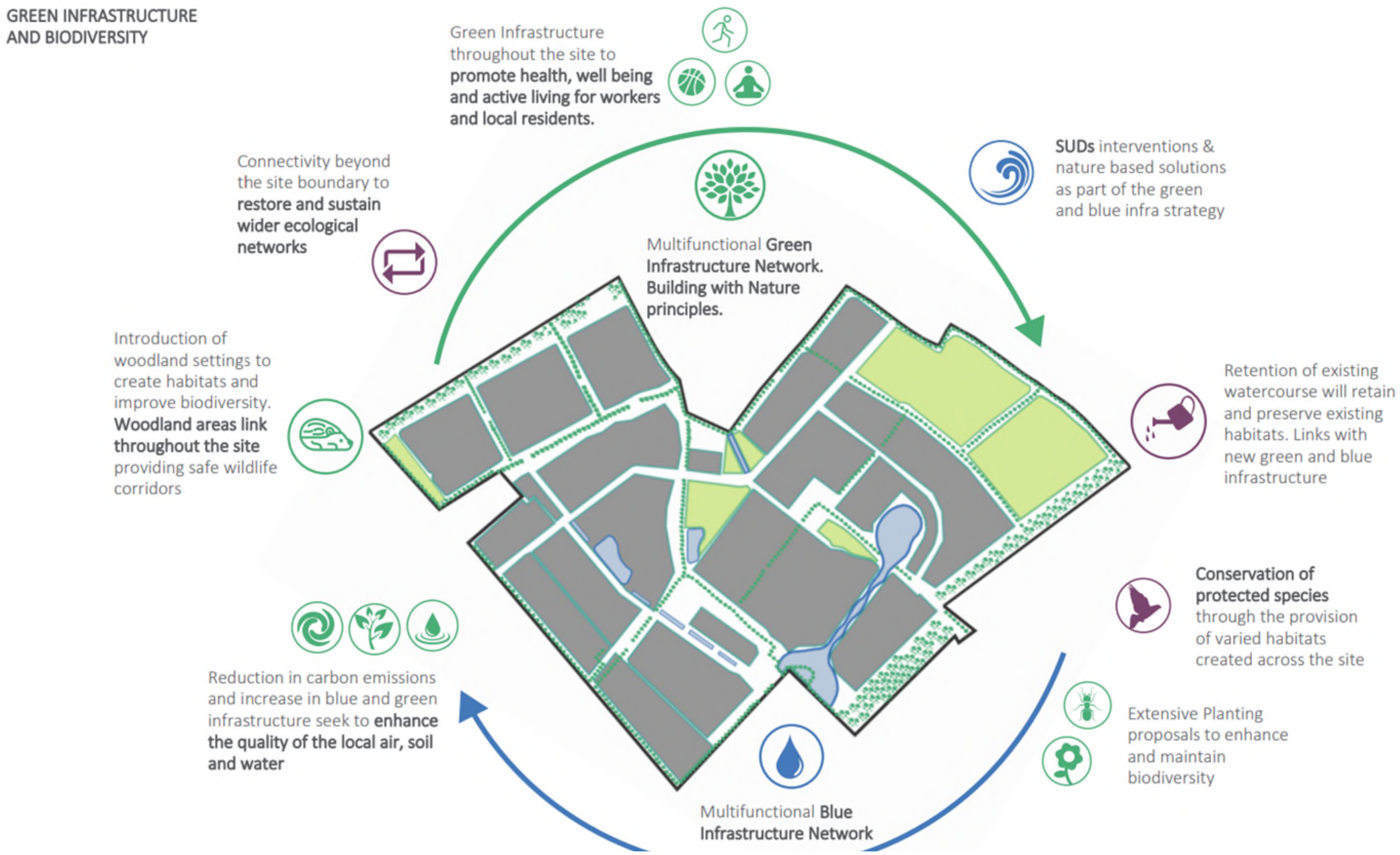

Figure 5 - Himley Village green infrastructure

13. Green Infrastructure

Green Infrastructure (GI) offers multiple benefits and is recognised in the UK 25 Year Environment Plan. The use of green spaces, urban parks and street trees as part of the green infrastructure strategy all help to reduce the risk of heat stress and flooding, while also improving the health and wellbeing of occupants and biodiversity across site.

13.1 Building with Nature

The Building with Nature (BwN) standards are used to deliver multifunctional spaces that are:

- Close to nature;
- Deliver cost effective ecosystem services, e.g. water management;
- Are supportive of nature's recovery; and
- Adapted for and resilient to climate change.

Whilst formal certification under BwN is not being sought, principles from the methodology will be incorporated into the Himley Village development design to enhance the site's green space; putting people and nature at the heart of the development, and strengthening the resilience of the development to climate change. In line with Eco-Town principles ET 8, and ET 14, significant green infrastructure will be incorporated into the scheme.

13.2 Vegetation

Trees and shrubs reduce heat loads in building by providing shading; plants absorb and reflect sunlight, reducing the solar radiation absorbed by the building surfaces. Additionally, vegetation lowers the ambient air temperature through evapotranspiration, which in turn effects the heat transfer from outside to building envelope and interior, providing further cooling for the building.

Street trees are a natural drainage feature due to canopy interception, water drawn from soil and additional infiltration by roots. Utilising street trees as part of a sustainable urban drainage system (SuDS) or management train can further increase the effectiveness of stormwater attenuation.

Well managed vegetation can also aid in the reduction of wildfire severity/spread, with the use of 'fire resistant' plants which can be used as a buffer between unmaintained land prone to wildfire and occupied areas.

The development will aim to mitigate the following risks: Heat Stress, Drought, Flooding, by including green infrastructure within the design.

14. Sustainable urban Drainage System (SuDS)

Although, the flood risk to the proposed development and surrounding area is considered low, the development will impact upon the resilience of the region to pluvial flooding due to the increase in hard surfaced areas, and is considered a high risk. It is therefore recommended that the design incorporates significant flood mitigation strategies to negate this risk.

SuDS's are designed to mimic natural drainage regimes, operating through infiltration where possible and attenuation combined with slow conveyance. A management train, which uses a number of SuDS's components in a series, works to control flow velocity and volume, whilst also removing pollutants.

This can include hard engineered solutions and/or green infrastructure "soft" SuDS's; more natural landscaped measures, typically above ground. Rarely will a single SuDS feature be sufficient to effectively manage even residual flood risk at a site. Management trains are specifically suited to masterplans and the development design currently proposes to include for the following measures as part of a management train:

- Source control management by intercepting run-of water from roofs for subsequent re-use (e.g. rainwater harvesting) or for storage and subsequent evapotranspiration. A green roof, for example, can retain 62% or 73% of rainwater whether extensive or intensive respectively.
- Planting trees/vegetation for retention and transpiration across the masterplan as part of urban parks
- SuDS-enabled street trees used to form interconnected channels of drainage.
- Retention systems that delay the discharge of surface water to watercourses by providing storage within balancing ponds, such as swales and attenuation basins
- Infiltration systems, such as infiltration trenches and soakaways, that mimic natural recharge, allowing water to soak into the ground;
- Permeable surfaces and filter drains, designed to allow rainwater to infiltrate into the underlying ground.

The development will give consideration to these measures to mitigate the following risks: Drought, Flooding.

15. Building design

As detailed in the climate risk assessment, all building typologies within the masterplan are likely to experience heat stress throughout the operational phase of the development, therefore careful consideration should be given to design aspects of the buildings.

Intelligent passive and active design measures will be incorporated to alleviate the risk of heat stress.

15.1 Passive Design

Often referred to as a 'fabric first' approach, passive design options utilise building form, massing and glazing ratios to exploit the natural environment of the site to help reduce energy demand. This can be used to increase the resilience of the development to future climate change impacts.

Passive design considerations for the Himley Development include:

- Control of solar gain to manage the risk of overheating in summer, but also allow the building to benefit from lower heat demand; via the size and depth of windows on different elevation
- Increased efficiency of building fabric, particularly the roof and walls to reduce heat gain;
- Maximising air tightness to minimise the impacts of uncontrolled air infiltration; and
- Strategic planting of trees to shelter lower-level buildings from high winds and provide shading from the sun.

Passive design measures will be carefully considered within the development design as appropriate to the construction type and end use, in the context of future climate scenarios to help mitigate the risk of overheating.

15.2 Active Design

The predicted increased likelihood and severity of heat stress will mean a greater reliance on cooling systems where the previous adaptation measures discussed do not completely reduce the risk, therefore systems that are reliable and efficient will be prioritised to be included within building services design.

16. Water Efficiency

As discussed in Section 11 the local area is in a water stressed zone and the proposed development will further exacerbate any drought events due to increased water demand. The proposed development will take measures to reduce water use and aim to include for water efficiency applications within building design such as:

- Fitting low-flow taps, showers and toilets, and low flow devises in washing machines and dishwashers is widely regarded as the best practice to reduce water consumption. The savings from this can be significant, with low flow taps and showers reducing water usage by up to 50%,
- Smart meters can also aid the reduction of water consumption; providing user data across a site, it affords the consumer an insight into their consumption and resulting water bill.

The inclusion of such measures will help to mitigate the risk of drought.

17. Rainwater Harvesting

The proposed development while also being as efficient with water use as possible may also include for water reuse/harvesting systems such as rooftop rainwater and surface water harvesting.

In both, rainwater is collected, filtered and stored after a rainfall event, providing greywater which is suitable for a range of non-potable uses which reduces the water demand on the proposed development. Excess rainwater may also be used to recharge local aquifers providing benefits to the surrounding areas.

Rooftop Rainwater Harvesting systems capture rain where it falls, utilising roofs, terraces, courtyards etc. as catchment areas. All buildings across the proposed development could be considered to include for a rainwater harvesting system, however, it would be most applicable to buildings with larger roof areas such as offices and commercial buildings, for example a rooftop rainwater harvesting system on the primary school alone could collect up to 1.6 million litres of water a year (268 thousand toilet flushes).

Rainwater harvesting has the added benefit of also working as part of a SuDS, thereby providing a co-benefit. As the rainwater is collected, stored and eventually reused, this alleviates pressure on the main drainage system and reduces the risk of floods occurring.

Surface water harvesting systems collect surface runoff from the ground after rainfall events using drains and underground storage tanks. Pumps located within these submersed tanks then pump harvested water directly to WCs or other appliances.

Systems such as The Climate Tile incorporate both systems and are designed to catch and redirect 30% of the projected extra rainwater due to climate change. Both methods of rainwater harvesting alleviate the pressure on the main drainage system and can work effectively as a SuDS component or be included within a green roof.

Water recycling systems would mitigate the following risks: Drought, Flooding. The development will give consideration to these systems.

Overheating Assessment

This section of the report provides an overview of the overheating assessment that has been carried out on the proposed development.

18. Overheating Analysis

Heat stress has been identified as a key risk for the proposed development. Therefore, an overheating assessment has been caried out to determine the overheating risk for the dwellings.

18.1 Overview

This section explains the causes of dwelling overheating, evaluates the likelihood of it happening in the development and presents potential solutions to mitigate this risk.

Several factors can contribute to overheating in dwellings, such as:

- High external summer temperatures;
- Solar gains through windows;
- Lack of openings / inadequate ventilation;
- Improved building fabric with better insulation U-values result in lower heat losses;
- Oversized / unrequired radiators or underfloor heating systems; and
- Insufficient temperature controls or timers for communal heating systems.

In order to assess whether the dwellings are likely to overheat, the Simplified Method for demonstrating compliance with Part O1 was utilised, in conjunction with adaptive thermal comfort assessment TM59 – Design Methodology.

18.2 Simplified method

For the simplified methodology the building's overheating risk category is based on location and whether it is cross-ventilated. This is used to select the relevant guidance for both of the following purposes.

a. To limit unwanted solar gains in summer

b. To provide an appropriate means of removing excess heat from the indoor environment

The proposed development is located in a 'moderate risk' location and all house typologies assessed were deemed to have cross-ventilation. The guidance for this risk category is stated below in table 20 & 21.

The building should not exceed the maximum glazing areas in table 20:

Table 20: Part 1.6a of the Simplified Method

Largest glazed façade orientation	1.6a Maximum area of glazing (% of floor area)	1.6b Maximum area of glazing in the most glazed room (% floor area of room)
North	18	37
East	18	37
South	15	30
West	11	22

The building should equal or exceed the minimum free areas in table 21:

Table 21: Part 1.3 of the Simplified Method

1.3	Free area
Total minimum free area	The greater of the following: a. 9% of the floor area b. 55% of the glazing area
Bedroom minimum free area	4% of the floor area of the room

All house typologies (excluding the below stated typologies) and a sample of four dwellings were assessed under the Simplified Method.

The following assumptions have been used in the assessment:

- All windows assumed to be openable to 90 degrees, except for rooflights which were assumed to be openable to 10 degrees.
- Front doors were not considered 'free areas' but patio doors were.
- Equivalent areas were utilised for the free area criterion because this better accounts for how different opening types will reduce the amount of air flow by both affecting the way air flows and reducing the physical area. Equivalent areas were calculated using the guidance in Part O Appendix D.

18.3 Simplified Method Overheating Results

50% of units tested pass the overheating criteria set out In the Simplified Method for Overheating. Of the units which failed, 70% fail due to the minimum requirement for free area set out in Part 1.3.

The design team have utilised these results to incorporate changes to the design where appropriate. This includes altering the fixed windows in the designs to include for more openable windows.

A sample of the worst case remaining 30% dwellings was modelled utilising dynamic thermal modelling and CIBSE TM59.

18.4 CIBSE TM59 Assessment

A thermal model has been produced, using IES Virtual Environment version 2022.2.0.0, to accurately reflect the conditions of the spaces concerned.

The TM59 introduces two criteria designed to be test the dwellings overheating risk. In order for a dwelling to achieve a pass, all of the following criteria need to be satisfied:

Criterion (a) - For living rooms, kitchens and bedrooms: sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature (upper limit of the range of comfort temperature) by 1˚K or more during the occupied hours of a typical non-heating season (1st May to 30th September). This criterion dictates 3% of occupied hours as a threshold.

Criterion (b) - For bedrooms only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26˚C for more than 1% of annual hours. (1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours)

Criteria for homes predominantly mechanically ventilated - For homes with restricted window openings, the CIBSE fixed temperature test must be followed, i.e., all occupied rooms should not exceed an operative temperature of 26˚C for more than 3% of the annual occupied annual hours (CIBSE Guide A (2015a)).

18.4.1 Model Assumptions and Inputs

The following assumptions have been made during the modelling process:

- All internal gains are defined by the TM59 profiles;
- U values are the same used for the energy calculations

18.4.2 Internal Gains

Solar gains are calculated automatically by the modelling software based on the orientation of the building, transmission coefficients of the glazing and solar angles.

The TM59 templates contain standardised information regarding occupancy, operational profiles, internal gains etc.

18.4.3 Window Opening

A strategy of open windows will be utilised to reduce the overheating risk in the bedrooms and living rooms via natural ventilation.

Windows in all living areas have been set to open during the day but close during the evening (between 10pm-7am) for security.

MVHR will be present as additional ventilation and mitigation to overheating for all units. MVHR flow rates of 8l/s and 13l/s for bedrooms and the living area, respectively has been modelled.

18.5 Overheating Results

The 'worst-case' unit assessed passed the 2020 and 2050 weather scenario overheating test. This demonstrates a 'future-proof' approach to the design at this point. 2080 climate scenarios were not tested.

This suggests that the remaining units which failed to meet the Simplified Method are unlikely to be at risk of overheating. As dynamical thermal modelling and CIBSE TM59 analysis is more accurate than the Simplified Method no further testing is required.

Conclusions

This report has provided a climate risk assessment for the proposed development. It then outlined the proposals for risk reduction strategies to mitigate the risks identified in this assessment.

As heat stress was identified as a high risk to the development an overheating assessment was also provided.

This report has provided a future climate change statement for the proposed phase of the Himley Village development.

A climate risk assessment was carried out, which considered a full range of current and future physical climate risks for the development's life span. A risk assessment is fundamental for informing the prioritisation of climate action and the incorporation of adaptation measures within the design proposals.

The development is expected to experience a number of impacts from physical hazards due to climate change including drought, heat stress, wildfire and flooding that all exhibit a risk of medium or above. Current and future physical climate related risks with a likelihood of 'medium' or above will be mitigated through risk reduction strategies to reduce the residual risk to 'low' where possible.

Risk reduction strategies that will be included and/or considered within the design proposal to increase resilience to impacts from climate change have been detailed.

As heat stress was identified has a high risk an overheating assessment was carried out using the Simplified Method of Overheating. Dynamic modelling and a CIBSE TM59 assessment was performed on the 'worst-case' typology. This results of this analysis indicate that the development is not at risk of overheating in 2020 and 2050 climate scenarios. 2080 climate scenarios were not assessed and therefore heat stress is still possible within the lifetime of the development and should consequently still be mitigated, where feasible.