13.0 Climate Change and Sustainability

13.1 Introduction

13.1.1 This chapter of the ES will identify and describe the nature and significance of the potential effects on, or as a result of, climate change as a result of the Proposed Development.

13.1.2 Brookbanks (BCL), instructed by Hallam Land Management, has undertaken the assessment as part of the Environmental Statement (ES) submitted in respect of the proposed development at North West Bicester (north east of the Marylebone - Birmingham railway line).

13.1.3 Consideration will be given to whether the Proposed Development is likely to make a significant impact on climate change and, also, the impact of climate change on the Proposed Development.

13.1.4 The ES chapter is supported by an Energy Statement ***(Appendix 13.1)*** which sets out a strategy for energy sustainability through offsetting carbon emissions and delivering a low carbon development. The Energy Statement will consider new and emerging legislation to work towards delivering zero carbon as well as determine methods for minimising environmental impact through passive and active measures.

Competency

13.1.5 In accordance with the Environmental Impact Assessment (EIA) Regulations (2017) the ES chapter has been carried out by competent experts. Brookbanks is a multi-disciplinary environmental, engineering and development consultancy with many years' experience of master developer roles; development management, civil engineering, transport and environmental consultancy. The company has extensive experience and expertise of the EIA process and includes Chartered members of the Institute of Civil Engineers and members of the Institution of Water and Environmental Management.

13.2 Regulatory and Policy Context

13.2.1 National policy for climate change (and the assessment of effects), and for reducing carbon emissions and promoting renewable energy technology, is informed by a wide range of legislation policy and guidance including notably the following:

- Town and Country Planning (Environmental Impact Assessment) Regulations
- Climate Change Act
- EIA Guide to Climate Change Resilience and Adaptation' (IEMA, 2015)
- NPPF (2021) and related guidance
- Local Planning Policy
- UK Building Regulations Part L (2010/2013/2016)

13.2.2 The main aim of these documents is to provide or inform policy, and provide guidelines, to reduce UK CO_2 emissions, as this is currently considered to be the largest man made contributor to climate change.

13.2.3 The ***Climate Change Act 2008*** (CCA08), was the first statutory legislation limiting CO_2 emissions. CCA2008 mandates that carbon emissions are reduced by 80% by 2050 (against a 1990 baseline), with targets set at 34% by 2020 and 60% at 2030. It is this primary legislation that drives local planning policy.

13.2.4 The Government's most recent response to climate change is the publication, in October 2021, of Net Zero Strategy Build Back Greener which sets out the Government's ambition to cut emissions, rather than announcing specific policies that will deliver the reduction in emissions.

Town and Country Planning (Environmental Impact Assessment) Regulations

13.2.5 Schedule 4 to the 2017 EIA Regulations requires an ES to include:

'*4. A description of the factors specified in regulation 4(2) likely to be significantly affected by the development…climate (for example greenhouse gas emissions, impacts relevant to adaptation)*

5. A description of the likely significant effects of the development on the environment resulting from:

(f) the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change;'

13.2.6 What this means in practice is addressed in guidance produced by the Institute of Environment Management and Assessment:

- The 'EIA Guide to Climate Change Resilience and Adaptation' (IEMA, 2015) provides a framework for the effective consideration of climate change resilience and adaption in the EIA process. This guidance states that the scoping of a project, taking into account climate change, should focus on general considerations rather than detailed, quantitative analysis; and
- The 'EIA Guidance on assessing greenhouse gas emission and significance' (IEMA, 2017) places the significance of GHG emissions within the context of national and sector emissions, as well as sets out proportionality of undertaking climate change assessments when considering that context

National Planning Policy Framework (NPPF, 2021)

13.2.7 The National Planning Policy Framework (NPPF) was first published in March 2012 and last updated in July 2021. It defines the overarching aims of the Government's sustainable development strategy, and recognises that planning plays a key role in minimising vulnerability, providing resilience and managing the risks, associated with climate change.

13.2.8 At its outset, within the Achieving Sustainable Development section the NPPF set sets out the priority to be afforded to realising sustainable development, the following objectives being identified:

- ***an economic objective*** *– to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;*
- ***a social objective*** *– to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering well-designed, beautiful and safe places, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and*
- ***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 and adapting to climate change, including moving to a low carbon economy.*

13.2.9 In relation to the specific issue of climate change, the NPPF expects local authorities to adopt proactive strategies to mitigate and adapt to climate change and support the move to a low carbon future. Para 151 of the NPPF places an expectation on local planning authorities to a) have positive strategies for energy from renewable and low carbon sources; b) consider identifying locations which would be suitable for energy generation and infrastructure; and c) identify opportunities for development to draw energy from decentralised, renewable, or low carbon systems,

13.2.10 Paragraph 150 indicates that new development should be planned in ways that:

- *"Avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and*
- *can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards*."

13.2.11 Para 153b expands this reference suggesting that development proposals should, in addition, take account of landform, layout, massing and landscaping *"to minimise energy consumption*".

13.2.12 These objectives should be delivered through the preparation and implementation of plans and the application of the policies in the Framework; they are not criteria against which every decision can or should be judged in isolation. Planning policies and decisions should play an active role in guiding development towards sustainable solutions, but in doing so

should take local circumstances into account, to reflect the character, needs and opportunities of each area.

13.2.13 The NPPF stresses that the importance of sustainability in new developments is to ensure that during construction and operation, the development minimises environmental impact. The Government is keen to limit the environmental impact of new construction projects through the reduction of CO2 emissions.

Planning Policy Guidance

13.2.14 Complementing the NPPF, Planning Practice Guidance (PPG) was issued in relation to climate change in March 2019.

13.2.15 The PPG again highlights the relevance of spatial planning: "*In addition to supporting the delivery of appropriately sited green energy, effective spatial planning is an important part of a successful response to climate change as it can influence the emission of greenhouse gases. In doing so, local planning authorities should ensure that protecting the local environment is properly considered alongside the broader issues of protecting the global environment. Planning can also help increase resilience to climate change impact through the location, mix and design of development*" [Paragraph: 001 Reference ID: 6-001-20140306].

13.2.16 Recognising the uncertainties involved, the guidance accepts that "*the impact of climate change needs to be taken into account in a realistic way. In doing so, local planning authorities will want to consider*:

- *identifying no or low cost responses to climate risks that also deliver other benefits, such as green infrastructure that improves adaptation, biodiversity and amenity*
- *building in flexibility to allow future adaptation if it is needed, such as setting back new development from rivers so that it does not make it harder to improve flood defences in future*
- *the potential vulnerability of a development to climate change risk over its whole lifetime*" [Paragraph: 005 Reference ID: 6-005-20140306]

13.2.17 The relationship between local and national guidance is addressed in para Paragraph: 009 Reference ID: 6-009-20150327: "*The National Planning Policy Framework expects local planning authorities when setting any local requirement for a building's sustainability to do so in a way consistent with the government's zero carbon buildings policy and adopt nationally described standards*".

Part L and F Step Changes and the Future Homes Standard

13.2.18 With the abandonment of the Code for Sustainable Homes (CfSH) and the Zero Carbon Homes Standard, national standards are now defined largely by the UK Building Regulations and their planned progression.

13.2.19 In June 2019, the Government set a commitment in the Climate Change Act 2008 for the United Kingdom to reach 'net zero' greenhouse gas emissions by 2050.

13.2.20 As part of the Government's intention to lead all future improvements through the UK Building Regulations, in October 2019, the then Ministry of Housing, Communities and Local Government issued undertook consultation on changes to Part L (conservation of fuel and power) and Part F (ventilation) of the Building Regulations for new dwellings.

13.2.21 This consultation set out the Government's plans for achieving, by 2025, the Future Homes Standard (FHS) to provide low carbon heating and high levels of energy efficiency, including proposed options to increase the energy efficiency requirements for new homes through a step change to Part L of the Building Regulations.

13.2.22 The consultation considered two options for the proposed step changes to Part L. Following a second consultation carried out from 18 January to 13 April 2021, 'Option 2' has been confirmed as the route forward, with all new homes to be required to have a 31% reduction in CO_2 emissions from 2022 in comparison to current standards. This reduction in carbon emissions is to be adopted on an interim basis pending introduction of the Future Homes Standard (in 2025).

13.2.23 In order to deliver the 31% reduction, new homes will be assessed against four performance metrics:

- Primary energy
- Minimum standards for fabric and fixed building services
- The Fabric Energy Efficiency Standard (FEES)
- Carbon dioxide emissions

13.2.24 New interim Part L and Part F legislation is expected to be released in December 2021 and enacted from June 2022, before more significant changes in 2025 that will require a 75% reduction is CO_2 emissions, in line with the FHS.

13.2.25 It is evident that a fabric first approach will be a pivotal element to the future construction of housing, with new builds 'future-proofed' to facilitate achieving carbon zero and have low carbon heating.

13.2.26 Part of this strategy is a reliance of low carbon heating, specifically heat pumps, to deliver heat to homes and remove the reliance on gas heating. Heat networks are referred to, but only in circumstances where there is the potential ability to move to low and zero carbon technologies/sources (and there is available such technologies or local energy sources) with minimal disruption to homeowners.

13.2.27 It should be noted that the Part L and FHS is only concerned with an individual dwelling for assessment and not the development as a whole.

UK Building Regulations Part S: Electric Vehicle Charging Points

13.2.28 As part of the Government's aims to achieve net zero greenhouse gas emissions by 2050, policies are being put in place, including Regulations, to move all new cars and vans to zero emissions, which will see electric vehicles (EVs), as well as potentially other technologies, become increasing common.

13.2.29 From 2025, existing non-residential buildings with more than 20 parking spaces will require at least 1 charge point.

13.2.30 The changes are expected to be implemented predominantly through amendments to the Building Regulations 2010.

Decarbonisation of the National Grid

13.2.31 Decarbonising the National Grid is an essential element to achieving the Government's targets for reducing emissions to net zero by 2050.

13.2.32 Clean energy will be required to power increases in electric vehicles, home heat pumps, as well as a range of other sustainable initiatives.

13.2.33 In May 2021, the Government announced its intention to bring forward legislation further committing to generating more nuclear power, marking six months since the publication of the Prime Minister's 10 Point Plan for a Green Industrial Revolution. The ten-point plan, released in November 2020, set out the approach that the Government intends to take to "build back better, support green jobs, and accelerate our path to net zero".

Local Policy

Cherwell Local Plan Part 1 2011-2031 (Adopted 2015)

13.2.34 The Cherwell Local Plan Part 1 2011 – 2031, adopted in 2015, sets out the development plan context for Bicester.

13.2.35 The most relevant policies of the Local Plan in relation to climate change and sustainability are as follows:

- Policy Bicester 1 North West Bicester
- Policy ESD1 Mitigating and Adapting to Climate Change
- Policy ESD2 Energy Hierarchy and Allowable Solutions
- Policy ESD3 Sustainable Construction
- Policy ESD4 Decentralised Energy Systems
- Policy ESD5 Renewable Energy
- Policy ESD6 Sustainable Flood Risk Management
- Policy ESD7 Sustainable Drainage Systems
- Policy ESD8 Water Resources

13.2.36 Policy Bicester1 allocates land to the north west of Bicester to accommodate a new zero carbon mixed use development. The allocation comprises some 6000 new homes and includes provisions to deliver high levels of sustainability through the development. In particular provision across the allocation is made for:

- A range of employment uses;
- Design and or infrastructure to promote walking and cycling and public transport use;
- Local centres to provide local accessible services and facilities
- Local community facilities including local education and sports facilities;
- A minimum of 40% of the development being devoted to green infrastructure;
- The provision of infrastructure to promote waste recycling.

13.2.37 ESD1 seeks to mitigate the impact of development on climate change both through strategic scale actions and within local site specific responses. Strategically ESD1 seeks:

- To distribute growth to the most sustainable locations;
- To deliver "*development that seeks to reduce the need to travel and which encourages sustainable travel options including walking, cycling and public transport*";
- The design of development to "*reduce carbon emissions and use resources more efficiently, including water*"
- To promote "*the use of decentralised and renewable or low energy where appropriate*".

13.2.38 At site level ESD1 looks for the "*incorporation of suitable adaptation measures in new developments to ensure that development is more resilient to climate change".* Specifically ESD1 indicates that this is likely to mean consideration of the following:

- Taking into account the known physical and environmental constraints when identifying locations for development;
- 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).

13.2.39 Policy ESD 2: Energy Hierarchy and Allowable Solutions promotes an 'energy hierarchy' as follows:

- Reducing energy use, in particular by the use of sustainable design and construction measures;
- Supplying energy efficiently and giving priority to decentralised energy supply;
- Making use of renewable energy; and

- Making use of allowable solutions.

13.2.40 Policy ESD3 focusses on Sustainable Construction and the responses anticipated in all residential development in Cherwell District including:

- achieving zero carbon development through a combination of fabric energy efficiency, carbon compliance and allowable solutions in line with Government policy;
- higher levels of water efficiency than required in the Building Regulations, with developments achieving a limit of 110 litres/person/day; and
- all new non-residential development will be expected to meet at least BREEAM 'Very Good'

13.2.41 Examples of the higher quality design being sought are cited as including the following individual measures:

- minimising both energy demands and energy loss;
- maximising passive solar lighting and natural ventilation;
- maximising resource efficiency Incorporating the use of recycled and energy efficient materials Incorporating the use of locally sourced building materials;
- reducing waste and pollution and making adequate provision for the recycling of waste;
- making use of sustainable drainage methods
- reducing the impact on the external environment and maximising opportunities for cooling and shading (by the provision of open space and water, planting, and green roofs, for example); and
- making use of the embodied energy within buildings wherever possible and re-using materials where proposals involve demolition or redevelopment.

13.2.42 Policy ESD4 encourages Decentralised Energy Systems where feasible.

13.2.43 Policy ESD5 confirms the Council's support for renewable and low carbon energy provision wherever any adverse impacts can be addressed satisfactorily.

13.2.44 Policy ESD6 and 7 promote Sustainable Flood Risk Management both through the location of development and the management of water within new developments by the adoption of sustainable drainage systems. Policy ESD8 seeks to protect water resources and the quality thereof.

North West Bicester Supplementary Planning Document, SPD 2016

13.2.45 The North West Bicester SPD expands upon the Local Plan Policy and provides guidance for the allocation, and includes a masterplan. The SPD has been reviewed and analysed as part of the masterplanning process.

Cherwell Climate Action Framework

13.2.46 In 2020 Cherwell District Council adopted a ***Climate Change Declaration*** and subsequently prepared its ***2020 Climate Action Framework.*** The Framework commits the Council to become climate active and carbon neutral. Over and above, the Framework seeks work towards a zero carbon environment across the district by 2030.

13.2.47 Five key areas of actions are identified, within which some additional objectives are offered:

Transport, connectivity and planning:

- Prioritise digital infrastructure and co-working facilities over road building: connectivity, enabled by full fibre broadband across Oxfordshire will replace the need for many journeys
- Increase the number of people walking and cycling in conjunction with the healthy place shaping principles: it will be accessible and normal
- Accelerate the rise of electric, shared and autonomous travel
- Increasingly deprioritise journeys by single occupancy private car
- Promote net zero carbon new developments, with high fabric standards, renewables maximised on site and low embodied carbon
- Continue to spearhead the development of the nationally important true zero carbon Eco-town development.

Natural Carbon Management

- Take advantage of 'natural capital' assets such as soils, woodlands, hedges and ponds in order to capture and store carbon and are valued by communities
- Protect, conserve and enhance carbon capture and storage through our natural environment
- Support the ambition to double tree cover in Oxfordshire with 'the right tree in the right place', as part of a holistic approach to enhance the county's biodiversity and green infrastructure.

Infrastructure business and systems

- Smart, flexible, local renewable generation that enhances local resilience identified in strategic planning
- Good design that favours zero carbon connectivity and low impact living from the outset
- Enabling electric charging infrastructure accessible for all residents
- Community ownership of energy generation and storage assets
- Change in the business community, business networks and development of the low carbon supply chain.

Waste and consumption

- Maximise waste reduction and recycling
- Target zero growth in waste per person and an increase in the circular economy
- Work towards assessing whole system carbon impacts in our waste strategy planning and seek to influence national policy.

Buildings and housing

By engaging with partners through OP2050, the Oxfordshire Energy Strategy, and Oxfordshire communities the Council supports initiatives that lead to:

- Extensive retrofitting of existing buildings
- Increase the proportion of work on fuel poverty delivered through improved building standards and the Oxfordshire Affordable Warmth Network.

13.3 Assessment Methodology

Overview of Approach

13.3.1 There is no stipulated or standard methodology for assessing the magnitude of climate change impacts and the significance of effects of proposed developments. Each project is assessed according to its individual characteristics.

13.3.2 The methodologies for assessing relevant related sustainability and climate change considerations are described within the relevant technical chapters of the ES (for instance Chapter 5: Traffic and Transport, Chapter 8: Landscape; Chapter 9: Ecology; Chapter 11: Water Resources, Flood Risk and Drainage; Chapter 4: Socio-Economic Effects and Chapter 14 Human Health..

13.3.3 Likely significant environmental effects are considered in relation to:

a) the impact of the development on climate change, and

b) the impact of climate change on the development adopting a qualitative perspective.

13.3.4 IEMA guidance on the assessment of the impact on climate change is set out above and emphasises the need for proportionality in the context of national, sector and local GHG emissions and other climate change effects.

13.3.5 The guidance recognises that qualitative assessments are appropriate, particularly where mitigation measures are proposed early on in the design stage.

13.3.6 Emissions associated with the proposed development will be minimal against the national, sector and local emissions inventories, and therefore a qualitative approach is appropriate for this assessment. Such an approach was set out in the Scoping process undertaken with CDC (and described below).

Effects of the Proposed Development on Climate Change

13.3.7 An initial high-level review of the potential impact of the proposed development on climate change was undertaken to develop the methodology for this assessment.

13.3.8 Consideration will be given to both direct and indirect greenhouse gas emissions including:

a) all direct greenhouse gas (GHG) emissions
b) indirect GHG emissions from consumption of purchased electricity, heat or steam; and
c) other indirect emissions, such as the extraction and production of purchased materials and fuels, waste disposal, etc.

13.3.9 In particular the following potential effects are among those to have been identified:

a) effects arising from the heating and supply of energy to homes;

b) effects arising from GCGs generated as a result of transportation activity

c) effects arising from consumption of food and materials.

13.3.10 Each of the above effects are capable of occurring at both the construction and operational stages of the Proposed Development.

13.3.11 In addition consideration is given to effects that the Proposed Development might have on the consequences of climate change – for instance:

a) the effects of the Proposed Development on the risk of flooding arising from climate change; and

b) the effects of the Proposed Development on the local ecological baseline conditions that are changing in response to climate change.

Impact of Climate Change on the Proposed Development

13.3.12 Also, the proposed development may be vulnerable to future climate conditions. Potential significant effects relate to high temperatures and heatwaves, extreme precipitation events, water shortage in drought conditions and other extreme weather events which could result in adverse effects during the construction and/or operation of the proposed development.

13.3.13 The climate baseline conditions for the site have been informed by UK Climate Projections 2018 (UKCP18) produced by the UK Met Office (Met Office, 2018). UKCP18 builds upon the previous projections to provide information on how the climate of the UK may change over the rest of this century. This information will be considered to identify the likely changes to climate to describe the future, emerging baseline and to qualitatively assess the likely significant effects of climate change on the proposed development.

13.3.14 The climate projections will be considered alongside the design information available and embedded mitigation to identify the vulnerability and resilience of the proposed development to climate change.

13.3.15 The principal potential effects of climate change that have been considered:

a) a rise in average temperature levels over climate change

b) changes in the patterns of rainfall including:

i. the frequency of more, and more severe, flood events

ii. an overall reduction in rainfall and water shortage.

c) changes in seasonal patterns.

Scoping and Response

13.3.16 A Scoping Report was submitted to Cherwell District Council (CDC) on 2nd September 2021. The Scoping Report 'scoped in' Climate Change, which is one on the environmental factors identified by the 'EIA Regulations' as part of the Environmental Impact Assessment (EIA) process.

13.3.17 The Scoping Opinion was issued by CDC on the 7th October 2021. With regard to climate change attention was drawn within the Scoping Opinion to:

- the context provided by "Design for Future Climate Change – Adapting Buildings Programme – North West Bicester Eco-Development" prepared by Oxford Brookes University, Hyder, Farrells and Bioregional – and the focus it provides on the issues of overheating and water stress;
- the need to consider how the principles of the England Biodiversity Strategy insofar as it relates to the effects of climate change on biodiversity.

13.3.18 Notwithstanding the agreed position that waste should be scoped out of the ES process, it was urged that consideration should be given to the circular economy as a significant contributor to climate change – resource extraction, use, disposal and recycling.

13.3.19 The Scoping Opinion has established that the methodology for the Climate Change assessment is agreed with CDC.

Surveys Undertaken

13.3.20 The format of this section sets out an appraisal of the baseline conditions, a description of the Proposed Development features and an identification of potential environmental effects due to the Proposed Development. The importance of each mechanism and an assessment of each potential effect are then considered along with any mitigation measures and recommendations for further investigations where necessary.

13.3.21 Methods of assessment have been employed that are consistent with current guidance and recommendations in the form statutory documents and recognised publications to ensure that the findings represent a robust approach to the assessment.

Method for Assessing Impacts and Magnitude and Significance of Effects

13.3.22 The significance of effects will be assessed by considering the sensitivity of receptors (i.e. their importance and ability to tolerate and recover from change) and the likely magnitude of the impact. By combining sensitivity and magnitude, the significance of the effect is established.

13.3.23 The tables below outline the criteria for determining the magnitude and significance of the identified impacts.

Table 11.1 Magnitude of Impact

Magnitude	**Criteria**
Large	Loss of attribute
Moderate	Losses on integrity or partial loss of attribute
Small	Minor impact / minor loss of attribute
Negligible	Insignificant loss of attribute that does not affect use or integrity

Table 11.2 Significance of Impact

MAGNITUDE	**SENSITIVITY**			
	High	**Medium**	**Low**	**Negligible**
Large	Major	Major	Moderate	Minor
Moderate	Major	Moderate	Minor	Negligible
Small	Moderate	Minor	Minor	Negligible
Negligible	Minor	Negligible	Negligible	Negligible

Table 11.3 Definition of Significance of Environmental Impacts

Significance of Impacts	**Definition**
Major	An effect which in isolation could have a material influence on the decision-making process.
Moderate	An effect which on its own could have moderate influence on decision making, particularly when combined with other similar effects.
Minor	An effect which on its own is likely to have a minor influence on decision making, but when combined with other effects could have a more material influence.
Negligible	An effect which on its own or in combination with other effects will not have an influence on decision making.

Limitations and Assumptions

13.3.24 Third party information has been used in the preparation of this report, which BCL by necessity assumes is correct at the time of writing. While all reasonable checks have been made on data sources and the accuracy of data, BCL accepts no liability for same.

13.4 Baseline Conditions

Existing Baseline Conditions

13.4.1 The main findings UK Climate Projections: Headline Findings July 2021 in relation to existing and historic baseline conditions include the following indicators:

a) the average temperature over the most recent decade (2009-2018) has been on average 0.3 °C warmer than the 1981-2010 average and 0.9 °C warmer than the 1961-1990 average;

b) all the top ten warmest years for the UK, in the series from 1884, have occurred since 2002;

c) a recording of 38.7 °C at Cambridge Botanic Garden on 25th July 2019 became the highest summer temperature officially recorded in the UK, exceeding the previous record of 38.5 °C recorded in August 2003;

d) the longest running instrumental record of temperature in the world, the Central England Temperature dataset, shows that the most recent decade (2009-2018) was around 1 °C warmer than the pre-industrial period (1850-1900);

e) this temperature rise in the UK is consistent with warming that has been observed at a global scale, of around 1°C since pre-industrial;

f) the 21st century so far, has been warmer than the previous three centuries;

g) the average hottest day of the year, in the decade (2008-2017)3, was on average 0.1 °C warmer than the 1981-2010 average and 0.8 °C warmer than the 1961-1990 average hottest day of 26°C;

h) the most recent decade (2009-2018) has been on average 1% wetter than 1981-2010 and 5% wetter than 1961-1990 for the UK overall;

i) winters in the UK, for the most recent decade (2009-2018), have been on average 5% wetter than 1981- 2010 and 12% wetter than 1961-1990;

j) summers in the UK have also been wetter, by 11% and 13% respectively (however, very long-period natural variations are also seen in the longer observational record. These show periods in earlier parts of the historical record with similar levels of UK summer rainfall to 2009-2018, illustrating the importance of considering long-period natural variations).

13.4.2 The development area currently exists predominantly as agricultural fields. This will emit high levels of greenhouse gases (GCGs) from livestock farming as well agricultural machinery, animal feed and fertiliser.

13.4.3 Existing baseline conditions relevant to transport, biodiversity, flood risk, drainage, socio-economics and are described elsewhere in other individual chapters of the ES.

13.4.4 The baseline for the Climate Change Assessment is a 'Do Nothing' scenario which is an assumed scenario where the Proposed Developments is not progressed.

Future Baseline Conditions (DO Nothing Scenario)

13.4.5 Climate change has the potential to impact on the future baseline conditions; for example, increased incidences of heavy and prolonged rainfall could increase flood risk from surface water, groundwater and drainage systems.

13.4.6 General climate change trends projected over UK land for the 21st century in UKCP18 are broadly consistent with earlier projections (UKCP09) showing an increased chance of warmer, wetter winters and hotter, drier summers along with an increase in the frequency and intensity of extremes.

13.4.7 More specifically:

a) "By the end of the 21st century, all areas of the UK are projected to be warmer, more so in summer than in winter.

b) In UKCP18, the probabilistic projections provide local low, central and high changes across the UK….By 2070, in the high emission scenario, this range amounts to 0.9 °C to 5.4 °C in summer, and 0.7 °C to 4.2 °C in winter

c) Hot summers are expected to become more common. The summer of 2018 was the equal-warmest summer for the UK along with 2006, 2003 and 1976. Climate change has already increased the chance of seeing a summer as hot as 2018 to between 12-25%. With future warming, hot summers by mid-century could become even more common, near to 50%

d) The temperature of hot summer days, by the 2070s, show increases of 3.8 °C to 6.8 °C, under a high emissions scenario, along with an increase in the frequency of hot spells.

e) Rainfall patterns across the UK are not uniform and vary on seasonal and regional scales and will continue to vary in the future. 3.2.2 In UKCP18, by 2070, in the high emission scenario, the range amounts to -47% to +2% in summer, and -1% to +35% in winter (where a negative change indicates less precipitation and a positive change indicates more precipitation

f) Despite overall summer drying trends in the future, new data from UKCP Local (2.2km) suggests future increases in the intensity of heavy summer rainfall events. For urban areas particularly, this will impact on the frequency and severity of surface water flooding. 3.2.5 Future climate change is projected to bring about a change in the seasonality of extremes. This has several implications for how we manage water. "

13.4.8 The potential range of future change in Central England is summarised in Figure 13.1 – reproduced from UKCP18 "Climate Change Over Land".

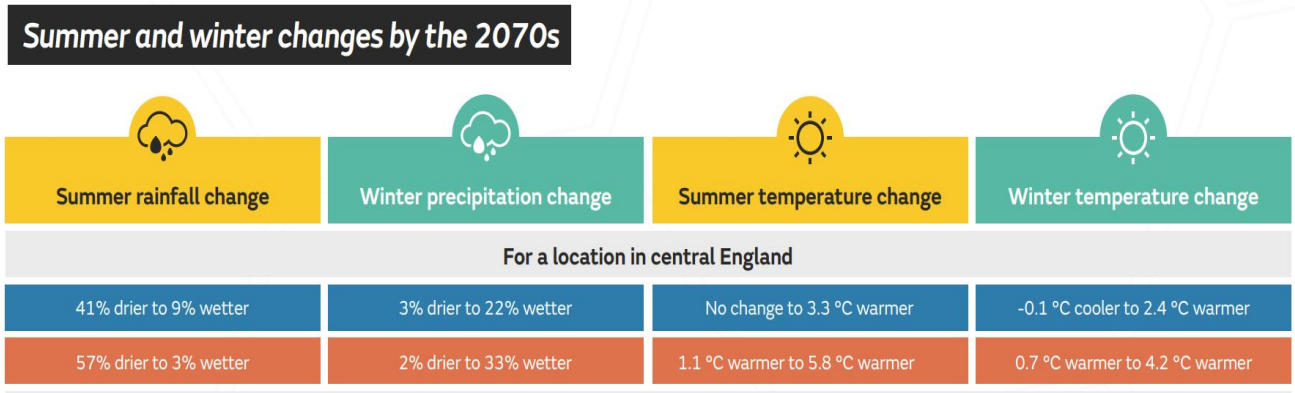

Figure 13.1- Future Climate Change

13.4.9 The UK Net Zero Strategy further sets out the future changes in the baseline Co2 emissions levels – noting declines across all sectors (See Figure 13.2)

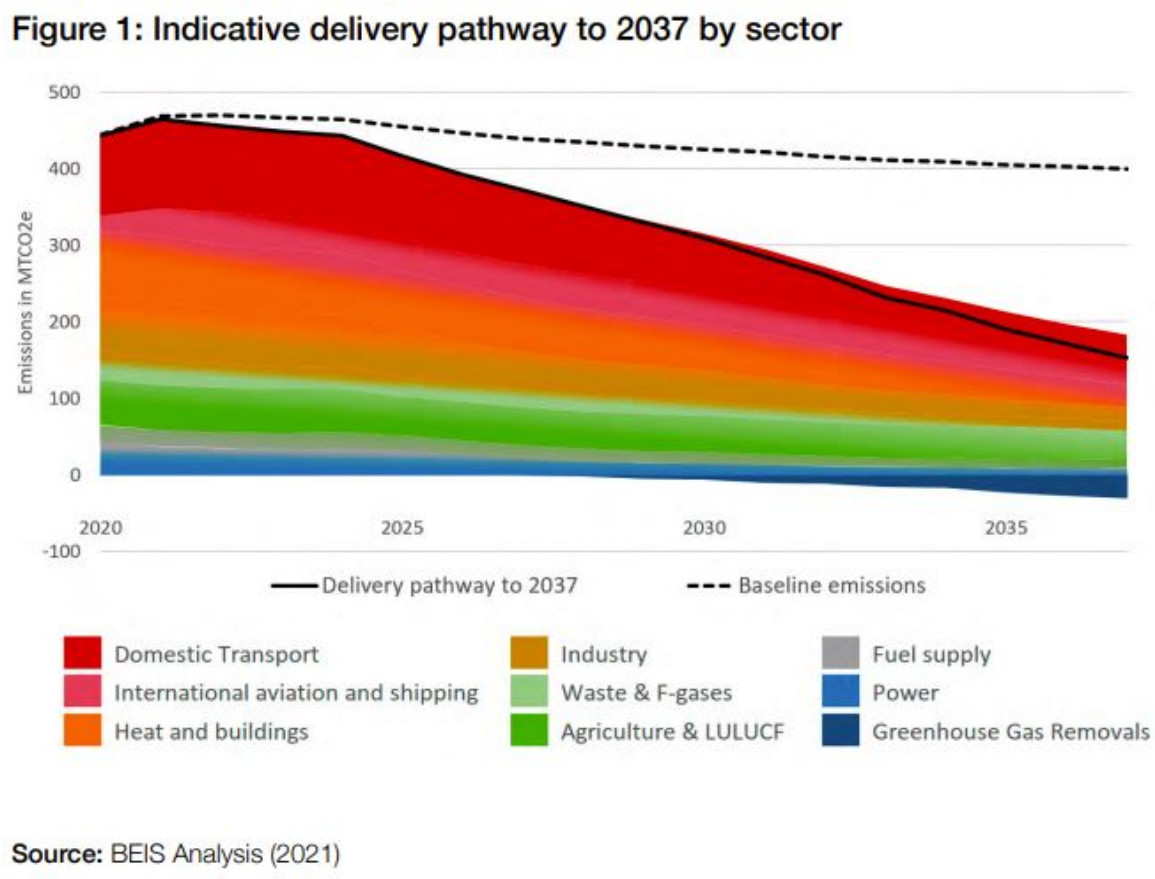

Figure 13.2- Future Climate Change [Net Zero Carbon Building Back Greener (2021)]

13.4.10 Future baseline assessments are also set out in other respective chapters of the ES.

13.5 Predicted Effects

Impact of Proposed Development on Climate Change

Construction Effects

13.5.1 During construction the direct effects of the Proposed Development on Climate Change will have been assessed as follows on the basis of no mitigation of the proposals. Nor does it take account of the relative assessment of effects compared to the provision of the same number of homes in an alternative, less sustainable location.

13.5.2 First, a principal source of emissions will be as a result of vehicular traffic associated with the construction process including earthmoving and supply vehicles on site and the import or export of soil of other materials from the site. The impact is assessed as being small at the local scale and insignificant at the regional scale. In terms of the significance of the impacts they are assessed as being temporary, and of minor – moderate significance.

13.5.3 Second, site preparation works, land clearance and construction activities will require the consumption of energy generated on site from generators or obtained from the national grid. The impact is assessed as being small at the local scale (involving little energy for heating) and insignificant at the regional scale. In terms of the significance of the impacts they are assessed as being temporary and of minor significance.

13.5.4 Third, site preparation and site clearance work during the construction phases has the potential for substantial impacts upon the biodiversity of the site and on the water environment – adding to the effects of climate change on both receptors. Without the embedded and planned mitigation (e.g. the retention of existing watercourses) described later in this section, site clearance work would have a moderate impact at the local scale and a small impact at the regional scale. The significance of such impacts is assessed as being of minor – moderate significance.

Operational Effects

13.5.5 In the operational phases of the development the principal effects of the development are set out below – again based on an assessment of the development alone and in the absence of the mitigation set out below. Nor does it take account of the relative assessment of effects compared to the provision of the same number of homes in an alternative, less sustainable location.

13.5.6 First, the emissions associated with heating in proposed buildings will result in one of the two primary climate change effects as a result of the completed development. In the context of the scale of the development relative to the number of dwellings in Cherwell District as a whole (some 5%) the impact is assessed (unmitigated) as small and of minor significance. That the new homes built (irrespective of the mitigation measures employed) will be built to substantially higher environmental standards than the existing housing stock as a whole(excluding new builds) further serves to underline the assessment of significance of effects.

13.5.7 Second the emissions associated with purchased electricity from the national grid during operation of the proposed development are likely to result in impacts as being small at the local scale and insignificant at the regional scale. In terms of the significance of the impacts they are assessed as being permanent and of minor significance.

13.5.8 Third, the emissions associated with vehicular movement and the use of petrol and diesel engines owned by occupiers of, and visitors to, the proposed development will result in the second of the two primary climate change effects as a result of the completed development. In the context of the scale of the development relative to the number of vehicles and movements in Cherwell District as a whole the impact is assessed (unmitigated) as small and of minor significance being of moderate sensitivity.

13.5.9 Fourth, there will be a beneficial effect in terms of the reduction in emissions arising from the process of carrying out agriculture and food processing – processes which will no longer be carried out following the completion of the development.

13.5.10 Fifth, and offsetting the third, there will be a negative impact as a result of the consumption of food and other materials by the population within the development. The impact is assessed as being small at the local scale and insignificant at the regional scale. In terms of the significance of the impacts they are assessed as being permanent and of minor significance. Indirect emissions associated with, for example, waste disposal and the production of purchased materials or fuels, have been scoped out of this assessment as it is not considered proportionate to the proposed development within the context of the EIA.

13.5.11 Sixth, the potential effects of the proposed development on the risk of flooding is not a direct effect on climate change but a potential indirect effect on the consequences of climate change (one of which is greater flood risk). The impact of the Proposed Development on flood risk has been assessed in the water resources section of the ES.

13.5.12 Sixth, similarly, the potential effects of the proposed development on biodiversity is not a direct effect on climate change but a potential indirect effect on the consequences of climate change (one of which is changes in ecological baseline conditions). The impact of the Proposed Development on ecological baseline conditions has been assessed in the ecology section of the ES.

Impact of Climate Change on Proposed Development

13.5.13 Two primary potential effects of climate change on the proposed development have been identified.

13.5.14 First rises in average temperature levels may have a negative effect on comfort and the need for ventilation and cooling in buildings. That the new homes built (irrespective of the mitigation measures employed) will be built to substantially higher environmental standards than the existing housing stock as a whole further serves to underline the assessment of significance of effects means that the effects are expected to be limited. In the context of the scale of the development relative to the number of dwellings in Cherwell

District as a whole (some 5%) the impact is assessed (unmitigated) as small and of minor significance but permanent.

13.5.15 Second, the contrasting effects of an overall reduction in rainfall coupled with more frequent severe rainfall events, presents challenges in terms of potential impacts on the water resources receptors and indeed in terms of biodiversity and landscape. The impact is assessed (unmitigated) as small at local level and negligible at regional level. Overall it is of minor significance but permanent. The impact of a reduction in agriculture on the site will be a beneficial impact in terms of a saving in water use presently taking place in the baseline condition.

13.6 Mitigation Measures

Embedded Mitigation in Proposed Development

13.6.1 As the proposed development forms part of the NW Bicester Eco-town, there will be a drive to substantially reduce carbon emissions across the site.

13.6.2 At the outset the identification of the site within the North West Bicester local plan allocation through a comprehensive local plan process embeds substantial mitigation in the proposed Development. In focussing the provision of needed new homes at a location identified as having strong environmental and sustainability credentials the effects of new development are greatly mitigated.

13.6.3 Indeed the effects of the Proposed Development on baseline conditions within the District are beneficial and permanent in comparison with meeting housing and development needs in less sustainable locations or in less sustainable development forms (e.g. in dispersed locations or on smaller sites lacking mitigation)

13.6.4 The allocation of North West Bicester in the Cherwell District Council included a requirement that development at North West Bicester be in accordance with a comprehensive masterplan for the whole area. Such a master plan was approved by the Council as part of a North West Bicester Supplementary Planning Document. Embedded within the masterplan are principles relating to the provision of employment and mixed use opportunities, to the retention of environmental capital, to making provision for sustainable modes of travel etc.

13.6.5 Moreover the masterplan set out the principles for how land uses be laid out across the Proposed Site and the wider North West Bicester allocation to mitigate the effects of, and enhance the benefits secured through, the Proposed Development.

13.6.6 The Proposed Development reflects that masterplan process and has further developed and reinforced the embedded mitigation secured through the Proposed Development.

Mitigation of Construction Effects of Development

13.6.7 Any construction effects arising from the proposed development will be addressed through the preparation of a Construction Environmental Mitigation Plan (CEMP) which will provide a robust basis for managing and mitigating any climate change effects from the construction

phase of the proposed development. Such a plan goes beyond a construction management plan which might hitherto have been provided which focuses upon the direct impact of a development (hours of operation, parking of vehicles etc) and includes the sustainability impacts of a development. Instead its scope will be expanded to include, in relation to climate change effects, the management of:

- Practices to be entered into by contractors and in construction activities;
- Ground works to avoid transportation of soils and earth to and from site as far as is possible;
- surface water management during the construction phase to avoid increasing flood risk and water quality impacts;
- construction traffic – the routes it takes;
- the operation of plant on the site and the running of engines etc.
- A site waste Management Plan will be prepared for the construction phases prior to the its commencement.
- of waste and recycling during construction;
- the protection of environmental resources being impacted by climate change – watercourses, landscape, biodiversity – during the construction phase.

13.6.8 The CEMP will be updated and reviewed throughout the construction phase in order to reflect current and emerging legislation throughout the build cycle.

Mitigation of Operational Stages of Development

Emissions Associated with Heating Buildings and Purchasing Electricity

13.6.9 The Energy Strategy attached as Appendix 13.1 sets out the approach to managing energy and hence the emissions that arise from the generation of energy from carbon based sources. The Proposed Development will therefore be underpinned by a detailed Energy Strategy that will consider the likelihood of the development making a significant impact on the environment and set out a strategy for energy sustainability through offsetting carbon emissions and steps to deliver a carbon zero development and that takes account of Future Homes standards.

13.6.10 During the master planning stage of the project, the designers and project team have considered, and will continue to do so, design features which could and would contribute to providing appropriate resilience to climate change. This includes the incorporation of wider measures set out below and the opportunities for a range of technologies to be used to generate energy from low carbon sources focussed on the provision of ground mounted photovoltaic arrays and/or other technologies.

13.6.11 The measures will address Cherwell District Council and Oxfordshire County Council's declared climate emergencies and work towards net zero carbon aspirations. With the

energy hierarchy to the fore, the Proposed Development will be designed to conserve and reduce energy requirements.

13.6.12 The Proposed Development will have integrated features to ensure fabric enhancements to prevent thermal loss and optimise energy efficiency within the proposed buildings.

13.6.13 The proposals will include measures within the built fabric to achieve a low carbon development. Detailed measures will be outlined further in the Reserved Matters Applications (RMA).

13.6.14 After consideration of various options to promote low carbon as part of the application proposals (including areas within or adjacent to the site to generate electricity from wind turbines), proposals have been developed for a ground mounted photovoltaic array (Solar Farm) in the northern part of the Proposed Development.

13.6.15 Other options to be considered as part of detailed proposals are identified as follows:

- Energy efficient lighting and appliances
- Roof mounted Photovoltaics
- Air Source Heat Pumps for residential plots
- Consideration of options for battery storage for homes to store renewable energy.

13.6.16 All mitigation measures will need to be subject to detailed technical feasibility assessments and financial viability.

13.6.17 The progression towards a Zero Carbon Solution for all housing will mitigate the impact of the development over the lifetime of the development and the further decarbonisation of the grid will further enhance the development to become a carbon sink.

13.6.18 As per the suggestion in policy Bicester 1, consideration has been given to sourcing waste heat from the Ardley Energy recovery facility. This is not a feasible or viable source of low carbon energy for the lifetime of the development.

13.6.19 Consideration was also made to the use of wind turbines to mitigate the impact of development. The scale of the development of viable wind turbines raised the particular issues of impact on the local landscape plus the presence of existing dwellings within the shadow flicker, noise and visual impact of any turbine.

Emissions Associated with Vehicular Traffic and Consumption

13.6.20 The development will be designed to offer ease of access to sustainable modes of transport and ways of living in order to reduce the carbon footprint of the area as well as improve social and economic prosperity.

13.6.21 The masterplan principles in the North West Bicester SPD and in the Proposed Development:

- Reduce the need to travel by accommodating development in a highly sustainable location within the District of Cherwell with high levels of accessibility to jobs and services
- Maximise the opportunities to work, play, and use services and community facilities within the North West Bicester Development
- Promote walkable neighbourhoods;
- Maximising, through design, sustainable transport connectivity in and around the site

13.6.22 In addition a Travel Plan will be approved prior to construction. The Travel Plan will include active measures to reduce the need to travel and to encourage journeys to be made by sustainable modes. It will ensure ample and secure cycle parking facilities and appropriate electric vehicle charging facilities.

13.6.23 The effects of both vehicular and heating and power are both mitigated by the proposals for in excess of 40% of the Proposed Development to comprise a multi-functional network of green infrastructure providing opportunities to move around by sustainable modes, to undertake leisure and recreation locally and to retain and enhance the landscape and biodiversity baseline conditions of the site.

13.6.24 The open space forms a well-connected network of green areas suitable for formal and informal recreation, preservation and enhancement of habitats and species on site, and creation and management of new habitats to achieve an overall net gain in biodiversity. A Management Plan will be provided to manage habitats on site and to ensure this is integral to wider landscape management. An additional and important aspect of the green infrastructure network is the mitigation it offers in terms of carbon sequestration including as a result of the extensive proposed tree and hedge planting– a mitigating effect that will continue to grow as the landscape and green space matures.

Emissions arising as a result of Consumption of materials and waste

13.6.25 Resource extraction, processing, use and disposal and recycling of materials at the end of life as part of a circular economy are varying contributors to climate change.

13.6.26 In this regard it is noted that Oxfordshire councils have ambitious targets to reduce the amount of waste generated and increase the amount recycled (Joint Municipal Waste Management Strategy 2018-2023). Enabling residents of new dwellings to fully participate in district council waste and recycling collections will the objective of the development thereby supporting Oxfordshire's high recycling rates, reducing the amount of non-recyclable waste generated and to minimise any associated climate impacts.

13.6.27 The provision of facilities to reduce waste within the Proposed Development include the provision of bringing forward sites positioned in accessible locations. Provision for sustainable management of waste both during occupation shall be provided through the preparation of a waste strategy to be approved prior to the occupation of the development.

The treatment of water waste will be the responsibility of Thames Water or other operator with increasingly stringent standards being imposed on such operators.

Impacts of Climate Change on the Proposed Development

13.6.28 Oxford Brookes University conducted a study, set out in *"Design for Future Climate Change – Adapting Buildings Programme – North West Bicester Eco-Town"* that summarised the main future risks to the proposed development to be overheating and water stress.

13.6.29 In order to prevent overheating, a comprehensive solar master planning scheme will be implemented across the site to maximise opportunities for passive heating during the winter and shading and cooling across the site during the summer months. This will also allow for the solar Photovoltaics (PV) cells referenced above to be installed on dwelling rooftops and maximise solar gain.

13.6.30 A carefully considered green infrastructure network will also aid with passive cooling on the urban environment and minimise any urban heat island effects.

13.6.31 With regard to the water environment, no built is proposed in areas of flood risk and development is set back from watercourses which provides opportunity for green buffers. The drainage proposals will include the embedding of sustainable urban drainage systems to fully mitigate the impact of climate change on the development in this regard.

13.6.32 One identified effect of climate change on the development is the potential to impact upon the green infrastructure planned as part of the development – through drought or temperature. In accordance with the England Biodiversity Strategy a key objective in the design and maintenance of the green spaces will be how ecological networks will be maintained and enhanced through the provision of coherent ecological networks that are resilient to current and future pressures. This will be secured through the planting regimes and maintenance provisions and deployment of drought tolerant planting.

13.6.33 To contribute to the mitigation of the impact of the development at a wider scale the proposed development is anticipated achieve the 110 litres/person/day, sought by the Cherwell Local Plan.

13.7 Residual Effects

13.7.1 Residual effects are set out in Table 13.1 below

Construction Effects

13.7.2 The assessments reported above do not identify any likely significant adverse effects on the development.

Operational Effects

13.7.3 The assessments reported above do not identify any likely adverse effects of significance.

13.7.4 The implementation of passive and active sustainable features within the site boundary will provide a long-term beneficial effect through lowering GHG emissions as well as reducing energy demand across the site.

13.8 Cumulative Effects

13.8.1 The list of schemes considered as part of the cumulative effects within the ES chapter are listed in section 1.

13.8.2 It is anticipated that regulatory control will ensure that developments completed elsewhere in the area will be required to implement measures similar to those outlined above that at least meet current standards. In such circumstances, the environmental effects resulting from the development will be negligible and not significant.

13.9 Conclusion on Statement of Effects

13.9.1 The potential significance of the impacts assumes that the mitigation measures outlined above have been implemented and are fully in accordance with current guidance and the requirements of the regulating authorities.

13.9.2 As the proposed development forms part of the NW Bicester Eco-town, there will be a drive to substantially reduce carbon emissions across the site. At the outset the identification of the site within the North West Bicester local plan allocation through a comprehensive local plan process embeds substantial mitigation in the proposed Development. In focussing the provision of needed new homes at a location identified as having strong environmental and sustainability credentials the effects of new development are greatly mitigated.

13.9.3 Indeed the effects of the Proposed Development on baseline conditions within the District are beneficial and permanent in comparison with meeting housing and development needs in less sustainable locations or in less sustainable development forms (e.g. in dispersed locations or on smaller sites lacking mitigation)

13.9.4 The assessments reported above do not identify any likely adverse effects of significance.

13.9.5 The implementation of passive and active sustainable features within the site boundary will provide a long-term beneficial effect through lowering GHG emissions as well as reducing energy demand across the site.

Table 13-1: Assessment of Significance of Residual Effects

Possible Effect	**Duration**	**Significance Major/Moderate/ Minor/Negligible Beneficial/Adverse**	**International/ National/ Regional/ Local**	**Mitigation**	**Residual Effect**
Construction					
Emissions generated from construction traffic	Temporary	Minor-moderate adverse	Local	CEMP	Negligible
Emissions generated from plant and machinery associated with site preparation and construction works	Temporary	Minor adverse	Local	CEMP	Negligible
Additional effects on biodiversity and water environment	Temporary	Minor-moderate adverse	Local	CEMP	Negligible
Operational Development					
Carbon Emissions from: Heating Purchased Power	Permanent	Minor adverse	Local	Energy strategy including the following options: fabric enhancements; ground mounted photovoltaic arrays; plot mounted	Negligible

				photovoltaics; air source heat pumps etc potential battery storage; Carbon sequestration within Gren Infrastructure network	
Emissions generated by vehicles used by occupiers of, or visitors to, the Proposed Development	Permanent	Minor adverse	Local	Embedded site location through allocation. Embedded comprehensive master plan design of mixed use development. Absence of alternative dispersed housing development in less sustainable locations or developments. Travel Plan.	Negligible
Emissions generated by agriculture	Permanent	Minor beneficial	Local	None	Minor beneficial
Consumption of food and goods by occupiers of the development	Permanent	Minor adverse	Local	Allotments and embedded design of local services and facilities. Waste management strategy.	Negligible
Impact of Climate Change on Proposed Development					
Effects of Increased average temperatures on occupiers of Proposed Development	Permanent	Minor Adverse	Local	Detail design and landscape layout to allow opportunities for passive heating in winter and cooling in summer.	Minor beneficial

Effects of Less Rainfall but More Frequent Severe rainfall events on Proposed Development	Permanent	Minor Adverse	Local	Avoidance of Development in the floodplain. SUDS. Green Infrastructure with flexible drought resistant planting.	Minor beneficial