10 Climate Change & Greenhouse Gases

10.1 Introduction

10.1.1 This chapter of the ES has been produced by Savills Earth to assess the Proposed Development in relation to the potential effects on and due to climate change.

10.1.2 Under The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (the '2017 EIA Regulations') as amended, applicants are required to include in the ES where relevant to the development "*a description of the likely significant effects of the development resulting from, inter alia: […] the impact of the development on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the development to climate change*" (Schedule 4, paragraph 5(f)).

10.1.3 Climate change in the context of development projects is typically considered in three parts, as is suggested by the wording in Schedule 4:

- the impact of greenhouse gas emissions (GHGs) caused directly or indirectly by the Proposed Development, which contribute to climate change;
- risks to the development caused by the changing climate and resilience or adaptation options; and,
- inter-related effects (such as changes in the sensitivity or resilience of receptors due to climate change) that in turn could influence the significance of other environmental effects of the development on those receptors.

10.1.4 This chapter is supported by technical appendices with further information on each of these areas:

- Appendix 10.1 with details of GHG emission calculations and benchmarks;
- Appendix 10.2 with details of climate projections and risk assessment; and
- Appendix 10.3 with details of inter-related climate change effects.

10.1.5 GHG emissions are normally expressed as carbon dioxide equivalents, explained in the methodology section below, and are therefore often referred to as 'carbon' as a shorthand (e.g. when speaking of 'low-carbon power' or 'carbon reduction targets').

10.2 Assessment Methodology

Legislative and Policy Context

10.2.1 Under the guidance used in this assessment, climate change policy and legislation at a local and national level forms part of the context used to judge the significance of GHG emission effects, together with published advice of experts concerning the adequacy of that policy and on measures needed to successfully implement it.

10.2.2 There is a great deal of legislation and policy which concerns climate change, energy, transport, the built environment and management of the natural environment in general, which is not exhaustively listed here; this summary instead focuses on aspects of legislation or policy where these matters intersect to be of most relevance to the Proposed Development.

Kyoto Protocol

10.2.3 The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change (UNFCCC), which set legally binding emission reduction targets for the 192 parties to the Kyoto Protocol[1]. The targets cover the emissions of seven greenhouse gases, namely: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), nitrogen trifluoride (NF_3), hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride (SF_6). These gases are commonly referred to as the 'Kyoto basket' of greenhouse gases. Under the Kyoto Protocol and UNFCCC, the UK initially committed to an emissions reduction target of 12.5% reduction compared to base year levels from 2008-2012 (the first commitment period).

Paris Agreement

10.2.4 The Paris Agreement is a legally binding international treaty on climate change, adopted by 196 parties at the UN Climate Change Conference (COP21) in 2015. Its overarching goal is to hold "*the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels*"[2]. It was reaffirmed by the Glasgow Pact[3] in 2021 at COP26.

10.2.5 Under Article 4 of the Paris Agreement, parties are required to communicate their intended domestic GHG mitigation targets. The UK's updated Nationally Determined Contribution (NDC) under the Paris Agreement (revised in September 2022 in light of the Glasgow Climate Pact) commits the UK to reducing economy-wide GHG emissions by at least 68% by 2030 compared to 1990 levels. At COP29 in November 2024, the UK pledged to make its next NDC an 81% reduction on 1990 levels by 2035[4].

Net Zero Legislation and Policy

10.2.6 The Climate Change Act 2008 (as amended in 2019)[5] commits the UK government to reducing GHG emissions by at least 100% of 1990 levels by 2050: a net zero target. The Act requires the UK government to set interim carbon budgets for the UK, in view of the urgency to reduce GHG emissions and severe consequences of more than a 1.5°C rise in global average temperature (in line with the Paris Agreement and Glasgow Pact). The Climate Change Act 2008 also established the Climate Change Committee (CCC) with a statutory role to give advice to government on carbon budgets, to report on progress in reducing carbon, and to give advice on national climate risks and adaptation. Advice from the CCC, while not adopted policy, is normally taken on board in producing carbon budgets for the net zero target due to the Committee's statutory role and is strongly relevant to consider in this assessment. The CCC works alongside[6] the Office for Environmental Protection (OEP), established under the Environment Act 2021[7], which has a monitoring and enforcement role for public authorities' plans and actions under environmental legislation.

[1] United Nations (1998): Kyoto Protocol to the United Nations Framework Convention on Climate Change https://unfccc.int/resource/docs/convkp/kpeng.pdf, accessed 02/10/24.
[2] United Nations (2015): Paris Agreement, https://unfccc.int/sites/default/files/english_paris_agreement.pdf, accessed 02/10/24.
[3] United Nations (2021): Glasgow Pact, https://unfccc.int/process-and-meetings/the-paris-agreement/the-glasgow-climate-pact-key-outcomes-from-cop26, accessed 08/10/24
[4] Prime Minister's National Statement at COP29: 12 November 2024, https://www.gov.uk/government/speeches/prime-ministers-national-statement-at-cop29-12-november-2024, accessed 09/01/25
[5] Climate Change Act 2008 (c. 27) as amended by The Climate Change Act 2008 (2050 Target Amendment) Order 2019, https://www.legislation.gov.uk/ukpga/2008/27/contents, accessed 02/10/24
[6] CCC and OEP (2022): Memorandum of Understanding between the CCC and the OEP. [Online] Available at: https://www.theccc.org.uk/wp-content/uploads/2022/08/CCC_OEP_MoU-_.pdf accessed 06/02/24
[7] The Environment Act 2021. [Online] Available at: https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted. Accessed 06/02/24

10.2.7 At present, the Fourth, Fifth and Sixth Carbon Budgets, set through The Carbon Budget Orders 2011, 2016 and 2021, are 1,950 $MtCO_2$ for 2023 to 2027, 1,725 $MtCO_2$ for 2028 to 2032 and 965 $MtCO_2$ for 2033 to 2037. The Sixth Carbon Budget is the first that is consistent with the UK's net zero target, requiring a 78% reduction in GHG emissions by 2035 from 1990 levels. The UK's current Nationally Determined Contribution (NDC) under the Paris Agreement (as reaffirmed in the Glasgow Pact) commits the UK to reducing economy-wide GHG emissions by at least 68% by 2030 compared to 1990 levels[8] and as noted above, the next NDC was pledged to be an 81% reduction on 1990 levels by 2035. Recommendations for the 7th Carbon Budget (2038-2042) have been published by the Climate Change Committee and will be considered by the government during 2025.

10.2.8 Under s.14 of the Climate Change Act 2008, the UK government must report on its proposals and policies for meeting each carbon budget. The Carbon Budget Delivery Plan 2023[9] is the present such report. The plan indicates that the quantified emission reductions predicted form the implementation of current policies are expected to be sufficient to deliver the Fourth and Fifth Carbon Budgets but may fall short of the Sixth Carbon Budget. However, in May 2024, the Delivery Plan was found to be unlawful following a judicial review and so the Secretary of State is required to produce a new plan within 12 months (i.e. by 2 May 2025).

10.2.9 The Net Zero Strategy (Build Back Greener), as revised in 2022 after court challenge, set out the UK's plans to achieve net zero emissions by 2050[10]. Part of this strategy outlines the policies and proposals for heat and buildings, which includes all new heating appliances in homes and workplaces from 2035 being low carbon. The UK's Heat and Buildings Strategy[11] sets this out in further detail and suggests that heat pumps will be a key technology for new buildings.

10.2.10 Progress on the Net Zero Strategy policies was captured in early 2023 by the Powering Up Britain: Net Zero Growth Plan policy paper[12]. Headline policies are around decarbonising transport through the zero emissions vehicle mandate and continuing the transition to heat pump use for building heating.

10.2.11 The National Infrastructure Strategy (2020)[13] was prepared by the National Infrastructure Commission, in response to the Commission's 2018 National Infrastructure report, and set out the UK Government's long-term infrastructure plans in accordance with the UK's 2050 net zero target. With regards to reducing emissions from residential buildings, the approach suggested in the Strategy is one of substituting fossil fuel boilers with low carbon alternatives (hydrogen and heat pumps) and greatly improving energy efficiency in homes. On 10 October 2024, the new Labour government announced that it will replace the National Infrastructure Strategy with

[8] United Kingdom of Great Britain and Northern Ireland's Nationally Determined Contribution (2022): https://assets.publishing.service.gov.uk/media/633d937d8fa8f52a5803e63f/uk-nationally-determined-contribution.pdf, accessed 19/11/24
[9] Carbon Budget Delivery Plan (2023): https://assets.publishing.service.gov.uk/media/6424b2d760a35e000c0cb135/carbon-budget-delivery-plan.pdf, accessed 29/07/24
[10] DESNZ and BEIS (2022): The Net Zero Strategy (Build Back Greener), https://www.gov.uk/government/publications/net-zero-strategy, accessed 02/12/24.
[11] BEIS (2021): Heat and Buildings Strategy. [Online] Available at: https://www.gov.uk/government/publications/heat-and-buildings-strategy, accessed 29/11/24.
[12] DESNZ (2023): Powering Up Britain: The Net Zero Growth Plan, https://assets.publishing.service.gov.uk/media/642556c560a35e000c0cb167/powering-up-britain-net-zero-growth-plan.pdf, accessed 03/10/24
[13] HM Treasury (2020): National Infrastructure Strategy, https://www.gov.uk/government/publications/national-infrastructure-strategy, accessed 03/10/24

a ten-year infrastructure strategy in Spring 2025[14], along with establishing a new National Infrastructure and Service Transformation Authority (NISTA).

10.2.12 The Clean Growth Strategy (2017)[15] sets out priorities relevant to planning for new residential developments of: improving the energy performance standard of new homes; making walking and cycling the "natural choice for shorter journeys"; requiring provision of electric vehicle charging points; and deploying heat networks and improving the standards of boilers to decarbonise heating.

Advice of the Climate Change Committee

10.2.13 The Climate Change Committee (CCC) has a statutory role under the Climate Change Act 2008 to provide advice to the government on setting carbon budgets, monitoring UK progress in meeting them, and on evidence-based policy measures that could be used for their achievement. It also advises on national climate risks, adaptation and resilience measures and progress towards implementing these.

10.2.14 In the latest review of UK progress in meeting carbon budgets[16], the overriding advice of the CCC has been that there remains important policy gaps and a lack of uptick in pace in carbon reduction. Despite a significant reduction in emissions in 2023, the UK is not on track to hit the NDC target of reducing emissions by 68% of 1990 levels by 2030; only a third of the emissions reductions required to achieve the 2030 target are currently covered by credible plans. The 2024 progress report indicates that action is needed across all sectors of the economy, with low-carbon technologies becoming the norm.

10.2.15 The Committee's most recent budget advice was on setting the Sixth[17] and Seventh[18] Carbon Budget. Headline points in the 'Balanced Pathway' of measures suggested for making the Sixth Carbon Budget feasible are introduction of low-carbon heating technologies and improved building energy performance, and reduction in the carbon intensity of cars and HGVs (with the necessary supporting charging and alternative fuelling infrastructure). For the Seventh Carbon Budget, electrification and low-carbon electricity supply, electric vehicles, heat pumps, increased efficiency and low-carbon choices are all key recommendations.

Building Regulations

10.2.16 Minimum standards for buildings are set by the Building Regulations 2010 (as amended) and the various Approved Documents, of which Parts L, G, F and O (ventilation, water efficiency, fuel and power and overheating) are the most relevant. They are amended periodically to tighten performance standards required for new buildings.

10.2.17 Of note, changes to Part L (conservation of fuel and power) and Part F (ventilation) via the 'Future Homes Standard' (FHS) and 'Future Buildings Standard' (FBS) are expected to come into effect in late 2025. These are expected to set new performance standards such that "*new homes and non-domestic buildings have high fabric standards, use low-carbon heating and are 'zero-carbon ready' (meaning no further work will be needed for them to have zero carbon*

[14] HM Treasury (2024): https://www.gov.uk/government/speeches/chief-secretary-to-the-treasury-sets-vision-for-future-of-britains-infrastructure, accessed 11/11/24
[15] DEZNEZ an BEIS (2017): Clean Growth Strategy. [Online] Available at: https://www.gov.uk/government/publications/clean-growth-strategy, accessed 12/10/24
[16] Climate Change Committee (2024): 2024 Progress Report to Parliament, https://www.theccc.org.uk/publication/progress-in-reducing-emissions-2024-report-to-parliament/, accessed 03/10/24.
[17] Climate Change Committee (2020): Sixth Carbon Budget, https://www.theccc.org.uk/publication/sixth-carbon-budget/, accessed 03/10/24.
[18] Climate Change Committee (2025): Seventh Carbon Budget, https://www.theccc.org.uk/wp-content/uploads/2025/02/The-Seventh-Carbon-Budget.pdf, accessed 26/02/25.

emissions once the electricity grid has fully decarbonised)". Whilst consultation closed in March 2024, a response is yet to be published. The stringency of this standard and technical details are therefore not finalised and may not provide the level of ambition required to future-proof for net zero, as explored for example by the UK Green Building Council[19]. Importantly, the FHS and FBS are focused on the occupational / operational phase of a building lifetime: embodied carbon is described as being out of scope, and subject to a future consultation on an approach to measuring and reducing this in due course.

10.2.18 As an interim measure, in 2021 (and as amended in 2023) Part L of the UK Building Regulations was amended in order to improve the energy efficiency and reduce the GHG emissions of new buildings to a lesser level than the Future Buildings Standard.

Climate Change Risk, Resilience and Adaptation

10.2.19 Under s.56 of the Climate Change Act 2008, the UK publishes a five-yearly national climate risk assessment, the latest being from 2022[20]. This is developed based on advice from the Climate Change Committee[21].

10.2.20 The national priority risk areas identified (most relevant to the Proposed Development) are:

- "*Risks of climate-related failure of the power system;*
- *Risks to supply of food, goods and vital services due to climate-related collapse of supply chains and distribution networks; and*
- *Risks to human health, wellbeing and productivity from increased exposure to heat in homes and other buildings*".

10.2.21 The response to climate risks through resilience and adaptation actions are set out in the National Adaptation Programme (NAP) under s. 58 of the Climate Change Act 2008, with the most recent being NAP3 published in 2023[22]. With respect to health, communities and the built environment it notes that the main climate risks are those resulting from high temperatures, changes to air quality and flooding.

National Planning Policy

10.2.22 The revised National Planning Policy Framework (NPPF)[23] states with regard to climate change that the core planning principle of the NPPF is that the planning system should:

"*…support the transition to net zero by 2050 and take full account of all climate impacts including overheating, water scarcity, storm and flood risks and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources,*

[19] UKGBC (2024): UKGBC response to the Future Homes and Buildings Standard. [Online] Available at: https://ukgbc.org/wp-content/uploads/2024/02/FHS-consultation-final.pdf, accessed 06/12/24

[20] Defra (2022): UK Climate Change Risk Assessment 2022, https://www.gov.uk/government/publications/uk-climate-change-risk-assessment-2022, accessed 09/10/24
[21] Climate Change Committee (2021): Independent Assessment of UK Climate Risk (CCRA3), https://www.theccc.org.uk/publication/independent-assessment-of-uk-climate-risk/, accessed 09/10/24
[22] Defra (2023): The Third National Adaptation Programme (NAP3) and the Fourth Strategy for Climate Adaptation Reporting, https://www.gov.uk/government/publications/third-national-adaptation-programme-nap3#full-publication-update-history, accessed 09/10/24
[23] MHCLG (2024): National Planning Policy Framework. [Online] Available at: https://assets.publishing.service.gov.uk/media/675abd214cbda57cacd3476e/NPPF-December-2024.pdf, accessed 30/09/25

including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure." (paragraph 161).

10.2.23 'Low-carbon' technologies are defined in the NPFF at page 77-78 as "*…those that can help reduce emissions (compared to conventional use of fossil fuels)."*

10.2.24 In paragraphs 161 (quoted above) and 162, the NPPF refers to the need for planning to provide climate adaptation and resilience:

"*Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating and drought from rising temperature*." (paragraph 162).

Adopted Local Planning Policy

10.2.25 The Wokingham Borough Council Core Strategy Development Plan (SDP)[24] was adopted in January 2010 and includes the following relevant policies:

10.2.26 Policy CP1 – "Sustainable development" sets out key objectives related to mitigating negative climate impacts of the proposed development. The policy states that the development must:

- *"Maintain or enhance the high quality of the environment;*
- *Minimise the emission of pollutants into the wider environment;*
- *Limit any adverse effects on water quality (including ground water);*
- *Ensure the provision of adequate drainage;*
- *Minimise the consumption and use of resources and provide for recycling;*
- *Incorporate facilities for recycling of water and waste to help reduce per capita water consumption; 7) Avoid areas of best and most versatile agricultural land;*
- *Avoid areas where pollution (including noise) may impact upon the amenity of future occupiers;*
- *Avoid increasing (and where possible reduce) risks of or from all forms of flooding (including from groundwater);*
- *Provide attractive, functional, accessible, safe, secure and adaptable schemes;*
- *Demonstrate how they support opportunities for reducing the need to travel, particularly by private car in line with CP6 (Managing Travel Demand); and*
- *Contribute towards the goal of reaching zero-carbon developments as soon as possible by:*

[24] Wokingham Borough Council (2010): Wokingham Borough Local Development Framework: Adopted Core Strategy Development Plan Document. [Online] Available at: https://www.wokingham.gov.uk/planning/how-apply-permission/how-apply-planning-permission/read-our-planning-guidance-and-policy-documents, accessed 16/05/25

- *a) Including appropriate on-site renewable energy features; and*
- *b) Minimising energy and water consumption by measures including the use of appropriate layout and orientation, building form, design and construction, and design to take account of microclimate so as to minimise carbon dioxide emissions through giving careful consideration to how all aspects of development form."*

10.2.27 Policy CP6 – "Managing Travel Demand" calls for the development to "*provide for sustainable forms of transport to allow choice*" and to "*not cause highway problems or lead to traffic related environmental problems*".

10.2.28 Policy CP7 – "Biodiversity" outlines the importance of nature conservation and requires the proposed development to avoid harming nature conservation sites and to create local biodiversity action plans.

10.2.29 The Managing Development Delivery Local Plan (MDD)[25] is a supplementary document that builds upon the SDP policies. It is worth noting that the WBC Climate Change Interim Policy Position Statement[26] clarifies how older policies in relation to sustainable development must be complied with under the current SDP. Relevant policies include:

10.2.30 Policy CC03 – "Green Infrastructure, Trees and Landscaping" outlines the need for developments to protect or enhance green the Borough's green infrastructure, integrating it with public spaces and countryside.

10.2.31 Policy CC04 – "Sustainable Design and Construction" presents key requirements for both new residential and non-residential builds:

- *New homes:*
  - *a) Seeking to achieve the requirement of the full Code for Sustainable Homes Level 4;*
  - *b) Meet internal potable water consumption targets of 105 litres or less per person per day (as part of the requirement to meet full Code for Sustainable Homes Level 4).*
- *New non-residential proposals of more than 100 m^2 gross non-residential floorspace:*
  - *a) Achieve the necessary mandatory Building Research Establishment Assessment Method (BREEAM) requirements or any future national equivalent*
  - *b) Meet or exceed statutory requirements for water resource management.*
- *All development, including conversions, alterations and extensions shall incorporate suitable waste management facilities, including on-site recycling.*

[25] Wokingham Borough Council (2014): Wokingham Borough Development Plan: Adopted Managing Development Delivery Local Plan. [Online] Available at: https://www.wokingham.gov.uk/sites/wokingham/files/2023-06/Adopted%20MDD.pdf , accessed 01/06/25
[26] Wokingham Borough Council (2022): Climate Change Interim Policy Position Statement. [Online] Available at: https://www.wokingham.gov.uk/sites/wokingham/files/2023-06/Adopted%20MDD.pdf , accessed 01/06/25

10.2.32 Policy CC05 – "Renewable energy and decentralised energy networks" state that schemes of more than 10 dwellings or non-residential proposals of more than 1000 m2 floorspace should deliver a minimum 10% reduction of carbon emissions through renewable energy or low carbon technology. It also provides guidance for renewable energy and decentralised energy works proposals.

10.2.33 Policy CC09 – "Development and Flood Risk (from all sources)" outlines the requirement of flood risk site research, mitigation, related procedures, and a flood risk assessment that development proposals must have.

10.2.34 Policy CC10 – "Sustainable Drainage" outlines requirements for proposals related to sustainable drainage systems (SuDS), and drainage strategies.

10.2.35 The adopted local plan is now considerably out of date, with the emerging Local Plan Update (LPU) for 2023-2040[27] set to replace it once it is adopted. The LPU includes the following policies relevant to climate change:

10.2.36 Policy SS1 – "Sustainable development principles" sets out sustainable development principles that align proposals with wider economic, social, and environmental objectives

10.2.37 Policy SS13: "Loddon Garden Village" outlines a comprehensive set of requirements for developments in the location to ensure that its overall development is cohesive and of high quality. Sub-sections of this policy relating to climate change are shown below:

- *"Landscape and green and blue infrastructure*
    - *6. Development proposals should devise and implement a comprehensive strategic landscape and green and blue infrastructure strategy that:*
    - *a) Provides a new country park incorporating the River Loddon and Barkham Brook that contributes to, and enhances, coherent ecological networks and habitats, which are integrated into the wider green and blue infrastructure beyond the garden village;*
    - *b) Protects and enhances the identified attributes of the River Loddon Valued Landscape and Barkham and Bearwood Valued Landscape;*
    - *c) Provide a network of connected, accessible and high-quality open spaces that includes tree lined streets, opportunities for local food growing and natural play, that integrate with the wider green and blue infrastructure network;*
    - *d) Retains, and incorporates appropriate buffers for, ancient woodland, ancient or veteran trees, watercourses, hedgerows, and other trees into the connected green and blue infrastructure of the site;*
    - *e) Provides a network of safe, attractive, landscaped and accessible public rights of way across the site, and where appropriate demonstrates how they connect into the existing rights of way network;*
    - *f) Contributes to establishing the Loddon long distance footpath for active travel; and*

[27] Wokingham Borough Council (2010): Wokingham Borough Local Plan Update 2023-2040. [Online] Available at: https://www.wokingham.gov.uk/planning-policy/emerging-local-plan-update , accessed 16/05/25

- *g) Establishes clear and robust arrangements for future maintenance.*

- *Drainage and flood alleviation*
  - *7. Development proposals should devise and implement a comprehensive drainage and flood alleviation strategy that:*
  - *a) Provides high quality sustainable drainage systems (SuDS) that are integrated into the wider landscape and green and blue infrastructure strategy, including mitigation at source and makes a positive contribution to attractive open spaces, and improvement to biodiversity and water quality;*
  - *b) Considers and takes opportunity as appropriate to improve the management of flood risk and reduce the risk of flooding to areas beyond the garden village; and*
  - *c) Establishes clear and robust arrangements for future maintenance.*

- *Biodiversity*
  - *8. Development proposals should devise and implement a comprehensive ecological strategy that:*
  - *a) Achieves a measurable biodiversity net gain of at least 20% as calculated using the latest statutory metric;*
  - *b) Shows how priority habitats and ecological features will be protected and enhanced, having particular regard to any Biodiversity Action Plan and Local Nature Recovery Strategy priorities;*
  - *c) Provide a suitable buffer between the built development and ecological areas, including (but not limited to) Local Wildlife Sites, areas of irreplaceable habitat and areas of priority habitat; and*
  - *d) Provide measures to avoid and mitigate the impact of development on the Thames Basin Heaths Special Protection Area. This will include the provision of sufficient and accessible Suitable Alternative Natural Greenspace on-site (as set out in Policy NE3).*

- *Sustainable design and construction*
  - *11. Development proposals should devise and implement a comprehensive energy and sustainability strategy that:*
  - *a) Applies passive design principles to ensure that form, orientation, building typologies, development densities and green and blue infrastructure are appropriately used to reduce energy demand and deliver climate resilient neighbourhoods;*
  - *b) Implements the energy hierarchy at all scales and demonstrates a fabric first approach;*
  - *c) Ensures that the total operational energy demand at completion of the Loddon Valley Garden Village is met from renewable or low-carbon sources on*

site, prioritising opportunities for heat networks, community energy initiatives or other solutions which take advantage of the scale of the development;

- *d) Provides measures to reduce the whole-life impacts by creating adaptable, durable buildings and employing construction methods and materials which minimise embodied emissions; and*
- *e) Provide measures to reduce water consumption.*

- *Minerals and waste*
  - *The potential for on-site minerals resources which may be winnable through prior extraction should be informed by minerals resource assessments. Where viable, development proposals should respond and implement a strategy for prior extraction."*

10.2.38 Policy CE1: "Design principles for efficient buildings" sets out considerations relevant to the project's Energy and Sustainability Statement to ensure that the project effectively applies the energy hierarchy.

10.2.39 Policy CE2: "Environmental standards for non-residential development" sets energy and water standards for the mentioned development type, in particular:

- Site average space heating demand of 15-20 kWh/m^2/yr.
- Site average total energy demand of no more than 70 kWh/m^2/yr through a "fabrics first" approach.
- Individual units not having a total energy demand above 90 kWh/m^2/yr irrespective of on-site renewable energy production.

10.2.40 Policy CE3: "Environmental standards for residential development" sets energy and water standards for the mentioned development type, in particular:

- Site average space heating demand of 15-20 kWh/m^2/yr.
- Site average total energy demand of no more than 35 kWh/m^2/yr through a "fabrics first" approach.
- Individual units not having a total energy demand above 60 kWh/m^2/yr irrespective of on-site renewable energy production.

10.2.41 Policy CE4: "Supporting a circular economy" states that residential proposals of 10 or more dwellings, or non-residential proposals of 1000 m^2 or greater, will require an economic strategy as part of the Energy and Sustainability Statement. If the development involves demolition of existing buildings or structures, the circular economy strategy should include a pre-demolition audit.

10.2.42 Policy CE5: "Embodied carbon" states that residential development proposals of 50 dwellings or more, or non-residential proposals of 5000 m2 or greater must conduct a whole life carbon assessment that:

- Follows nationally recognised Whole Life-Cycle Carbon Assessment Methodology.

- Demonstrates implemented measures that reduce the development's impact on embodied carbon, particularly for major new build schemes.

10.2.43 Policy CE6: "Reducing energy consumption in existing buildings" touches upon improving energy efficiency, reducing carbon emissions, and overall sustainability principles for existing buildings to ensure their longevity. It also establishes retrofitting measures for listed buildings and buildings within conservation areas.

10.2.44 The LPU states further policies related to the proposed development:

- Policy SS2 – "Spatial strategy and settlement hierarchy" touches upon "the sustainable extension of defined major and modest settlements" and outlines the allowances and restrictions of community development depending on settlement size and location.

- Policy SS8 – "Meeting employment needs" outlines requirements for the development to provide and support workplaces that the local economy needs.

- Policy SS10 – "Meeting our housing needs" states the Council's objectives related to proving new dwellings.

10.2.45 The Right Homes, Right Places – Wokingham Borough emerging Local Plan (2023 - 2040) includes the following relevant policies:

10.2.46 Policy SS1: "Sustainable development principles" sets out key sustainable development principles to encourage proposals to contribute across economic, social and environmental objectives.

10.2.47 Policy SS13: "Loddon Valley Garden Village" includes the allocation at Loddon Valley Garden Village, and sets out development, place shaping and delivery principles.

10.2.48 Policy CE1:"Design principles for efficient buildings" lists a sequence of considerations that must be made and demonstrated through an Energy and Sustainability Statement, to ensure developments effectively apply the energy hierarchy. These considerations include in priority order:

- building orientation to optimise solar gain and minimise heat loss; efficient building form to enhance thermal performance;

- use of low-impact, durable materials to reduce both operational and embodied carbon;

- heat supply systems that avoid direct fossil fuel use;

- and on-site renewable energy generation sufficient to meet total annual energy demand

10.2.49 Policy CE2: "Environmental standards for non-residential development" is seeking to secure net zero non-residential developments through detailing energy and water standards. Non-residential development proposals are expected to:

- generate at least the same amount of renewable electricity on-site as it demands over the course of a year;

- achieve a site average space heating demand of around 15- 20kWh/m²/year;

- a site average total energy demand of no more than 70 kWh/m²/year through a 'fabric first' approach to construction. No individual unit is to have a total energy demand in excess of 90 kWh/m²/year, irrespective of amount of on-site renewable energy production.

- minimise their impact on the water environment by incorporating practical measures such as greywater recycling, rainwater harvesting, water-saving technologies, permeable surfacing, and, where appropriate, green roofs or walls.

10.2.50 Policy CE3: "Environmental standards for residential development" is seeking to secure net zero residential developments through detailing energy and water standards. Residential development is expected to

- generate at least the same amount of renewable electricity on-site as it demands over the course of a year;

- achieve a site average space heating demand of around 15-20kWh/m²/year;

- achieve a site average total energy demand of 35 kWh/m²/year, through a 'fabric first' approach to construction. No single dwelling is to have a total energy demand in excess of 60 kWh/m²/year, irrespective of amount of on-site renewable energy production.

- minimise their impact on the water environment by incorporating practical measures such as greywater recycling, rainwater harvesting, water-saving technologies, permeable surfacing, and, where appropriate, green roofs or walls.

10.2.51 Policy CE4: "Supporting a circular economy" states that residential development proposals of 10 dwellings or more, or non-residential development proposals of 1,000m² or greater, will be required to submit a circular economy strategy as part of the Energy and Sustainability Statement. Where proposals includes the demolition of existing buildings or structures, the circular economy strategy should include a pre-demolition audit.

10.2.52 Policy CE5: "Embodied carbon" states that residential development proposals of 50 dwellings or more, or non-residential development proposals of 5,000m² or greater, must demonstrate what measures have been taken to reduce embodied carbon, and major new build schemes should identify steps taken to reduce the development's impact on embodied carbon (for example regarding design and materials), through a whole-life carbon assessment following a nationally recognised Whole Life-Cycle Carbon Assessment methodology.

10.2.53 Policy CE7: "Low carbon and renewable energy generation" defines conditions for energy generating schemes, supporting those of appropriate size and scale, with no unacceptable impacts on landscape, biodiversity, agricultural land quality and food production, heritage assets, the character of the area and residential amenity. It also requires a minimum 10% biodiversity net gain and an end-of-life strategy.

10.2.54 Policy C1: "Active and Sustainable Transport and Accessibility" states that development proposals should promote active and sustainable transport, prioritising walking, cycling, and public transport. They should include inclusive infrastructure and support electric vehicle use. An accessible transport system for all ages and abilities is a priority, optimising connectivity and making active travel the first choice for short trips.

10.2.55 Policy C3: “Active Travel” sates that proposals must encourage active travel, focusing on walking, wheeling and cycling. They should enhance pedestrian routes to ensure safety and accessibility, improve wayfinding and support cycling through better public spaces and facilities.

10.2.56 Policy C5: “Parking and Electric Vehicle Charging” states that development proposals should provide adequate vehicle and cycle parking, considering accessibility needs. In addition, electric vehicle charging points must be included, and retrofitting in existing areas is encouraged. Residential developments of 10 or more units must submit an Electric Vehicle Charging Strategy.

10.2.57 Policy FD1: “Development and Flood Risk” states that proposals must address all flood risks, including historic flooding and climate change, aligning with national policy and the Strategic Flood Risk Assessment. Developments in Flood Zones 2 or 3 must consider vulnerability, and a site-specific Flood Risk Assessment is required for areas with known flooding issues.

10.2.58 Policy FD2: “Sustainable drainage” states that proposals should manage surface water sustainably and replicate greenfield runoff characteristics. SuDS must be included in residential developments of 10 or more dwellings, unless infeasible.

10.2.59 Policy NE1: “Biodiversity and geodiversity” states that developments must protect and enhance valuable biodiversity and geodiversity features, incorporating ecological surveys and management plans while avoiding habitat fragmentation.

10.2.60 Policy NE4: “Trees, woodland, hedges and hedgerows” states that proposals must protect existing trees and hedgerows and ensure their integration into the landscape, with sufficient space for growth. Any affected trees must be assessed, and mitigation is required for visual or conservation value losses.

10.2.61 Policy HC4: “Open Space, Sports, Recreation, and Play Facilities” states that developments affecting open space and recreation facilities will only be permitted where existing provision is surplus, suitable alternatives are available, or the proposal supports the site’s primary use, with new developments encouraged to support shared community use. Residential schemes must provide or contribute to open space and recreation in line with policy standards, with off-site financial contributions and long-term maintenance arrangements agreed with the council where on-site provision is not feasible.

10.2.62 Policy HC1: “Promoting Healthy Communities” focuses on fostering vibrant and safe communities through quality environments and local services that enhance health and wellbeing. Development proposals must assess their impact on residents' health and include strategies to promote healthier communities. A Health Impact Assessment (HIA) is necessary for residential developments with 10 or more units and non-residential projects exceeding 1,000 m².

Guidance and Best Practice

10.2.63 The main guidance used for this assessment has been:

- the Institute of Environmental Management and Assessment (IEMA) guide ‘Assessing Greenhouse Gas Emissions and Evaluating their Significance’[28]; and

[28] IEMA (2022): Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance. *2nd Edition*. [Online] Available at: https://www.iema.net/resources/blog/2022/02/28/launch-of-the-updated-eia-guidance-on-assessing-ghg-emissions, accessed 01/07/24.

- the IEMA EIA guide to 'Climate Change Resilience and Adaptation'[29].

10.2.64 Additional guidance used for the quantification of GHG emissions and climate risk assessment includes:

- the Greenhouse Gas Protocol suite of documents from the World Resources Institute and the World Business Council for Sustainable Development (WRI and WBCSD)[30];
- Valuation of Energy Use and Greenhouse Gas: Supplementary guidance to the HM Treasury Green Book from the Department for Energy Security and Net Zero (DESNZ, 2024)[31];
- UK Government GHG Conversion Factors for Company Reporting (DESNZ and BEIS, 2024)[32]; and
- The UK Green Building Council (UKGBC) Framework for Measuring and Reporting of Climate-related Physical Risks to Built Assets[33].

Predicting effects

Predicting Effects – GHG Emissions

10.2.65 In overview, GHG emissions have been estimated by applying published emissions factors and/or benchmark data to activities required for the Proposed Development. The emissions factors relate to a given level of activity, a physical or chemical process, or amount of fuel, energy or materials used to the mass of GHGs released as a consequence.

10.2.66 The assessment methodology for GHG emission calculations also follows the outlined methodology set out in the EIA Scoping Request (Appendix 5.1) for Loddon Valley Garden Village SDL, which includes to the Proposed Development Site. WBC adopted the provisions relevant to this Climate Change Chapter in their entirety within the Scoping Opinion (Appendix 5.2). However, WBC did request that sulphur hexafluoride (SF_6) emissions, which were initially proposed to be scoped out, be retained within the assessment scope for consistency with scope 3 assumptions used in BS 15978 and PAS 2080. This request has been addressed by including SF_6 within the CO_2e calculations using normalised benchmarks, ensuring alignment with WBC's expectations and national guidance. No further specific requirements were raised by WBC in relation to climate change assessment methodology.

10.2.67 Further detail of the approach, data inputs, assumptions and boundaries of the calculations is given in Appendix 10.1: GHG Emission Calculations.

[29] IEMA (2020): Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation. [Online] Available at: https://www.iema.net/resources/reading-room/2020/06/26/iema-eia-guide-to-climate-change-resilience-and-adaptation-2020, accessed 01/07/24.
[30] WRI and WBCSD (2004): The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard. Revised edition, Washington and Geneva: WRI and WBCSD.
[31] DESNZ (2023): Valuation of Energy Use and Greenhouse Gas: Supplementary guidance to the HM Treasury Green Book. [Online] Available at: https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal, accessed 01/07/24.
[32] DESNZ and BEIS (2024): Government Conversion Factors for Company Reporting of Greenhouse Gas Emissions. [Online] Available at: https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting, accessed: 01/07/24.
[33] UKGBC (2022): A Framework for Measuring and Reporting of Climate-related Physical Risks to Built Assets. [Online] Available at: https://ukgbc.org/wp-content/uploads/2022/02/UKGBC-Measuring-and-Reporting-Physical-risk-Report.pdf, accessed 01/07/24.

10.2.68 The GHGs considered in this assessment are those in the 'Kyoto basket'[34] of global warming gases expressed as their CO_2-equivalent (CO_2e) global warming potential (GWP). GWPs used are typically the 100-year factors in the Intergovernmental Panel on Climate Change Sixth Assessment Report[35] or as otherwise defined in emissions factors and for national reporting under the United Nations Framework Convention on Climate Change (UNFCCC).

10.2.69 The main emissions sources within the boundary of the assessment comprise:

- the 'embodied carbon' of materials used in construction;
- transport of materials to site and use of construction plant;
- operational energy consumption; and
- operational transport.

Impact Magnitude

10.2.70 As GHG emissions can be quantified directly and expressed based on their GWP, the magnitude of impact is reported numerically as tCO_2e rather than requiring a descriptive scale.

Receptor Sensitivity

10.2.71 GHG emissions have a global effect rather than directly affecting any specific local receptor to which a level of sensitivity can be assigned. The global atmospheric mass of the relevant GHGs and consequent warming potential, expressed in tCO_2e, has therefore been treated as a single receptor of high sensitivity. It is considered to be of **high** sensitivity given the importance of the global climate as a receptor, the limited and decreasing capacity to absorb further GHG emissions without severe climate change resulting, and the cumulative contribution of GHG emission sources.

Effect Significance

10.2.72 The IEMA assessment guidance for GHG emissions describes five levels of significance for emissions resulting from a development, each based on whether the GHG emission impact of the development will support or undermine a science-based 1.5°C compatible trajectory towards net zero.

10.2.73 To aid in considering whether effects are significant, the guidance recommends that GHG emissions should be contextualised against pre-determined carbon budgets, or applicable existing and emerging policy and performance standards where a budget is not available or not meaningfully applicable at the scale of development assessed. It is a matter of professional judgement to integrate these sources of evidence and evaluate them to determine significance.

10.2.74 Taking the guidance into account, the following have been considered in contextualising the Proposed Development's GHG emissions:

- the magnitude of net GHG emissions in construction and operation as a percentage of national and local carbon budgets;

[34] The 'Kyoto Basket' encompasses the following greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), nitrogen trifluoride (NF_3), hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride (SF_6).
[35] Table 7.15 in IPCC (2021): Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)].

- the GHG emissions intensity of the Proposed Development at lifecycle stages A1-A5 (materials and products manufacturing, transport to site, and installation) relative to business-as-usual and good-practice performance benchmarks;
- the GHG emissions intensity of the Proposed Development's operational energy use relative to business-as-usual and good-practice performance benchmarks; and
- whether the Proposed Development contributes to, and is in line with, the applicable UK policy for GHG emissions reductions, where this policy is consistent with science-based commitments to limit global climate change to an internationally-agreed level (as determined by the UK's current Nationally Determined Contribution under the Paris Agreement).

10.2.75 Effects from GHG emissions are described in this chapter as adverse, negligible or beneficial based on the following definitions, which closely follow the examples in Box 3 of the IEMA guidance.

- **Major Adverse:** the Proposed Development's GHG impacts would not be compatible with the UK's net zero trajectory. Its GHG impacts would not be mitigated, or may be compliant only with do-minimum standards set through regulation. The Proposed Development would not provide further emissions reductions required by existing local and national policy for projects of this type. A project with major adverse effects is locking in emissions and does not make a meaningful contribution to the UK's trajectory towards net zero.
- **Moderate Adverse:** the Proposed Development's GHG impacts would not be fully compatible with the UK's net zero trajectory. Its GHG impacts would be partially mitigated and may partially meet the applicable existing and emerging policy requirements, but it would not fully contribute to decarbonisation in line with local and national policy goals for projects of this type. A project with moderate adverse effects falls short of fully contributing to the UK's trajectory towards net zero.
- **Minor Adverse:** the Proposed Development's GHG impacts would be compatible with the UK's 1.5°C-aligned trajectory and would be fully consistent with up-to-date policy and good practice emissions reduction measures. The Proposed Development may have residual emissions, but these are substantially reduced. A project with minor adverse effects is fully in line with measures necessary to achieve the UK's trajectory towards net zero.
- **Negligible:** the Proposed Development would achieve emissions mitigation that goes well beyond existing and emerging policy compatible with the 1.5°C-aligned trajectory, such that radical decarbonisation or net zero is achieved well before 2050. A project with negligible effects provides GHG performance that is well 'ahead of the curve' for the trajectory towards net zero and has minimal residual emissions.
- **Beneficial:** the Proposed Development would result in emissions reductions from the atmosphere, whether directly or indirectly, compared to the without-project baseline. As such, the net GHG emissions would be below zero. A project with beneficial effects substantially exceeds net zero requirements with a positive climate impact.

10.2.76 **Major** and **moderate adverse** effects and **beneficial** effects are considered to be significant.

10.2.77 **Minor adverse** and **negligible effects** are considered to be not significant.

Geographical Scope

10.2.78 GHG emissions have a global effect rather than directly affecting any specific local receptor. The impact of GHG emissions occurring due to the Proposed Development on the global atmospheric concentration of the relevant GHGs, expressed in CO_2e, will be considered in the assessment. As GHG impacts are global and cumulative with all other sources, no specific geographical study area is defined for the identification of receptors or assessment of effects.

10.2.79 However, GHG emissions caused by an activity are often categorised into 'scope 1', 'scope 2' or 'scope 3' emissions, following the guidance of the WRI and the WBCSD Greenhouse Gas Protocol suite of guidance documents.

- Scope 1 emissions: released directly by the entity being assessed, e.g. from combustion of fuel;
- Scope 2 emissions: caused indirectly by consumption of imported energy, e.g. from generating electricity supplied through the national grid; and
- Scope 3 emissions: caused indirectly in the wider supply chain, e.g. the embodied carbon in materials, transportation, or the disposal of waste products.

10.2.80 The assessment has sought to include emissions from all three scopes, where this is material and reasonably possible from the information and emissions factors available, to capture the impacts attributable to the Proposed Development.

10.2.81 The majority of GHG emissions are likely to occur within the territorial boundary of the UK and hence within the scope of the UK's national carbon budgets. However, in recognition of the climate change effect of GHG emissions (wherever occurring) and the need, as identified in national policy, to avoid carbon leakage overseas when reducing UK emissions, potential scope 3 GHG emissions that may physically occur outside the UK have been considered where relevant.

Temporal Scope

10.2.82 GHG emissions from the construction and occupation phases of the Proposed Development have been assessed. As the application is not for a time-limited planning permission, and there is no end of life stage defined, decommissioning effects have not been assessed.

10.2.83 GHG emissions reporting follows the indicative phasing outlined earlier within the ES, with further detail listed below:

- Commencement of development – Q1 2027 (operational emissions from retained buildings and traffic)
- First completions/occupation – Q3 2028 (construction emissions from the Proposed Development and operational emissions from retained buildings, traffic and the Proposed Development)
- Completion of development – 2042 (construction emissions from the Proposed Development and operational emissions from retained buildings, traffic and the Proposed Development)

10.2.84 The varying atmospheric residence time of GHGs once emitted, and their differing climate impact, has been considered through the use of 100-year GWP factors to express these in a common CO_2e metric.

10.2.85 The timing of GHG emission impacts and mitigation (reductions) is also a part of evaluating the significance of effects, due to the cumulative heating effect of changing GHG concentrations in the atmosphere. For example, achieving net zero or reduced emissions by 2035 instead of 2045 would avoid a decade of cumulative heating, with consequences in the long term for the likelihood of remaining with a global 1.5°C or 2°C average temperature change.

Predicting Effects – Climate Risks

10.2.86 A risk assessment matrix approach has been used to evaluate the potential impact of climatic hazards, consequence, likelihood and resulting risk profile to the Proposed Development. This has been informed by the UKGBC guidance 'A Framework for Measuring and Reporting of Climate-related Physical Risks to Built Assets'[36].

10.2.87 The risk assessment is provided in Appendix 10.2 which defines the qualitative scales used to describe the probability and consequence of each hazard, and how the resulting risk score is determined. Receptor sensitivity is not directly defined, but rather a range of risk consequences from 'minor' to 'severe' is used, the definitions of which are formulated with regard to the sensitivity of buildings, businesses and residents or workers to hazards.

10.2.88 The scale of risk is from 'very low' to 'very high'. Risk ratings greater than 'moderate' have been considered to be significant.

Geographical Scope

10.2.89 The UKCP18 dataset provides probabilistic projections in 25 km grid squares. The primary geographical scope is the 25 km grid square in which the Proposed Development is located. However, regional and national trends from the UKCP18 overview report have also been considered as further context.

Temporal Scope

10.2.90 Given the first complete year of full operation (2039) and the potential longevity of its operational lifetime (not being proposed to be subject to a time-limited consent), the temporal scope of the assessment has been based on probabilistic climate change anomaly projections for the time periods 2030-2059 and 2070-2099 to consider the initial period after completion, and long-term risks out to the end of the century.

Predicting Effects – Inter-Related Effects

10.2.91 The assessment has considered how impacts of the Proposed Development, in combination with the effects of climate change, may affect receptors throughout the construction phase and occupational lifetime.

10.2.92 There are two ways in which climate change could exacerbate or ameliorate the effects of the Proposed Development on sensitive receptors. Firstly, climate change could alter the sensitivity of receptors or the baseline environment, thereby increasing the significance of effects; and secondly, climate change could modify an impact pathway, i.e. by changing the magnitude or spatial extent and introducing new receptors.

[36] UKGBC: A Framework for Measuring and Reporting of Climate-related Physical Risks to Built Assets: https://ukgbc.org/wp-content/uploads/2022/02/UKGBC-Measuring-and-Reporting-Physical-risk-Report.pdf, accessed 29/07/24

10.2.93 The assessment is qualitative only and does not aim to be determinative of significance levels, which have been assessed in the applicable ES topic chapters; but identifies where there is the potential for inter-related effects to increase or decrease the significance of effects reported alone.

10.2.94 The potential avenues for inter-related effects are presented in Appendix 10.3.

Geographical Scope

10.2.95 The geographical scope for inter-related effects would be that of the individual impact pathways, as reported in the respective ES topic chapters.

Temporal Scope

10.2.96 The inter-related effects of climate change on the Proposed Development have been assessed for the construction and occupation phase.

Consultation

10.2.97 An EIA Scoping Report was submitted to WBC in December 2024 and a response received on the 28th February 2025.

10.2.98 A single EIA Scoping Opinion was requested from WBC relating to development across all land interests within Loddon Valley Garden Village. A request for an EIA Scoping Opinion was submitted in December 2024 in order to agree the scope with WBC prior to the commencement of assessments. The purpose of EIA Scoping Report was to provide sufficient information for WBC to consider and consult upon the scope of the EIA.

10.2.99 The assessment methodology for GHG emissions and climate risk presented in this chapter is consistent with the approach outlined in the EIA Scoping Report submitted by the Applicant. WBC issued a Scoping Opinion in March 2025 which endorsed the proposed methodology in its entirety, without requesting amendments to the overall approach. As mentioned earlier, the only specific clarification requested by WBC related to the inclusion of sulphur hexafluoride (SF_6) within the scope of assessment, which has been addressed by incorporating SF_6 into the CO_2e calculations using normalised benchmarks, allowing for consistency in the reporting with scope 3 assumptions used from BS 15978 and PAS 2080

10.2.100 No further consultation specific to climate change has been undertaken with statutory consultees and/or other relevant consultees in relation to the scope and/or methodology of the assessment.

Assumption and Limitations

10.2.101 There are two main limitations to the assessment. Firstly, the Proposed Development is subject to an outline planning application with all matters, except access, reserved, and hence is at an early parameters-based stage of design. The assessment has therefore used broad and conservative assumptions for a ‘business-as-usual’ case to estimate the magnitude of GHG emission impacts prior to further mitigation that could be specified at the detailed design stage.

10.2.102 Secondly, both the GHG impacts and the climatic risks to the Proposed Development over its life could change depending on the global warming trajectory that eventuates and on adaptation or mitigation at a national level, e.g. decarbonisation of energy supplies and transport. The assessment has used climate projections based on present-day knowledge. The climate projections used provide a probabilistic range of data which allows for known uncertainties. With regard to GHG emissions, present-day emission factors in Defra and

DESNZ guidance have been used, which represents a conservative position given the expected decarbonisation over time, but future projections have also been considered where available.

10.3 Baseline Conditions

Current Baseline

10.3.1 The current GHG emissions from the Site prior to development have been estimated based on its existing uses which include a small number of de minimis agricultural buildings, and farmland. Based on benchmarked energy consumption for similar facilities. Emissions from the remaining buildings are considered negligible, contributing less than 5 tCO_2e/year. Agricultural land use, assuming low-intensity operations without intensive livestock or fertiliser application, is estimated to contribute 10–30 tCO_2e/year, primarily from soil management and machinery use. Additionally, transport emissions associated with these uses—such as light vehicle movements, farm machinery, and occasional deliveries—are estimated to contribute a further 10–25 tCO_2e/year. Taken together, the total current GHG emissions from the Site are estimated to fall within the range of 25–60 tCO_2e/year. These figures represent a conservative estimate and are intended to provide a contextual baseline for assessing the impact of the Proposed Development.

10.3.2 With regard to current climate, the baseline is the local and regional climate and resulting weather patterns recorded in Met Office data. This is in the context, however, of trends in global climate changes affecting the UK climate, which at their present rates may be considered part of the known baseline. The change in baseline over time with climate change is set out in Appendix 10.2.

Future Baseline

10.3.3 The future baseline for GHG emissions is assumed to be the continuation of farmland, which would remain a *de minimis* source of GHG emissions and not significant to the assessment of Proposed Development impacts.

10.3.4 The potential future baseline for climatic conditions is shown in the probabilistic climate change projections set out in Appendix 10.2. This changing baseline will also affect the future baseline for other receptors, particularly the water environment, ecological receptors and landscape receptors, which is an inter-related effect of climate change. The future baseline with consideration of a changing climate is set out in the respective topic chapters of the ES and the potential avenues of inter-related effects are considered in Appendix 10.3.

10.4 Inherent Design Mitigation

Construction

10.4.1 The Sustainability Statement included in Appendix 3.1 of the ES contain details on material selection recommendations and lower-carbon alternatives to mitigate construction-stage embodied carbon impacts. In addition to this, the Construction Environmental Management Plan (CEMP) will include measures that will help to reduce the GHG impacts of construction activity on-site, through use of well-maintained plant, optimisation of construction methods and material use, retaining excavated material within the development area, and implementing best practice waste management.

10.4.2 Habitat creation can be considered to be inherent mitigation for the vegetation and soil carbon lost during the construction phase. However, it will take several decades for the woodland habitat to reach maturity and for this mitigation to be realised, and the continuing store of carbon

depends on the woodland then being retained in perpetuity. As such, while the potential carbon benefits of habitat creation are noted in the assessment, they are not relied upon as verified carbon offsets to mitigate construction-stage impacts.

10.4.3 There is no specific embedded design mitigation for climate risks in the construction phase. However, it is typical for reputable construction contractors to provide effective management of workforce health and safety related to weather conditions, and to use a project programme and construction methods adapted to weather risks (such as waterlogged ground conditions).

Operation

10.4.4 The Climate Change Statement for the Proposed Development puts forward mitigation measures that allow for carbon neutrality for buildings within the programme:

- Firstly, adopting a fabric-first approach combined with passive design strategies to minimise energy demand;
- Secondly, utilise efficient active systems within buildings;
- Offsetting any remaining operational emissions with on-site renewable energy generation (PV) sized to meet operational demands.

10.4.5 For reducing GHG emissions from operational transport, the embedded mitigation measures comprise:

- Car clubs;
- Mobility hubs;
- Electric Vehicle (EV) charging infrastructure in all residential buildings and some public charging points at the Park and ride;
- Cycle hire services;
- Cycle parking within every property, at the mobility hub, and new Park and Ride;
- Electric bicycle charging infrastructure
- Dedicated pedestrian and cycle routes within the Site.

10.4.6 With regard to climate risks, whilst the design of the development is still in outline, it is assumed that in line with standard practice, potable water efficiency and flood risk management / SuDS measures will be incorporated.

10.5 Potential effects prior to additional mitigation

Construction Phase

GHG Emissions

Impact Magnitude

10.5.1 The construction phase will involve earthworks to prepare the Site levels, other civils work, construction of buildings, roads and utilities, and planting of landscaping. Construction of the Proposed Development will cause direct and indirect GHG emissions from the fuel and energy used by construction plant and in the ‘embodied carbon’ of materials used. The embodied carbon refers to the indirect emissions in the supply chain for those materials: extracting and

transporting the raw materials, manufacturing them into products, and delivery of those products to site.

10.5.2 Landscaping is likely to involve a mixture of habitat creation, including grassland and scrub and some areas of tree planting. While the tree planting in particular has the potential to provide some carbon sequestration over the lifetime of the Proposed Development, the area of planting is not such that this would be material to the overall carbon balance, so it has not been assessed further in this assessment. A preliminary indication of the scale of carbon sequestration provided by the proposed planting can be found within the Climate Change Statement, submitted with this application.

10.5.3 At this early stage of masterplan development, the outline application is based on defined parameters rather than detailed design. As such, a full bill of quantities for construction materials has not yet been established. Consequently, construction-stage GHG emissions have been conservatively estimated using published benchmarks relevant to developments of this type. Where these benchmarks reflect 'business as usual' (BAU) construction practices, the potential for further mitigation has been considered and is discussed in the Additional Mitigation section.

10.5.4 Details of the benchmark values and GHG emission calculations are provided in Appendix 10.1: GHG Emission Calculations. The reported values represent conservative estimates, as they do not account for anticipated decarbonisation within the construction industry over the duration of the build. This is also due to the ongoing refinement of the Proposed Development's phasing plan.

10.5.5 It should be noted that the benchmarks used to assess embodied and operational carbon emissions in Appendix 10.1 may differ from those applied in the carbon calculations presented within the Climate Change Statement. The calculations for the ES have considered benchmarks aligned with a Future Homes Standard design, whereas the calculations within the Climate Change Chapter go further in ambition to reflect WBC's targets with reduced operational and embodied benchmarks. Therefore, while this ES aims to present a conservative (worst-case) scenario for emissions over time, it does not reflect the energy efficiency measures and sustainable building practices incorporated into the design, which are detailed in both the Climate Change Statement and the Sustainability Statement.

10.5.6 Construction traffic has not been separately assessed at this stage. Due to the phased nature of the Proposed Development, each year of the build-out period will involve a combination of construction and operational traffic.

10.5.7 The transport consultant has advised that construction traffic is excluded from the 2026 dataset, reflecting the limited activity expected during the early stages of development. The 2028 dataset includes both construction and operational traffic, aligned with the anticipated progress of the scheme at that time. By 2040, the Proposed Development is expected to be fully complete, and the dataset reflects operational traffic only.

10.5.8 Across all phases, the datasets used are considered to provide reasonably conservative estimates of traffic-related emissions.

10.5.9 The remainder of this ES chapter assesses the GHG emissions for the Proposed Development, full details of which can be found is ES Chapter 3.

10.5.10 For the 2027 phase, no construction-stage emissions are reported due to development commencing from this point.

10.5.11 For the 2028 phase, the total estimated construction-stage GHG emissions for the Proposed Development, with a BAU design, would be **4000 tCO_2e**.

10.5.12 For the 2042 phase, the total estimated construction-stage GHG emissions for the Proposed Development, with a BAU design, would be **30,400 tCO_2e**.

10.5.13 For the whole development, the total estimated construction-stage GHG emissions for the Proposed Development, with a BAU design, would be **34,400 tCO_2e**.

10.5.14 The calculations for these totals are presented in Appendix 10.1.

Significance of Effect

10.5.15 Paragraph 10.2.73 defined three ways in which GHG impact magnitude could be contextualised to aid in determining significance of effects: as a percentage of local carbon budgets; by comparison to benchmarked emissions intensity; and with reference to whether the impact is in line with national net zero- and Paris Agreement-compatible policy goals for carbon reduction.

10.5.16 The existing total GHG emissions baseline in Wokingham in 2022 (the latest year available) is **700,240 tCO_2e**, or **532,033 tCO_2e** if excluding sources considered to be outside the authority's influence (see Appendix 10.1).

10.5.17 For the Proposed Development, the construction-stage GHG emissions for the 2028 phase would be **0.004%** of the present-day baseline annual emissions in the local authority area, or **0.006%** of the present-day total baseline annual emissions under the local authority's influence.

10.5.18 For the 2042 phase, with the whole development completed, the construction-stage GHG emissions would be **0.32%** of the present-day baseline annual emissions in the local authority area, or **0.43%** of the present-day total baseline annual emissions under the local authority's influence.

10.5.19 The Tyndall Centre for Climate Change Research has recommended national and local authority-specific carbon budgets up to 2100 that, in its research, are considered to be an equitable distribution and compatible with a 1.5°C-aligned trajectory for the UK. The Tyndall Centre carbon budgets are more stringent than the UK national budgets (as advised by the Climate Change Committee): the budget for Wokingham would result in achieving near zero carbon[37] no later than 2042.

10.5.20 The recommended future carbon budget for Wokingham is approximately **1,720,000 tCO_2** in total for the construction period 2027-2042. Recommended future Wokingham carbon budgets have been calculated for each phase's period (see Appendix 10.1).

10.5.21 For the 2028 phase, the recommended future carbon budget for Wokingham is approximately **480,000 tCO_2** in total for the construction period 2027-2028. The construction-stage GHG emissions would be equivalent to **0.1%** of this budget for the Proposed Development at this point.

10.5.22 For the 2042 phase, the recommended future carbon budget for Wokingham is approximately **1,240,000 tCO_2** in total for the construction period 2029-2042. The construction-stage GHG

[37] The Tyndall Centre defines zero or near zero carbon as achieving CO2 levels >96% lower than in the Paris Agreement reference year of 2015, excluding non-CO2 GHGs and aviation and shipping emissions. The carbon budgets are for energy-related CO_2 emissions only.

emissions would be equivalent to **2.7%** of this budget for the Proposed Development at this point.

10.5.23 For the whole development, the recommended future carbon budget for Wokingham is approximately **1,720,000 tCO_2** in total for the construction period 2027-2042. The construction-stage GHG emissions would be equivalent to **2%** of this budget for the Proposed Development.

10.5.24 While the UK national carbon budgets do not provide a useful scale of context for individual development emissions, the trajectory of GHG reductions towards the UK's net zero goal that they define is relevant: the Fourth Carbon Budget (2023-27) and Fifth Carbon Budget (2028-32) require a 23% and 32% national reduction respectively compared to the baseline period of the Third Carbon Budget (2018-22). On the assumption of a business-as-usual approach, the Proposed Development may not include measures to reduce its construction-stage impacts in line with this trajectory.

10.5.25 National and local policy and expert guidance, referenced at the start of this chapter, requires *"radical reductions in GHG emissions"* in the UK economy and built environment. Advice from the Climate Change Committee is that that buildings remain the UK's second-highest emitting sector and there is a need for a significant increase in the pace of emission reductions and on-the-ground delivery of policy measures to achieve the UK's net zero emissions. With an assumed business-as-usual approach, absent further mitigation, this would not be achieved by the Proposed Development during its construction phase.

10.5.26 Taking these contextual factors into consideration, and in line with the significance of effect definitions set out in paragraph 10.2.75 and the high sensitivity of the receptor, it is judged that the embodied carbon of the Proposed Development could have a **minor adverse** effect that is **not significant**, prior to further mitigation.

10.5.27 Evidence-based performance targets that could be adopted for mitigating construction-stage GHG impacts have been developed and are emerging from bodies such as RIBA, LETI and the UKGBC. More onerous benchmarks by these industry standards have been considered within the calculations presented in the Climate Change Statement, and are discussed in the Additional Mitigation section, below.

Climate Risks

10.5.28 The construction phase is expected to be from 2027 to 2042, i.e. starting around two years from the present day. Climate change in the UK is ongoing but conditions in the near future, during the early construction period, are not likely to differ substantially to those encountered at present. Greater change may become apparent towards the end of the construction period and risks have been considered on that basis.

10.5.29 As discussed in the assessment approach section, and detailed in Appendix 10.2, the climate risk assessment uses a matrix of the probability of hazard occurrence and the severity of consequence to estimate risk, with risk ratings of moderate or greater considered to be significant. Magnitude of impact and sensitivity of receptor are therefore not separately defined in this section.

10.5.30 Potential climatic risks during the construction period are to the workforce, for example in summer 'heatwave' conditions with high peak temperatures, to the public from increased risk of construction dust in drought conditions, and also the risk of programme disruption, for example where snow / ice, high wind or waterlogged ground prevent certain construction works. The risk assessment in Appendix 10.2 indicates that before consideration of mitigation,

workforce risk could be **moderate**, which is considered to be **significant.** Other risks would be low, which is not significant.

Operational Phase

GHG Emissions

10.5.31 Operation of the Proposed Development will cause direct and indirect GHG emissions due to the use of electricity within the buildings and combustion of fuel from the additional road traffic generated by the Proposed Development. These will largely occur outside the Site boundary, and although a number of key aspects of development design can strongly influence these emissions, it is also acknowledged that demand for residential developments means these emissions may also occur at an alternative site without the Proposed Development. Nevertheless, being a consequence of operational use of the Proposed Development, these are included in the assessment.

10.5.32 There could also be embodied carbon from maintenance and refurbishment work during the buildings' lifetime. This would be dependent on resident choices and is difficult to estimate at an outline planning stage. Given the expected UK trajectory of decarbonisation to 2050, future maintenance and refurbishment is likely to have substantially lower carbon intensity than the initial construction stage (assessed above), so has not been separately estimated in this assessment.

10.5.33 Details of the GHG emission calculations are given in Appendix 10.1: GHG Emission Calculations, along with potential emission totals for the considered phasing stages within this ES.

10.5.34 Baseline present day operational emissions across the Proposed Development has not been calculated for the 2027 phase due to development only commencing from that point.

10.5.35 For the 2028 phase of the Proposed Development, operational emissions from grid-supplied energy are estimated at **110 tCO_2e/annum** using present-day emission factors, or **28 tCO_2e/annum** using projected 2028 emission factors. These figures account for energy use from the first 50 completed and occupied residential units.

10.5.36 For the 2042 phase of the Proposed Development, operational emissions from grid-supplied energy are estimated at **950 tCO_2e/annum** using present-day emission factors, or **55 tCO_2e/annum** using projected 2042 emission factors. These figures account for energy use across the fully completed Proposed Development.

10.5.37 The Transport Assessment accompanying the planning application provides daily trip generation figures for the Proposed Development. These have been multiplied up to annual figures on a conservative (maximum-case) basis assuming 365 days of annual vehicle trips.

10.5.38 The assessment of GHG emissions from transport has focused on commuting emissions from car trips, and does not further assess emissions associated with modal shift to bus use, which presents a conservative scenario. A commuting distance of 19km (based on Census data) has been used for car commuting. Calculations for traffic emissions are presented in appendix 10.1.

10.5.39 Baseline present day transport emissions from total vehicle trips based on 2025 traffic data are estimated to be **15,143 tCO_2e/annum.**

10.5.40 Transport emissions from total vehicle trips of each phase are estimated to be **15,405 tCO_2e/annum** for the 2027 phase,**17,223 tCO_2e/annum** for the 2028 phase, and **19,311 tCO_2e/annum** for the 2042 phase. This is based conservatively on present-day emissions

factors, and is likely to become lower over the Proposed Development's operating lifetime, particularly with the phase-out of new petrol and diesel light vehicle sales expected in the 2030s.

Significance of Effect

10.5.41 Paragraph 10.2.73 defined three ways in which GHG impact magnitude could be contextualised to aid in determining significance of effects: as a percentage of local carbon budgets; by comparison to benchmarked emissions intensity; and with reference to whether the impact is in line with national net zero- and Paris Agreement-compatible policy goals for carbon reduction.

10.5.42 The existing total GHG emissions baseline in 2022 in Wokingham (see Appendix 10.1) for the domestic sector is estimated to be **307,774 tCO_2e/annum** with the total local authority area emissions being **700,240 tCO_2e/annum**.

10.5.43 The existing total GHG emissions baseline in 2022 in Wokingham under authority influence for the domestic sector is estimated to be **227,074 tCO_2e/annum** with the total local authority area emissions is **537,249 tCO_2e/annum**.

10.5.44 Operational GHG emissions for the 2028 phase equates to **110-28 tCO2e/annum**. This is equivalent to **0.015% – 0.004%** of the total present-day baseline annual local authority emissions, or **0.02% – 0.005%** of the total emissions under the authority's influence.

10.5.45 Operational GHG emissions for the 2042 phase equates to **950-55 tCO2e/annum**. This is equivalent to **0.38% – 0.02%** of the total present-day baseline annual local authority emissions, or **0.49% – 0.03%** of the total emissions under the authority's influence.

10.5.46 The Tyndall Centre for Climate Change Research recommended future carbon budget for Wokingham is approximately **320,000 tCO_2e/annum** during the period 2023-2027. As completion of the first phase of residential units is not predicted until 2028 there is expected to be no GHG emissions impact of operational energy use for the Proposed Development for both baseline conditions and the 2027 phase using present-day emission factors.

10.5.47 The Tyndall Centre for Climate Change Research recommended future carbon budget for Wokingham is approximately **160,000 tCO_2e/annum** during the period 2028-2032. The GHG emissions impact of operational energy use for the Proposed Development for baseline conditions would be equivalent to **0.28%** of this budget using present-day emission factors, or **0.07%** of this budget if using future-year emissions factors.

10.5.48 The Tyndall Centre for Climate Change Research recommended future carbon budget for Wokingham is approximately **40,000 tCO_2e/annum** during the period 2038-2042. The GHG emissions impact of operational energy use for the Proposed Development for the 2042 phase would be equivalent to **2.37%** of this budget using present-day emission factors, or **0.14%** of this budget if using future-year emissions factors. With regard to comparison to performance benchmarks, at this outline stage prior to detailed design and energy strategy, conservative benchmark values have been used for the assessment.

10.5.49 With regard to comparison to performance benchmarks, at this outline stage prior to detailed design and energy strategy, conservative benchmark values have been used for the assessment.

10.5.50 With regard to policy measures for emissions reduction, it is understood that the Proposed Development would use electricity for regulated and unregulated energy demand, which would offer GHG emissions reductions compared to gas-fired heating, and enables the development to benefit from expected future reductions in the carbon intensity of electricity supply. However, at this outline stage of design, further measures to reduce energy use in line with local and

national policy are not established. A preliminary energy strategy outlined within the Climate Change Statement indicates that any remaining operational emissions from proposed buildings, after demand reduction measures, will be offset by on-site photovoltaic panels (PVs).

10.5.51 Taking these contextual factors into consideration, and in line with the significance of effect definitions set out in paragraph 10.2.75 and the high sensitivity of the receptor, it is judged that the Proposed Development could have a **moderate adverse** effect from operational energy use that is **significant**, prior to mitigation measures. The incorporation of the proposed energy strategy, including the use of a fabric-first approach, efficient active systems, and on-site renewable energy generation through photovoltaic panels sized to match operational demand, forms part of the Inherent Design Mitigation for the Proposed Development. These measures are embedded within the design from the outset and are intended to reduce operational greenhouse gas emissions to have a **minor adverse** effect, to a level that is **not significant.**

10.5.52 For baseline conditions the Proposed Development, the transport GHG emissions would be equivalent to **4.9% or 8.8%** of the present-day baseline annual local authority area emissions in the transport sector for both totals, or **4.8%** of the recommended annual total carbon budget for Wokingham in 2023-2027 according to the Tyndall Centre budget.

10.5.53 For the 2027 phase of the Proposed Development, the transport GHG emissions would be equivalent to **5% or 8.9%** of the present-day baseline annual local authority area emissions in the transport sector for both totals, or **4.81%** of the recommended annual total carbon budget for Wokingham in 2023-2027 according to the Tyndall Centre budget.

10.5.54 For the 2028 phase the Proposed Development, the transport GHG emissions would be equivalent to **5.6% or 10%** of the present-day baseline annual local authority area emissions in the transport sector for both totals, or **11.4%** of the recommended annual total carbon budget for Wokingham in 2028-2032 according to the Tyndall Centre budget.

10.5.55 For the 2042 phase of the Proposed Development, the transport GHG emissions would be equivalent to **6.3% or 11.2%** of the present-day baseline annual local authority area emissions in the transport sector for both totals, or **48%** of the recommended annual total carbon budget for Wokingham in 2038-2042 according to the Tyndall Centre budget.

10.5.56 The Proposed Development Site is located to form an extension to the urban area of Wokingham and incorporates local services for amenities (and education should the need for a primary school be progressed). This reduces the need for longer trips to access services and improves the feasibility of active transport options for residents. However, at this outline stage of design, typical road transport for commuting and other trips has been assumed for the assessment.

10.5.57 Taking these contextual factors into consideration, and in line with the significance of effect definitions set out in paragraph 10.2.75 and the high sensitivity of the receptor, it is judged that the Proposed Development could have a **moderate adverse** effect from transport emissions that is **significant**, prior to additional mitigation.

Climate Risks

10.5.58 Potential climatic risks to the buildings and residents of the Proposed Development have been assessed for the periods of 2030-2059 and 2070-2099 for a high global emissions scenario, for a maximum-case assessment.

10.5.59 The climate projections data show increased intensity in seasonal precipitation trends: precipitation is predicted to decrease during the driest season and month, and increase during the wettest season and month. Temperatures are anticipated to increase annually relative to

the 1981-2010 baseline, both during the coldest and hottest seasons and months. Finally, humidity is also expected to increase during both the summer and winter, and hence the annual average will increase.

10.5.60 The main hazards considered potentially applicable are as follows:

- pluvial flooding of Site or access;
- overheating of buildings due to high temperatures;
- decline in water resource supply or quality caused by drought;
- structural damage caused by extreme storm and wind events, or heat stress leading to expansion and buckling;
- disruption or storm damage to road network surrounding Site;
- shrinking and swelling of soils due to excessive rainfall and drought cycles, leading to subsidence;
- building fabric damage due to condensation/mould from increased humidity;
- poorer indoor air quality from open windows/doors for ventilation during high temperatures;
- increase in fuel poverty from increase in cooling demand; and
- landscaping/habitat failure or increased watering or maintenance requirements.

10.5.61 Appendix 10.2 sets out the risk assessment matrix for these hazards, considering probability, consequence and the embedded mitigation.

10.5.62 The flood risk and adaptation of the Site in order to mitigate it is detailed in the Flood Risk Assessment accompanying the planning application. Of the remaining identified hazards, overheating of buildings affecting residents in high temperature events, building damage in storm events and high temperatures, and (depending on soil type) soil shrinkage leading to subsidence were judged to potentially have a '**moderate'** risk, which is considered to be **significant**.

10.6 Additional Mitigation

10.6.1 The preceding sections have set out the scientific and policy context requiring new development to both mitigate and adapt to climate change. At this outline planning stage, prior to detailed design, the assessment of potential impacts based on business-as-usual or benchmark data has indicated potential for significant adverse impacts from the Proposed Development, in the sense that a business-as-usual approach would be insufficient to meet the policy objectives to decarbonise the built environment and increase resilience to climate risks.

10.6.2 Accordingly, additional good-practice mitigation measures are recommended for the construction and operational stages of the Proposed Development where potentially significant adverse effects were identified, for incorporation within the detailed design and construction plan. Where necessary, these measures will go further to enable the Proposed Development to effectively mitigate GHG emissions and adapt to climate risks.

10.6.3 This would be in line with local policy CP1, SS1, and CE1 to encourage sustainability in all new developments and reduce GHG emissions and with the NPPF objectives to shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience to climate change.

Construction Phase

10.6.4 A potentially significant adverse effect from construction has been predicted prior to additional mitigation. The following section describes the recommended mitigation measures which could be adopted to reduce this impact to not significant, some of which are already considered within the Climate Change Statement.

Embodied Carbon

10.6.5 To mitigate embodied carbon impacts, a recognised framework should be used to set an appropriate emissions intensity target, to guide design, procurement and construction decisions accordingly, and to monitor and report on its achievement.

10.6.6 The UKGBC has published a framework definition for net zero buildings to define a target for substantially reduced or net zero emissions from construction, including use of offsetting for residual emissions if necessary. The pilot version of the full UK Net Zero Carbon Buildings Standard was published in September 2024[38], which builds on the UKGBC framework by setting recommended embodied carbon limits and performance standards, starting with 2025 as a baseline and ratcheting down the emissions performance in line with a sector-specific trajectory to net zero (compatible with the UK national commitments). This is a suitable standard to follow in order to achieve effective mitigation of construction-stage impacts for the proposed development's construction in 2027-2039.

10.6.7 Under this approach and meeting the UKGBC's 2030 performance standards, for example, the total construction stage GHG emissions would be reduced from **34,400 tCO_2e** to **12,470 tCO_2e** for the Proposed Development. This could be reduced further if later construction phases adopt increasingly tight UKGBC standards for later years.

10.6.8 Performance targets are also recommended in existing RIBA and LETI guidance, shown in Appendix 10.1 which could also be reviewed during detailed design to establish the appropriate good practice target to meet.

GHG Emissions Mitigation Measures

10.6.9 A whole life carbon assessment (WLCA) for the Proposed Development should be undertaken prior to RIBA Stage 4 – Technical Design, to identify construction carbon hotspots and guide optioneering to achieve reductions. This should follow the RICS guidance *'Whole Life Carbon Assessment (WLCA) 2nd Edition'*[39] (or any update prevailing at the time) and be undertaken with 'IMPACT'-compliant WLCA tools. An embodied carbon reduction target that meets or exceeds policy requirements for decarbonising the construction sector at that time should be set (as discussed above) and the WLCA used to identify a pathway to achieve that.

10.6.10 In overview, the Proposed Development's life cycle embodied carbon emissions can be reduced by using the following principles and examples. The appropriate and feasible measures will need to be determined during detailed design, and not all examples suggested at this stage may be feasible or the optimum solution.

Specify materials with low embodied carbon intensities

[38] UK Net Zero Carbon Buildings Standard (2024), https://www.nzcbuildings.co.uk/pilotversion, accessed 02/12/24.
[39] RICS (2023): Whole life carbon assessment for the built environment. 2nd edition. [Online] available at: https://www.rics.org/profession-standards/rics-standards-and-guidance/sector-standards/construction-standards/whole-life-carbon-assessment, accessed 07/02/24

- Use verified Environmental Performance Product Declarations and engage with or require the design & construction contractor to engage with tier one suppliers for the main materials and major engineered components to procure lower-carbon products.
- Identify big-ticket items, in terms of embodied carbon (e.g. foundations and superstructure) and evaluate the use of alternative materials (e.g. using concrete with a high cement replacement content or substituting the use of carbon intensive concrete and steel with a timber-framed structure).
- For concrete, substitution of a lower-carbon material in place of the carbon-intensive ordinary Portland cement should be considered, with cement substitution by low-carbon waste materials such as ground granulated blast-furnace slag or pulverised fuel ash (GGBS or PFA).
- For steel, specify 'green steel' where possible. Green steel can be defined as that which is made from 100% recycled steel, made in an electric arc furnace powered via 100% renewable energy.
- Consider the whole life carbon implications of material substitutes. In certain cases, materials with an initial higher embodied carbon content may be an optimal solution when considering the implications of durability, adaptability and operational energy use.

Regenerative design

- Specify building materials that have the capacity to remove CO_2 from the atmosphere (e.g. specify concrete with high carbonation potential or use of structural timber, thereby sequestering carbon within the structure over the course of the development's lifetime).
- Where appropriate (depending on structural requirements), make of use framing in engineered timber (CLT, glulam and LVL) or lightweight timber stud walls that are sustainably sourced, as verified by means of a FSC or PEFC certification, for example.
- Where appropriate, make use of wall panels with a timber carcass, OSB sheathing and hempcrete or and natural fibre insulation.

Source local building materials

- Particularly for bulk materials, sourcing these locally where possible will reduce transport GHG emissions.

10.6.11 It is important that the embodied carbon implications of the design are considered in parallel with the operational energy use related emissions and with a view to maintenance requirements, in order to optimise GHG emissions across the duration of the development's expected lifetime. For example, whilst designing more lightweight buildings (e.g. by using timber frames in place of masonry) may reduce the embodied carbon associated with construction, the reduced thermal mass of the buildings may have negative implications for operational energy use. Detailed dynamic thermal modelling is required alongside whole life carbon assessments in order to arrive at an optimal solution.

Construction management

10.6.12 Prior to commencement of construction, good working practices should be defined through the CEMP for the Proposed Development. Measures in the CEMP should ensure that, where

possible and relevant for the Proposed Development, construction activities generating GHG emissions are undertaken efficiently in order to minimise emissions in the following ways:

- construction materials should be sourced locally where possible, to minimise the impact of transportation;
- vehicles used in road deliveries of materials, equipment and waste arisings on- and off-site should be loaded to full capacity to minimise the number of journeys associated with the transport of these items;
- all machinery and plant should be procured to adhere with emissions standards prevailing at the time and should be maintained in good repair to remain fuel efficient;
- when not in use, vehicles and plant machinery involved in site operations should be switched off to further reduce fuel consumption;
- where possible, local waste management facilities should be used to dispose of all waste arisings, to reduce distance travelled and associated emissions;
- the volume of waste generated should be minimised, and resource efficiency maximised, by applying the principles of the waste hierarchy throughout the construction period including use of segregated waste storage to maximise recycling potential for materials;
- where possible, welfare cabins, site lighting and similar equipment which incorporates on-site renewable energy supply should be procured; typically units with PV panels and, where applicable, battery storage are commercially available; and
- where possible, hiring/purchasing alternative fuel/electric construction plant; at the time of writing, fully electric, hybrid or hydrogen-adapted plant (fuel cell or hydrogen reciprocating engine power packs) is now becoming more readily available. Either as demonstrators or for smaller plant items is already available on the market from major manufacturers. Such plant may become more widely available at the time of construction work from 2026 onwards.

Roles and responsibilities

10.6.13 PAS2080 and associated guidance from the ICE[40] and the CLC[41] provide a helpful structure for roles and responsibilities at each project stage. While these standards are applicable to infrastructure developments, the structure of roles and responsibilities is considered to be useful and relevant to major developments of any type. In brief, the suggested structure of roles and responsibilities is likely to mean that at the current early design stage, the Applicant's responsibility as the project owner and initial designer is to:

- take account of whole-life carbon in decision-making and procurement;
- apply the carbon reduction hierarchy (avoid/switch/improve);

[40] ICE, 2023: Guidance Document for PAS2080. Available at https://www.ice.org.uk/media/vm0nwehp/2023-03-29-pas_2080_guidance_document_april_2023.pdf, accessed 06/01/25
[41] CLC, undated: Guidance Document for PAS2080. Available at https://www.constructionleadershipcouncil.co.uk/wp-content/uploads/2019/06/Guidance-Document-for-PAS2080_vFinal.pdf, accessed 06/01/25

- set a clear carbon vision, leadership and initial carbon reduction target for the works; and
- not over-constrain the design specification too early, which may limit carbon reduction and innovation opportunities.

10.6.14 When appointing a design and construction contractor, or an internal delivery team, their carbon management policies could be considered a factor within the decision making process of appointment. This could be on the basis of a contractor's or internal team's own performance record, documented corporate strategy and targets for moving towards net zero, and/or specific carbon management and innovation questions at tendering stage.

10.6.15 At the further design and delivery stage, the lead responsibility for managing carbon and achieving reductions will typically transition to the appointed design and construction contractor or internal delivery team, with the project owner being in a monitoring role.

Climate Risks

10.6.16 A moderate risk was found during the construction phase to the construction workforce as a result of high temperature and/or humidity conditions. For construction workers' welfare, the following good-practice measures, drawn from HSE guidance[42], should be incorporated into the Construction Environmental Management Plan.

Cold environments

- Ensure the personal protective equipment issued is appropriate
- Provide mobile facilities for warming up, and soup or hot drinks
- Introduce more frequent rest breaks
- Consider delaying the work until warmer times of the year without compromising on safety
- Make sure workers can recognise the early symptoms of cold stress, such as a cough or body aches

Hot environments

- Reschedule work to cooler times of the day where needed
- Provide more frequent rest breaks and introduce shading to rest areas
- Provide free access to cool drinking water
- Introduce shading in areas where people are working
- Encourage workers to remove personal protective equipment when resting to help encourage heat loss
- Make sure workers can recognise the early symptoms of heat stress

Operational Phase

[42] HSE, undated: Outdoor Working. https://www.hse.gov.uk/temperature/employer/outdoor-working.htm

Energy

10.6.17 A potentially significant adverse effect from energy consumption has been predicted prior to further mitigation.

10.6.18 As with the construction phase, the pilot version of the UK Net Zero Carbon Buildings Standard could be followed in order to achieve effective mitigation of operational-stage impacts for the proposed development. If meeting the UKGBC's 2030 performance standards, the total operational stage GHG emissions are estimated to be reduced from **950 tCO2e/annum** to **781 tCO2e/annum** for using present-day emissions factors.

10.6.19 The UK Net Zero Carbon Buildings Standard also sets minimum requirements for on-site renewable energy generation, which would be 65 kWh/m^2 building footprint / year for single family homes and single-storey storage and distribution, and 40 kWh/m^2 building footprint / year for all other building types. This is treated under the Standard as being a zero-emission supply because the embodied carbon of PV panels would be included in the up-front construction stage carbon performance standard. With these on-site renewable generation targets met together with the energy use intensity targets, the Proposed Development could see a saving of **453 tCO_2e/annum** using present-day emissions factors.

10.6.20 Managing energy consumption and the source of supply is a fundamental element of reducing GHG emissions for a development of this nature. A detailed, site-specific Energy Strategy should be developed, supported by demand and supply modelling, at the detailed design stage to evaluate options that would be feasible to meet the on-site heat and power demand and set a site-wide GHG emissions reduction target for energy compared to a business-as-usual scenario. The energy hierarchy should be followed, i.e. 'Be Lean', 'Be Clean', 'Be Green'. Provision of renewable energy should be considered where feasible, in line with local policy requirements.

10.6.21 A post-occupancy evaluation should be undertaken, in order to minimise the performance gap between as-designed energy use and actual energy use and provide useful feedback on the efficacy of measures employed, which can inform other development.

Transport

10.6.22 A potentially significant adverse effect due to GHG emissions from traffic generation has been predicted prior to further mitigation. Residents' travel and deliveries are not fully within the developer's direct control to mitigate. Solutions through national measures around tightening vehicle emission standards and future bans on fossil-fuelled private car sales, as laid out under current policy, can be expected; however, this also relies on provision of suitable supporting infrastructure at public and private sites such as the Proposed Development.

10.6.23 The following additional site-level mitigation is therefore recommended.

- A Travel Plan should be implemented to achieve modal shift away from private cars.
- Provision of high capacity electric vehicle charging points for all parking spaces, notwithstanding exemptions under Part S.

Climate Resilience and Adaptation

10.6.24 Flood risk and appropriate mitigation are detailed in the Flood Risk Assessment accompanying the planning application.

10.6.25 Of the remaining identified hazards that were assessed, overheating of buildings affecting residents in high temperature events, building damage in storm events and high temperatures, and soil shrinkage leading to subsidence were judged to potentially have a '**moderate'** or greater risk, which was considered to be **significant**.

10.6.26 The primary mitigation for building structural risks is compliance with the Building Regulations, following appropriate geotechnical ground investigation, and with an appropriate engineering allowance as safety margin in designs. Specific additional mitigation cannot be determined at this outline planning stage, but it is recommended that future climatic conditions using up-to-date UKCP18 projections data (or equivalent at the time) are specifically considered during detailed civil engineering and architectural design.

10.6.27 Overheating of buildings and the subsequent impact to residents and (if applicable) pupils would be managed through passive design measures (i.e. consideration of building fabric, glazing and solar gain) and where necessary by a mechanical ventilation system. It is recommended that during detailed design, future temperature conditions are considered in specifying the above factors using up-to-date UKCP18 projections data (or equivalent at the time). Consideration of natural ventilation and lighting as a balance with solar gain, and design of external areas and landscaping for shading, are recommended to mitigate this risk.

10.7 Residual effects

Construction Phase

GHG Emissions

10.7.1 With full implementation of the additional mitigation during detailed design, the effect due to embodied carbon during the construction phase could be reduced to **minor adverse** and **not significant**.

Climate Risk

10.7.2 With full implementation of the additional mitigation during detailed design, the Proposed Development's risk could be reduced to **low** and **not significant**.

Operational Phase

GHG Emissions

10.7.3 With implementation of additional mitigation, the residual effect of operational energy use could be reduced to **minor adverse** and **not significant**.

10.7.4 GHG emission effects from traffic generation are only partially within the scope of what the developer can control or influence via additional mitigation. With full implementation of the additional mitigation on-site in combination with expected national transport decarbonisation trends (which the additional mitigation supports), the residual effect could be reduced to **minor adverse** and **not significant.**

Climate Risk

10.7.5 With full implementation of the additional mitigation during detailed design, the Proposed Development's risk could be reduced to **low** and **not significant**.

10.8 Implications of Climate Change

10.8.1 Climate change could cause inter-related effects, in which it exacerbates or ameliorates the effects of the Proposed Development on sensitive receptors (i.e. the inter-related effects of climate change with other environmental impact pathways).

10.8.2 Inter-related effects are effects that interact spatially and/or temporally, resulting in multiple effects, or effects of a greater significance, upon a single receptor. The inter-related effects of climate change can be considered in two categories:

- climate change altering the sensitivity of receptors or the baseline environment, thereby increasing the significance of effects; and
- climate change modifying an impact pathway, i.e. by changing the magnitude or spatial extent and introducing new receptors.

10.8.3 These have been assessed within each technical chapter of the ES as applicable, under this section heading (Implications of Climate Change). Each author has considered the impact of climate change on the Proposed Development and adaptations to climate change, utilising the UKCP18 climate change projections, concluding as to whether potential climate change may alter the predicted effects, and if so, in what way.

10.8.4 The main areas where there is a potential for inter-related effects, subject to technical leads' assessment, are considered to be:

- landscape planting: increased temperatures and drought conditions, or increased soil erosion from extreme weather events, could cause landscape planting to fail;
- air pollutant dispersion: a change in prevailing weather patterns and localised changes in atmospheric chemistry could impact air pollutant dispersion, thereby affecting short-term and potentially annual-average concentrations. Additionally, increased temperatures could lead to a greater sensitivity to episodes of poor air quality, e.g. for people with long-term respiratory or cardiovascular health conditions;
- noise conditions: increased temperatures could lead to a greater sensitivity to noise due to open windows/doors for ventilation;
- potable water supply: increased temperatures and drought conditions could reduce the resilience of potable water supply; and
- transport network resilience: extreme weather events could reduce the resilience of the transport network to additional traffic generation.
- surface water and flood risk: more intense rainfall and extreme weather may increase surface water runoff and flood risk, potentially affecting residents, ecologically designated sites, and other land uses.
- ecological resilience: increased temperatures, drought, or more extreme weather may affect ecologically designated sites, key habitat features, and protected species through habitat loss, degradation, or shifts in ecological balance.
- socio-economic impact: climate-related impacts on agricultural land may affect productivity and viability, with secondary implications for land-based employment and the local economy.
- health implications: higher temperatures and worsening air quality could pose risks to both current and future residents of the Proposed Development, especially those with pre-existing health conditions or vulnerabilities.

10.8.5 The future climatic conditions and the potential nature of inter-related effects are discussed further in Appendix 10.3.

10.9 Cumulative effects

10.9.1 A qualitative interim cumulative effects assessment is conducted to identify any significant cumulative impacts of the Proposed Development on sensitive receptors within both the Loddon Valley Garden Village Strategic Development Location and the wider committed development.

10.9.2 Chapter 5 – Approach to Assessment provides the Cumulative Development Schedule, which lists consented schemes 5 km from the Proposed Development that produce uplift of more than 1,000m² (GEA) of mixed-use floor space or over 80 residential units.

Loddon Valley Garden Village Strategic Development Location

10.9.3 As all developments within the Loddon Valley Garden Village Strategic Development Location (SDL) are expected to be delivered within a similar timeframe, assuming their construction and operational emissions to be of a similar typology and density of the Proposed Development, their cumulative GHG emissions have the potential to contribute to a combined impact on the atmospheric mass of GHGs.

10.9.4 In the absence of construction and operational GHG emissions data for the neighbouring SDL sites, this assessment has considered the cumulative impact of the SDL as a whole by treating the atmospheric mass of GHGs as a high-sensitivity receptor. The cumulative emissions from the SDL are therefore expected to be greater than those of the Proposed Development alone, but remain within the scope of the local carbon budget trajectory if mitigation measures consistent with national and local policy are adopted across all sites.

Wider Committed Development

10.9.5 The cumulative effect of any GHG-emitting wider committed development on climate change has been considered qualitatively in this assessment. As with the SDL, the cumulative impact is assessed against the atmospheric mass of GHGs as a global receptor. The assessment assumes that all committed developments will be subject to current and emerging planning policy requirements, including energy efficiency standards, low-carbon technologies, mitigation measures aligned with the UK's net zero trajectory, and WBC's emerging policies.

10.9.6 Furthermore, the climate risk assessment included in Appendix 10.2 has incorporated future climate projections (UKCP18 RCP8.5 scenario) to account for the cumulative influence of global GHG emissions on local climate conditions. This ensures that the resilience and adaptation measures proposed for the Proposed Development are robust under worst-case climate scenarios.

10.10 Summary

10.10.1 The assessment has identified a range of potential climate change and GHG impacts associated with the Proposed Development across both the construction and operational phases, summarised below and in Table 10.3, along with associated mitigation measures, summarised in Table 10.4.

10.10.2 During the construction phase, the Proposed Development is expected to result in indirect GHG emissions from the embodied carbon of materials, their delivery to site, and direct emissions from on-site construction activities and land-use change. These impacts are considered to have

a minor adverse effect, which is not significant, provided that carbon management measures are implemented in line with RICS Whole Life Carbon Assessment guidance. Risks to the construction workforce and programme due to climate hazards, particularly heat stress, are considered to be moderate and therefore significant, but can be reduced to low and not significant through good-practice health and safety measures embedded in the Construction Environmental Management Plan (CEMP).

10.10.3 In the operational phase, the Proposed Development is expected to generate indirect GHG emissions from both energy consumption and traffic generation. Without mitigation, these impacts are considered to have a moderate adverse effect, which is significant. However, with the implementation of embedded mitigation measures, such as high-performance building fabric, heat pumps, on-site solar PV, and electric vehicle infrastructure, these effects can be reduced to minor adverse and not significant.

10.10.4 Climate risks to buildings and future occupants, including overheating, storm damage, and subsidence, are also considered to be moderate and significant. These risks can be mitigated through appropriate design measures, including orientation, shading, ventilation, and compliance with Building Regulations, reducing the residual effect to low and not significant.

10.10.5 Overall, the Proposed Development has the potential to contribute to climate change through GHG emissions and to be affected by climate-related risks. However, with the adoption of recommended mitigation measures, these impacts can be effectively managed to ensure alignment with national and local climate policy objectives.

10.11 References

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10.12 Assessor information

10.12.1 The team involved in the production and calculations for this Chapter and associated appendices are Daveriel, Milo and Jo from the Sustainable Design team within Savills Earth. Their qualifications and further information can be found in the table overleaf.

Table 10.1 Assessor Information

Chapter	Responsibility	Name	Qualifications	Assessor information
Climate Change & Greenhouse Gases	Savills Earth	Daveriel Purugganan	MEng	Daveriel is a Graduate Sustainable Design Consultant within the Sustainable Design team at Savills Earth. Having developed a holistic building design approach, he has a strong interest in structural systems, whole life carbon assessments of building projects, circular economy strategies, and supporting Net Zero Carbon strategies for assets and portfolios. Daveriel is currently working towards MCIBSE qualification.
		Milo Jackson-Brown	MSc MCIBSE (Affiliate)	Milo is a Consultant at Savills Earth, working in the Sustainable Design team. A degree in Biology has given him a passion for the environment and a desire to protect it. At Savills he has worked on a range of projects developing his skills and experience in whole life carbon analyses, energy modelling and Net Zero pathways. He aims to further develop his knowledge of the many facets of sustainable design, helping to deliver Net Zero carbon solutions for the betterment of the planet.

Chapter	Responsibility	Name	Qualifications	Assessor information
		Joanna Conceicao	MSc, BArch & Urban Design, CEnv MISEP	Jo is an Associate Director at Savills Earth, and provides comprehensive sustainable design and energy strategy guidance, effectively minimising energy demand and carbon footprint in buildings and masterplans. As a Chartered Environmentalist and Member of the Institute of Environmental Management & Assessments, she brings a wealth of experience in a variety of sectors, optimising collaboration with stakeholders, architects, planners, and policymakers to achieve set sustainability goals and enhance the overall quality of life for present and future generations within the built environment.

Table 10.2 Summary of effects

Receptor	Receptor sensitivity	Description of potential impact	Proposed mitigation	Residual effect	Significant / not significant
Construction Phase					
Atmospheric concentration of GHGs (global climate)	High	Indirect GHG emissions from construction material use ('embodied carbon') and delivery, and direct emissions from on-site construction activity and land-use change with **minor adverse (not significant)** effect	Undertake carbon management using RICS guidance 'Whole Life Carbon Assessment (WLCA) 2nd Edition. Allowing for reduction target setting, lifecycle analysis to inform detailed design, and monitoring of as-built outcomes.	Could be reduced to **minor adverse**	Could be reduced to **not significant**
Construction programme and workforce	Up to high	Risks to the construction workforce health and safety, and to the constriction programme, with some **moderate (significant) risks**	Good-practice measures for workforce health and safety, drawn from HSE guidance, to be incorporated in the CEMP	Could be reduced to **low**	Could be reduced to **not significant**
Operation Phase					
Atmospheric concentration of GHGs (global climate)	High	Indirect GHG emissions from energy consumption with **moderate adverse (significant)** effect	Implementation of highly efficient building fabric, use of heat pumps and on-site solar PV will provide embedded mitigation as set out in the Energy and Sustainability Statement.	Could be reduced to **minor adverse**	Could be reduced to **not significant**
Atmospheric concentration of GHGs (global climate)	High	Indirect GHG emissions from traffic generation with **moderate adverse (significant)** effect	Provision of high capacity EV charging for all parking spaces (which may be above the current Part S minimum requirement) as future-proofing to enable higher EV uptake. Travel Plan with measures to encourage modal shift.	Could be reduced to **minor adverse**	Could be reduced to **not significant**
Development buildings and users	Up to high	Risks to the physical integrity of buildings and to health and	Flood risk and drainage management (see FRA); consideration of	Could be reduced to **low**	Could be reduced to

Receptor	Receptor sensitivity	Description of potential impact	Proposed mitigation	Residual effect	Significant / not significant
(climate risks)		wellbeing of residents with some **moderate (significant) risks**	orientation, glazing, shading and ventilation in design; water demand reduction (see as set out in the Energy and Sustainability Statement); geotechnical investigation, civil and architectural design in line with Building Regulations		**not significant**

Table 10.3 Summary for Securing Mitigation

Identified receptor	Type and purpose of additional mitigation measure (prevent, reduce, offset, enhance)	Means by which mitigation may be secured (e.g. planning condition / legal agreement)	Delivered by	Auditable by
Construction Phase				
Atmospheric concentration of GHGs (global climate)	Carbon management to reduce embodied emissions (WLCA, low-carbon materials, efficient construction practices)	Planning Condition / Design Code / Contractor Requirements	Applicant / Contractor	Applicant / Contractor / LPA
Construction workforce	Health and safety measures to reduce climate-related risks (e.g. heat stress)	CEMP / Site Management Plan	Contractor	Applicant / Contractor / LPA
Operation Phase				
Atmospheric concentration of GHGs (global climate) – energy use	Passive design, efficient systems, on-site renewables to reduce and offset operational emissions	Planning Condition / Energy Strategy / Design Code	Applicant / Contractor	Applicant / Contractor / LPA

Identified receptor	Type and purpose of additional mitigation measure (prevent, reduce, offset, enhance)	Means by which mitigation may be secured (e.g. planning condition / legal agreement)	Delivered by	Auditable by
Atmospheric concentration of GHGs (global climate) – transport	EV infrastructure, Travel Plan, modal shift measures to reduce transport emissions	Planning Condition / Travel Plan / S.106 Agreement	Applicant / Contractor	Applicant / Contractor / LPA
Development buildings and users (climate risks)	Design measures to reduce overheating, flood risk, and structural vulnerability	Planning Condition / Design Code / Building Regulations Compliance	Applicant / Contractor	Applicant / Contractor / LPA