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ES Chapter 15 - Climate Change

Authored by Expedition

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THE CROWN ESTATE

East Hemel

15. Climate Change

15.1 Introduction

15.1.1 This Chapter sets out the likely significant effects of the Development's carbon emissions on the environment (presented in the Greenhouse Gas (GHG) Impact Assessment) and the effect of climate change on the Development (presented in the Climate Change Resilience Assessment (CCRA). It has been prepared by Expedition Engineering. This Chapter is supported by further detailed information contained within the following Appendices (**ES Volume 3**):

- **Appendix 15.1**: Data Source for GHG Assessment;
- **Appendix 15.2**: GHG Assessment Results;
- **Appendix 15.3**: Climate Change Resilience Assessment;
- **Appendix 15.4**: Policy and Legislative Context and Compliance; and
- **Appendix 15.5**: Climate Change – Consultation.

15.1.2 Expedition Engineering comprise environmental designers, climate resilience engineers and sustainability specialists with specific expertise in climate change mitigation and adaptation. They have developed the evidence base of climate impacts for numerous development projects to achieve successful planning applications. Their team have expertise in climate risk assessment and mitigation including flooding and overheating. They are leaders in the field of energy and carbon management, influencing policy through roles through the UK Green Building Council (UKGBC), London Energy Transformation Initiative (LETI) and the National Infrastructure Commission. Professional accreditations include Fellowship of the Institution of Civil Engineers (ICE), the Institute of Environment and Sustainability Professionals (ISEP) (formerly the Institute of Environmental Management and Assessment (IEMA)), and Chartered Engineers with the Institute of Building Services Engineers (CIBSE).

15.1.3 This Chapter describes the assessment methodology (which is aligned with RICS[1]) and the baseline conditions. It identifies the likely significant effects of Climate Change, outlining the essential mitigation measures required to avoid, prevent, reduce or offset any likely significant adverse effects, and reporting on the likely residual effects after these measures have been implemented.

15.1.4 The assessment comprises the high-level quantification of the Development's whole life GHG emissions, hereafter called 'GHG Impact Assessment' for brevity and a CCRA. The assessment of in-combination climate impacts (ICCI) has been scoped out, hence the ICCI is not part of this Chapter.

[1] Royal Institution of Chartered Surveyors (RICS). Whole Life Carbon Assessment for the Built Environment – Professional Standard, 2nd edition. RICS, 2024

15.1.5 This Chapter is intended to be read as part of the wider Environmental Statement (ES) and planning documentation, with specific reference to ES Chapters such as **ES Volume 2, Chapter 10: Transport and Access**, **Chapter 14: Water Resources and Flood Risk** and supporting planning documents: Flood Risk Assessment (FRA) (**ES Volume 3, Appendix 14.1**), Outline Sustainable Drainage Strategy (ODS) (**ES Volume 3, Appendix 14.2),** Outline Construction Environmental Management Plan (CEMP) (**ES Volume 3, Appendix 6.1**); Energy and Sustainability Statement (including Climate Change) (submitted as a supporting document to the Outline Planning Application) and Outline Operational Waste Management Plan (submitted as a supporting document to the Outline Planning Application).

15.2 Assessment Methodology and Significance Criteria

Assessment Methodology

15.2.1 This section outlines the methodology for the Climate Change Assessments, including:

- Greenhouse Gas Impact Assessment (GHGIA); and
- Climate Change Resilience Assessment (CCRA).

Scope of the Assessment

15.2.2 The EIA Scoping Report prepared to support the request for an EIA Scoping Opinion, and the EIA Scoping Opinion received in response from St Albans City & District Council (SADC) and Dacorum Borough Council (DBC) have informed the scope of this assessment. It is noted that the EIA Scoping Opinion was in agreement with the proposed scope of the assessment and did not identify any requirement for additions or variations. A copy of the consultation comments from SADC and DBC and our responses can be found in **Appendix 15.5**.

15.2.3 A GHGIA and CCRA have been scoped into this Chapter, while an in ICCI assessment has been scoped out. Further details are provided below in respect of GHGIA and CCRA methodologies. As ICCI has been scoped out, it is not considered any further within this Chapter.

Temporal Scope

15.2.4 The GHGIA and CCRA assume an operational life of 60 years for the Development.

15.2.5 Whilst there is no phasing plan accompanying the Outline Planning Application (OPA), we have taken the Applicant's outline dates for completion which assumes the Development will be fully complete and operational by 2045. There is no phasing plan accompanying the OPA; therefore, a reasonable scenario of emissions has been assumed.

15.2.6 As a reasonable scenario, 2045 is assumed to be the first year of full operation, i.e. when the Development is completed (by end of 2044) and operational in its entirety. Construction is assumed to occur up to 2044 for simplicity. Due to the absence of a detailed phasing plan at this stage, the timing and scale of emissions for each stage of Development remains uncertain, making it difficult to model progressive decarbonisation. Therefore,

assuming that the whole Development is built by 2044 provides a conservative scenario for comparison against the decarbonisation pathway, as this date will be closer to a timeframe with more stringent carbon budgets and more extreme climate predictions.

GHG Impact Assessment (GHGIA)

Study Area

15.2.7 The spatial and geographical scope of this assessment will extend to the Site boundary of the Development. The GHG assessment will address emissions arising from activities occurring within the Site and associated activities outside of it such as user transport and the production of materials procured during construction and operation.

Methods and Sources for Baseline Area

15.2.8 The GHGIA includes any increase or decrease in GHG emissions as a result of the Development, measured against the baseline GHG emissions/carbon sequestration related to the Site, in line with IEMA's 2022 guidance document[2].

15.2.9 The carbon sequestration estimates presented in this assessment were calculated using the standard formula recommended by IEMA and Natural England: Sequestration = Area × Sequestration Rate × Time Period. This approach aligns with the methodology outlined in IEMA[2] and Natural England[3] guidance (NERR094). Sequestration rates were selected based on habitat-specific averages provided in NERR094, ensuring that the estimates reflect UK-specific land use characteristics and are consistent with best practice in greenhouse gas assessments.

15.2.10 Existing building's energy performance has been obtained from their Energy Performance Certificates (EPCs), some listed farmsteads do not have EPCs as they are unheated spaces and have been excluded from the baseline.

The Works

15.2.11 The carbon emissions associated with the construction stage (RICS modules A1-A5) have been estimated by using upfront carbon benchmarks per proposed use class and GIA for buildings, and by building a high-level simplified upfront carbon model for the main infrastructure elements.

15.2.12 In the absence of detailed design information, a business-as-usual scenario aligned with LETI Band E (as typical worst case 'business as usual', BaU) has been applied as the baseline for the Development (referred as 'Proposal'), while an aspirational scenario aligned with LETI Band A, equivalent to the 2030 target, which indicates a net zero carbon aligned trajectory, has been used for comparison and to estimate the significance of effect. The values applied can be found in **Table 15.3**.

15.2.13 The carbon impact of demolition has been assessed based on demolition areas expected during site clearance, in line with Parameter Plan '250604_EHUK_PRP_XXX_XXX_DR_T_00005-Demolition Plan'.

[2] IEMA Guide: Assessing Greenhouse Gas Emissions and Evaluating their Significance, 2nd Edition (2022)
[3] Natural England. NERR094: Carbon Storage and Sequestration by Habitat, 2021.

15.2.14 For further details on the data used for the construction stage of GHG emissions please refer to **ES Volume 3, Appendix 15.1**.

The Completed and Operational Development

15.2.15 Operational energy emissions (life cycle RICS module B6) for the Completed and Operational Development were estimated using Energy Use Intensity (EUI in kWh/m^2.GIA) benchmarks per proposed plot use type, prior to the incorporation of renewables. The contribution of on-site renewables is not expected to deliver significant energy or carbon savings and therefore the approach of not accounting their contribution for the purposes of the carbon impact assessment is a reasonable, conservative approach.

15.2.16 'BaU' and 'Aspirational' scenarios have been used for EUI performance for the Development, as detailed in **Table 15.4**.

15.2.17 The Development's energy strategy will be 100% electric and therefore, the UK national grid carbon intensity was used to estimate emissions associated with energy use. The decarbonisation of the national grid has been considered using the Department for Energy Security & Net Zero electricity emissions factors for the operational years of the development. The first operational year is 2045 and the final year of operation of the Development for the purposes of this assessment is assumed at 2105 (60 years after the final phase has been completed).

15.2.18 Annual water demand (life cycle RICS module B7) estimates for the Development (in m3/annum) were estimated by the Civil Engineers, as detailed in **Appendix 15.1**. The carbon intensity of potable water supply and wastewater management has been assumed unchanged over the 60-year operational stage of the Development, as a reasonable scenario, and taken from UK Government's Greenhouse Gas Reporting[4] database.

15.2.19 User transport emissions (life cycle RICS module B8) were estimated using the annual average daily traffic data (AADT – number of daily trips per vehicle type) for the Completed and Operational Development based on the assessment of impacts of East Hemel on the local highway network, as presented in the Transport Assessment prepared in support of the planning application.

15.2.20 AADT data were translated into fuel and electricity consumption over the 60-year service life using decarbonisation projections (shift from petrol and diesel vehicles to electric vehicles) and fuel intensity per km travelled sourced from the TAG Databook, 2025[5]. Daily trips were estimated for the Development once all phases are complete, therefore for the purposes of this assessment, 2045 is assumed as the first year in operation.

15.2.21 The operational stage embodied carbon emissions for buildings (life cycle RICS modules B1-B5 and C1-C4) have been estimated using the carbon benchmarks per proposed use class and GIA. 'BaU' and 'Aspirational' scenarios have been used for the lifecycle emissions for the Development, as detailed in **Table 15.2**.

[4] UK Government. Greenhouse Gas Reporting: Conversion Factors for Company Reporting. Department for Energy Security and Net Zero, 2025
[5] Department for Transport. TAG Data Book. UK Government, May 2025

15.2.22 Operational waste management emissions have been estimated using annual waste estimates by waste type for the proposed quantum of Development and assumptions on end-of-life scenarios, in line with British Standard[6].

15.2.23 Carbon sequestration associated with the Complete and Operational Development were estimated by identifying green and blue infrastructure provision as illustrated in Parameter Plan '250604_EHUK_PRP_XXX_XXX_DR_T_00002-Green Infrastructure Parameter Plan' and then applying Natural England's[7] guidance to establish the potential carbon storage of the types of habitats provided.

15.2.24 For further details on the data and assumptions used for the Completed and Operational Development's GHG assessment as per the above, please refer to **Appendix 15.1**.

Methods of Technical Assessment

15.2.25 The scope of the assessment has been agreed as part of the EIA scoping process and is based on the IEMA Guidance[2]. The carbon assessment adopts a whole-life approach and accounts for both direct and indirect emissions related to the demolition, construction, operation, and end-of-life life cycle stages of East Hemel, over a 60-year reference study period. The spatial and system boundaries of the assessment are presented in detail in the sections that follow.

15.2.26 The impact of GHG emissions will be assessed using the RICS Whole Life Carbon Assessment[1] (WCLA) industry-recognised methodology and will encompass both buildings and main infrastructure works.

15.2.27 The carbon emissions sources and elements shown in **Table 15.1** have been considered for inclusion in the GHG impact assessment. The emission sources that are considered to have the potential to give rise to likely significant effects during The Works and / or during the Completed and Operational Development have been scoped into the assessment and have therefore been considered within the ES. The remainder emissions sources have been scoped out. For each element, a justification is provided on their inclusion or exclusion from the assessment. For consistency of reporting, each source of emissions is mapped against the life stage modules in line with RICS[1].

Table 15.1: Elements Scoped In and Elements Scoped Out of the GHG Impact Assessment

GHG Emissions Sources	The Works	The Completed and Operational Development	Justification
Applies to Baseline conditions and Development Carbon sequestration related to land-use. [not included in RICS methodology]	Scoped Out	**Scoped In**	Scoped in as there is available information to estimate carbon storage in arable and agricultural land and soils (applicable to Baseline). Natural England has provided estimates for carbon storage, with options to adapt to specific agricultural land-use types. Although the guidance states that the carbon storage in agricultural land is minimal, the capacity to measure encourages its inclusion in

[6] British Standards Institution. BS 5906:2005 Waste Management in Buildings – Code of Practice. BSI, 2005

GHG Emissions Sources	The Works	The Completed and Operational Development	Justification
			the GHG assessment. There should also be an attempt to estimate the carbon sequestration of the development, using a mix of land-use types. This will be obtained from Natural England[7], with options to adapt to specific agricultural land-use types.
Pre- construction [RICS Module A0]	Scoped Out	Scoped Out	Scoped out of the baseline calculation due to its classification as a non-physical pre-construction activity, such as preliminary studies, design assessments, or stakeholder engagement. According to the A0 life cycle stage definition, these types of activities typically have much lower direct environmental impacts compared to the construction and operational phases of a built asset.
Extraction, transporting and manufacturing processes to produce the construction products, components and equipment required to construct the Development. [RICS Modules A1-A3]	**Scoped In**	Scoped Out	Significant source of upfront carbon emissions.
Transportation of construction products, materials and components from factory gate to project site for assembly. [RICS Module A4]	**Scoped In**	Scoped Out	Minimum boundary required to estimate upfront carbon emissions.
On-site construction-related activities, including pre-construction demolition, groundworks, on-site energy use, emissions associated with the production, transportation and end-of-life management of wasted materials. [RICS Module A5]	**Scoped In**	Scoped Out	Minimum boundary required to estimate upfront carbon emissions. Demolition and earthworks will be reported separately to other A5 sources.

[7] Natural England. Carbon Storage and Sequestration by Habitat. 2021.

GHG Emissions Sources	The Works	The Completed and Operational Development	Justification
In use embodied carbon emissions, comprising fugitive emissions from refrigerants, maintenance and repair emissions, anticipated replacement of built asset components, accounting for production, transportation and assembly of new components and end-of-life management of replaced components. [RICS Modules B1-B5]	Scoped Out	**Scoped In**	Required for a whole life carbon assessment. Significant source of embodied carbon emissions.
Operational energy use [RICS Module B6]	Scoped Out	**Scoped In**	There are several existing buildings onsite, which will be retained in the Development. The EPC ratings of these buildings are available, hence an estimation on energy use will be made from this data to feed into the GHG baseline. The assessment will also capture the in-use operational energy emissions for buildings in the Development.
Operational energy use – New Buildings [RICS Module B6]	Scoped Out	**Scoped In**	Required for a whole life carbon assessment. Significant source of operational carbon emissions in typical developments, not a significant source of emissions in developments designed to be 'net-zero ready' or net-zero in operation.
Operational water use - Buildings [RICS Module B7]	Scoped Out	**Scoped In**	Required for a whole life carbon assessment. Not a significant source of operational carbon emissions.
User activities: Commute and logistics to/from the Site [part of RICS Module B8]	Scoped Out	**Scoped In**	Significant source of carbon emissions in operation.
User activities: Operational Waste management emissions	Scoped Out	**Scoped In**	Operational waste reduction and sustainable waste management is a key objective of the Development. Included for completeness.
End-of-life emissions including	Scoped Out	**Scoped In**	Technically emissions do not fall within the operational stage as they occur at the end of the

GHG Emissions Sources	The Works	The Completed and Operational Development	Justification
demolition/deconstruction, transport to waste management facilities and waste processing or waste disposal emissions. [RICS Module C]			service life of the project. However, emissions of Module C are included within industry benchmarks and required for a whole life carbon assessment. Not a significant source of embodied carbon emissions.
Enabling infrastructure construction and in-use embodied carbon emissions. Civils infrastructure comprises roads/pavements and other hard surfacing, surface water drainage, foul drainage and utilities, acoustic barrier. [part of RICS modules A1-A5]	**Scoped In**	Scoped Out	Enabling infrastructure elements will be assessed to the extent feasible, using the design information available at the time of the assessment. The assessment boundary will comprise primary infrastructure: vehicle access roads, pavements and public realm hard landscaping; primary networks for surface water drainage, wastewater drainage and utilities. Exclusions will be outlined in the chapter but expected to comprise, where applicable: utility buildings (e.g. power substations), electric vehicle charging infrastructure, PV, mechanical and electrical equipment e.g. pumps and external lighting).
Relevant to Baseline conditions only. Emissions related direct impacts from fertiliser and pesticide use on agricultural land. [not included in RICS methodology]	Scoped Out	Scoped Out	Scoped out of the baseline calculation due to a lack of reliable information and expected minimum impact. Carbon impacts of fertiliser from farmers are not well reported as it falls within scope 3. Estimations for emissions associate with agricultural land are only available at a country-wide level and for all agriculture activity (rather than just the impact of fertiliser. This makes an unreliable metric to quantify the impact of a specific area of agricultural land using a specific type and amount of fertiliser. Only 0.28% of UK's GHG emissions are associated with nutrient use on agricultural land.
Relevant to Baseline conditions only. Emissions related to agricultural production, upstream and downstream supply chain of produce (including transport of produce and waste). [not included in RICS methodology]	Scoped Out	Scoped Out	Scoped this out is a conservative approach, as the net impact of the Development will come out higher by not quantifying these emissions. We are also scoping out carbon release from soil disturbance.

GHG Emissions Sources	The Works	The Completed and Operational Development	Justification
Transport of workers to site [part of RICS Module A5]	Scoped Out	Scoped Out	Minor scale of emissions typically not assessed.
Water use during construction [part of RICS Module A5]	Scoped Out	Scoped Out	Minor scale of emissions typically not assessed.
Carbon release from soil disturbance during groundworks [not required in RICS]	Scoped Out	Scoped Out	Not typically assessed. Not required to be included in RICS Guidance. No industry-recognised methodology or guidance to inform this assessment.
Enabling infrastructure in-use operational energy emissions [part of RICS module B6]	Scoped Out	Scoped Out	Relatively small source of carbon emissions in operation. Insufficient data on operational energy use data of mechanical and electrical equipment (e.g. pumps) used in infrastructure assets.
Operational energy use emissions outside of buildings (infrastructure, EVs charging) [part of RICS Module B6]	Scoped Out	Scoped Out	Insufficient design information available. Scale of emissions would be relatively small compared to all other sources.
Emissions associated with water used by non-building integrated systems (e.g. irrigation of landscape) [part of RICS Module B7]	Scoped Out	Scoped Out	Insufficient design information available. Relatively minor scale of emissions due to small landscaped areas, and most of the planting not requiring irrigation beyond establishment. Typically, not assessed.
Emissions associated with process water used in light industrial units. [part of RICS Module B7]	Scoped Out	Scoped Out	Insufficient design information available. Water consumption benchmarks not available; water consumption estimates cannot be reliably developed as future tenants are not known. Scale of emissions would be relatively minor compared to all other sources.

Assumptions and Limitations

15.2.28 The Development proposals are not well advanced to provide details on infrastructure works and building design, therefore this assessment adopts a number of assumptions to derive a reasonable assessment at this stage.

15.2.29 Below is a list of excluded elements from the infrastructure carbon calculations due to a lack of sufficient information at the planning stage to enable an accurate estimate:

- Temporary works;
- Upgrades to existing roads;
- Proposed junctions;
- Concrete surface water culvert;
- Rainwater harvesting tanks;
- Pumping stations;
- District heating network;
- Substations;
- Low Voltage Power infrastructure;
- Gas infrastructure;
- Potable Water Infrastructure;
- Telecommunications infrastructure;
- PV panels and communal batteries;
- External Lighting;
- Soft landscaping (strategic earthworks are included);
- Off-site infrastructure improvements;
- Multi-storey car parks;
- Structural elements such as retaining walls; and
- Noise bund construction (strategic earthworks are included).

15.2.30 Embodied carbon emissions of buildings: the assessment adopted benchmarks from LETI in the absence of detailed design. As LETI does not currently provide benchmarks for all building typologies, a conservative approach has been adopted for this analysis.

15.2.31 Benchmarks for embodied carbon and Energy Use Intensity (EUI) are taken from LETI by use class. Where a specific use class benchmark is not available, the worst-case use class has been applied. Specifically, the worst-case scenario benchmark for the office building class has been applied to other building classes in the absence of typology-specific data.

15.2.32 An additional scenario, referred to as the 'aspirational' scenario, was used to assess embodied and operational carbon emissions aligned with the UK's net zero trajectory. **Table 15.2**, **Table 15.3** and **Table 15.4** below, show the two different scenarios.

Table 15.2: Lifecycle Embodied Carbon (A1-5, B1-5, C1-4) Performance Benchmarks recommended by RIBA & LETI

Life Cycle Embodied Carbon [$kgCO_2e/m^2$ GIA]	Office	Residential	Education	Retail
A (2030 Aspirational)	<750	<650	<540	<535
E (Proposal)	<1400	<1200	<1000	<1050

Table 15.3: Upfront Carbon (A1-A5) Performance Benchmarks recommended by RIBA & LETI

A1-A5 [$kgCO_2e/m^2$ GIA]	Office	Residential	Education	Retail
A (2030 Aspirational)	<350	<300	<300	<300
E (Proposal)	<950	<850	<750	<850

15.2.33 The reasonable scenario for the Baseline condition assumes that the current land use is predominantly arable land, with a baseline carbon sequestration rate of approximately 0.29 tCO_2/ha per year. Upon development, various green space typologies with differing sequestration capacities are proposed, including natural and semi-natural habitats, parks and gardens, greenspaces, allotments, sports areas, and Suitable Alternative Natural Greenspaces (SANGs). These are estimated to sequester carbon at rates ranging from 0.5 to 2.5 tCO_2/ha per year, depending on habitat type and management practices. Specifically, natural and semi-natural areas are expected to sequester around 2.5 tCO_2/ha annually, parks and gardens, greenspaces, and allotments approximately 1 tCO_2/ha, sports fields about 0.5 tCO_2/ha, and SANGs approximately 2 tCO_2/ha. This reflects an improvement over the baseline condition and highlights the potential for net carbon sequestration post-development. However, the scenario conservatively considers the emissions associated with construction and operation, alongside the initial lower sequestration baseline, to provide a balanced view of the Development's carbon impact.

15.2.34 The assessment of construction (lifecycle stages A1–A5) and operational embodied carbon emissions of buildings (lifecycle stages B1–B5, C1–C4) assumes performance levels based on use class. In cases where regulatory requirements mandate more ambitious levels of performance than the assumed benchmarks, future development will be expected to comply with the applicable regulations.

15.2.35 The assessment of operational energy emissions (RICS module B6) is based on assumed energy use intensity (kWh/m² GIA) values per use class. The decarbonisation of the UK electricity grid up to 2105 is factored into the calculation using projections from the Department for Energy Security and Net Zero (DESNZ, 2023), last updated in November 2023.

Table 15.4: Energy Performance Benchmarks recommended by LETI & UK GBC

EUI [kWh/m2.GIA]	Office	Residential	Education	Retail/Indoor sports/Mixed industrial	Medical centre	Business, Research & Development / Logistics
Aspirational	55	35	65	80	100	130
Proposal	130	140	130	130	130	130

15.2.36 The construction emissions (lifecycle stages A1-A5) of the main infrastructure elements are estimated based on high-level estimates of bill of materials deducted from a preliminary cost plan for the Development. The following elements have been included:

- Hardstanding build-ups for the sustainable transport corridor, secondary, tertiary and access roads, play streets and parking;
- Strategic earthworks cut and fill;
- Communications cables and trenches;
- High Voltage power network cables and trenches;
- Sustainable Drainage System features;
- Surface water drainage below ground network and trenches;
- Foul water drainage below ground network and trenches; and
- A414 Bridge.

15.2.37 The assessment of operational traffic emissions is affected by limitations and assumptions applicable to the estimates of annual trip generation numbers. Further uncertainties stem from the use of future projections regarding the energy source of vehicles and the future carbon intensity of energy sources (fuel and grid electricity) as well as further assumptions and simplifications inherent in the calculation (e.g. average distance travelled per trip and vehicle type).

15.2.38 Operational waste management emissions over the lifecycle of the Development (through to 2105) are estimated using current waste generation rates, average recycling performance, and present-day carbon factors and end-of-life scenarios from UK statistic data available. The carbon impact of operational waste management from the Development is thus considered overestimated, representing a worse-case scenario, in the absence of better data.

15.2.39 Demolition emissions used an industry benchmarks data available from RICS1 PS 2nd edition was used to inform the calculation.

15.2.40 The entire masterplan is delivered in a single construction phase, completed in 2044, with the first year of operation commencing in 2045.

15.2.41 It is assumed that the existing or embedded mitigation measures currently in the design of East Hemel will be fully implemented in the final design and construction.

15.2.42 A full overview of the assumptions adopted in the carbon assessment is presented in in **ES Volume 3, Appendix 15.1**.

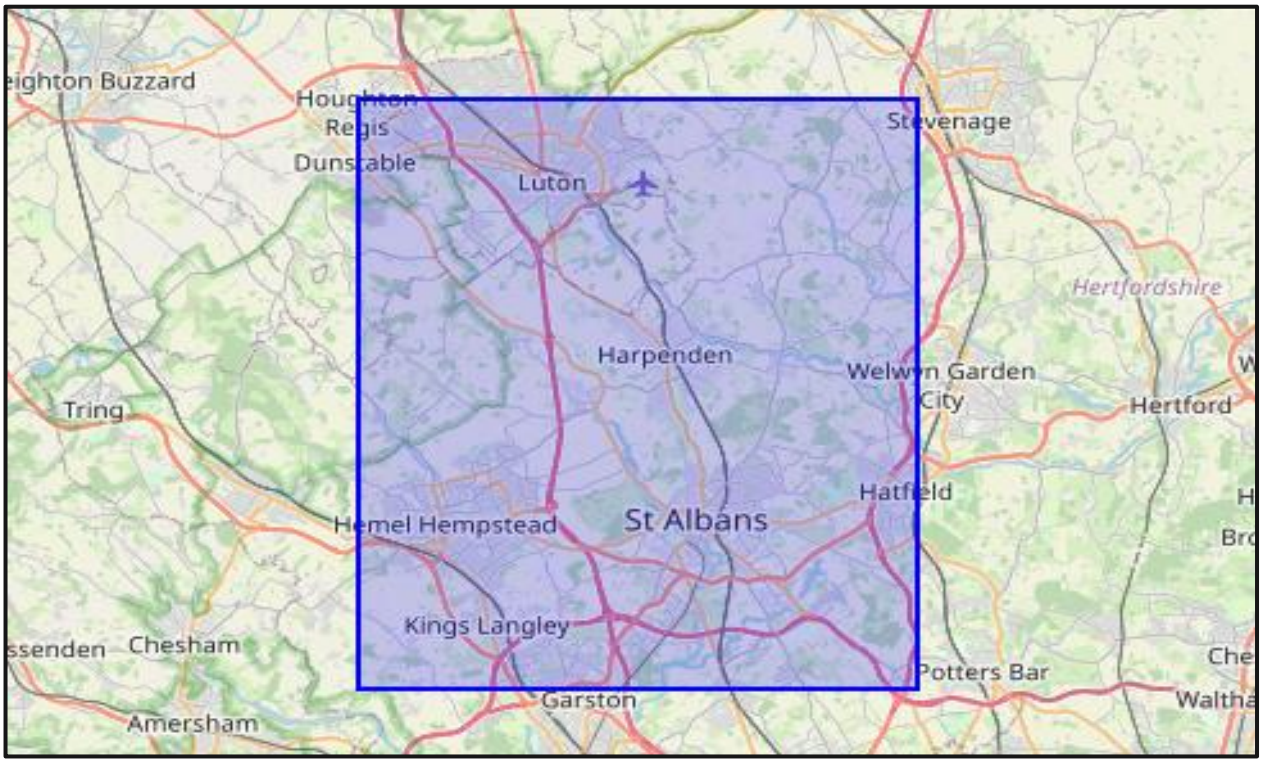
CCR Assessment (CCRA)

Study Area

15.2.43 The CCRA study area comprises the Site. The spatial and geographical scope extends to a 25 sqkm area that includes the Site.

15.2.44 UKCP18 probabilistic data[8] used for the analysis is provided in 25 km grid format therefore data from the grid square that includes the Site are within scope, shown approximately in 152. This aligns with the UKCP18 data for probabilistic projections.

Figure 15.1: Approximate 25sqkm Data Location



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[8] Met Office, 2018. UK Climate Projections. [online] Available at: https://www.metoffice.gov.uk/research/approach/collaboration/ukcp [Accessed 29 July 2025].

15.2.45 The scope of the CCRA is based on the Guidelines for the IEMA CCR Guidance[9]. The main climate effects that have been scoped in and out of the CCRA are presented in

15.2.46 **Table 15.5**. The elements not considered to give rise to likely significant effects on the Development have not been considered within the ES, such as increased flooding from groundwater sources, flooding from fluvial and tidal sources, flooding from sea level rise, extreme cold events & snow.

Table 15.5: Elements Scoped In and Elements Scoped out of the CCRA

[9] IEMA, 2020. Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation. [online] Available at: https://www.iema.net/content/iema-eia-guide-to-climate-change-resilience-and-adaptation-2020/ [Accessed 05 August 2025].

Element Scoped in (Climate Effects)	The Works	The Completed and Operational Development	Justification
Flooding from increased extreme rainfall events (surface water flooding)	**Scoped In**	**Scoped In**	Climate change will likely increase the frequency and intensity of rainfall events.
Wetter winders and increased, prolonged humidity	**Scoped In**	**Scoped In**	Climate change will likely lead to wetter, warmer winters.
Subsidence or ground movement due to changes in moisture content	**Scoped In**	**Scoped In**	Climate change will likely lead to changes in ground moisture content due to changing rainfall patterns.
Drought and water stress	**Scoped In**	**Scoped In**	Climate change will likely lead to decreased summer rainfall in combination with higher temperatures leading to increased frequency of drought conditions.
Heatwaves and overheating	**Scoped In**	**Scoped In**	Climate change will lead to increased frequency and duration of periods of extreme heat.
Warmer summers and increased solar radiation due to less cloud coverage	**Scoped In**	**Scoped In**	Climate change will likely lead to warmer temperatures due to reduced cloud cover from reduced air moisture content.
Increased extreme high winds & storms	**Scoped In**	**Scoped In**	Climate change will likely lead to increased frequency and intensity of extreme events.
Increased flooding from groundwater sources	Scoped Out	Scoped Out	High level of uncertainty on impacts of climate change on ground water levels.
Flooding from fluvial and tidal sources	Scoped Out	Scoped Out	East Hemel is not in a location at risk of fluvial or tidal flooding.
Flooding from sea level rise	Scoped Out	Scoped Out	East Hemel is not in a location at risk of tidal flooding.
Extreme cold events & snow	Scoped Out	Scoped Out	Extreme cold events and snow are likely to decrease due to climate change therefore represent a reduced risk compared to the existing climate.

Assumptions and Limitations

15.2.47 It is assumed that the existing or embedded mitigation measures currently reflected within the Development will be fully implemented in the final design and construction.

15.2.48 This assessment has followed the methodology set out in the Assessment Methodology section. The assessment is of a qualitative nature by experts in the field and informed by climate data and input from the design team.

15.2.49 The UKCP18 data, that the future baseline is based on, are simulations of a limited number of climate scenarios. Therefore, the analysis does not cover all possible scenarios and is based on a number of assumptions. However, the range of values given is the best information available at the current time and allows the most accurate predictions of future climate hazards.

Significance Criteria

Assessing the Magnitude of Impact

GHG Impact Assessment

15.2.50 The significance of a project's emissions is based on its net impacts over its lifetime against the baseline development activity and is evaluated by contextualising East Hemel's GHG footprint against local net zero carbon trajectories, current and emerging policies as well as best practice industry guidance by expert bodies.

15.2.51 The aim of contextualisation is to determine whether East Hemel supports or undermines a trajectory towards net zero, however it is acknowledged that determining this trajectory and the project's position within it is a challenge and comes down to professional judgement.

15.2.52 As stated by IEMA's guidance:

"The crux of significance therefore is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050."

15.2.53 The following evidence base has been used to contextualise the Development's carbon emissions:

- Tyndall Centre for Climate Change Research recommended carbon budget for St Albans;
- LETI industry benchmarks for embodied carbon emissions per proposed use class; and
- UKGBS & LETI benchmarks for operational energy use intensity per proposed use class.

15.2.54 It is noted that the UK's national carbon budget has not been considered in the contextualisation exercise as it is too high level and of such a scale that individual projects' emissions only come to make up a very small portion (typically less than 0.01%).

15.2.55 The interpretation of significance of carbon impacts adopts the criteria shown in **Table 15.6**. These are in line with criteria put forward within IEMA's Guidance[2] (Box 3: Examples of significance criteria).

15.2.56 Since the global climate is the receptor of GHG emissions and has a high sensitivity, GHG impact assessment does not utilise a significant matrix and the criteria below is used to determine the significance of effect[2].

15.2.57 Effects classified as Major, or Moderate are considered to be **'significant'** for GHG Impact Assessment. Effects classified as Minor, Negligible, are considered **'not significant'** for GHG Impact Assessment.

15.2.58 GHG emissions during The Works can be considered to have a direct and short-term effect in the atmosphere, as the Development's construction would result in increasing GHG emitted over a 5 to 10-year construction period for each phase, for example. Whereas emissions associated with the Completed and Operational Development would have both direct and indirect effects, and are likely to be of longer-term:

- Direct and long-term effects (Scope 1 of the GHG Protocol): Direct emissions from sources under the control of the Development, such as on-site fuel combustion or refrigerant leakage. Indirect and long-term effects (Scopes 2 and 3 of the GHG Protocol):
- Indirect emissions from purchased electricity (Scope 2), and wider value chain emissions (Scope 3), such as occupant transport, operational waste, purchased goods, and user behaviour over time.

15.2.59 While the Completed and Operational Development may give rise to a range of indirect downstream emissions (Scope 3), only selected categories, such as user transport and operational waste, are included within the scope of this assessment. Other Scope 3 emissions are not quantified. The focus remains on direct (Scope 1), energy-related indirect (Scope 2), and selected Scope 3 emissions associated with the construction and operation of the Development.

Table 15.6: GHG Impact Assessment - Significance Criteria

Vulnerability	Criteria
Major adverse	The project's GHG impacts are not mitigated or are only compliant with do-minimum standards set through regulation, and do not provide further 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 project's GHG impacts are partially mitigated and may partially meet the applicable existing and emerging policy requirements but 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 project's GHG impacts would be fully consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type. A project with minor adverse effects is fully in line with measures necessary to achieve the UK's trajectory towards net zero.
Negligible	The project's GHG impacts would be reduced through measures that go well beyond existing and emerging policy and design standards for projects of this type, 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 project's net GHG impacts are below zero and it causes a reduction in atmospheric GHG concentration, whether directly or indirectly, compared to the without-project baseline. A project with beneficial effects substantially exceeds net zero requirements with a positive climate impact.
CCRA	

15.2.60 The criteria in **Table 15.7** are used to evaluate the magnitude of climate-related impacts, based on potential level of disruption in relation to geographical boundaries, health implications to communities, economic and environmental loss, and to the functioning of buildings and infrastructure. The sensitivity of the receptors is taken into consideration when determining the magnitude of impact: the higher the sensitivity of a receptor, the less resilient it will be to climate change risks (details on assessing the sensitivity of the receptors is provided in the next section). Determining the consequence of impact is essentially a qualitative assessment, based on professional judgement.

Table 15.7: CCRA – Magnitude of Impact Criteria

Magnitude of Impact	Spatial Extent	Health	Economic Activity	Environmental Loss and Reversibility	Buildings & Infrastructure
Very Large Adverse	The impact affects the entire development area or extends beyond its boundaries, potentially impacting surrounding communities or ecosystems.	Causes significant, long-term harm to human health, possibly irreversible, affecting a large portion of the population.	Results in substantial, long-term economic losses, threatening the viability of the development and causing significant unemployment or business closures.	Leads to the irreversible loss of critical habitat, or irrecoverable damage to ecosystems.	Widespread destruction or significant damage to the majority of buildings, infrastructure, and critical facilities. This could include major flooding, collapse, or extensive structural damage requiring complete rebuild or extensive repairs. The functionality of the development is severely compromised, potentially for a prolonged period.
Large Adverse	The impact affects a significant portion of the development area, with potential spillover effects into nearby areas.	Causes serious health issues that are reversible with intervention but affect a significant number of people.	Results in considerable economic losses that significantly affect the development's growth and cause noticeable unemployment or business downturns.	Causes significant degradation of the environment that is reversible only in the long term and leads to the loss of significant biodiversity.	Considerable damage to a significant portion of buildings and infrastructure, such as critical utilities (water, electricity) and transportation networks, leading to long-term disruptions. Requires substantial investment for repairs and may temporarily reduce the resilience and operational capacity of the development.
Moderate Adverse	The impact is localized within certain sections of the development, with limited effects	Leads to moderate, short- to medium-term health issues that are reversible and	Causes moderate economic losses that can be recovered with some effort, affecting some businesses and	Results in moderate environmental damage that is reversible in the medium term, affecting some species and habitats	Moderate damage to buildings and infrastructure, with impacts that are noticeable but not catastrophic. This might include minor structural damages that require

Magnitude of Impact	Spatial Extent	Health	Economic Activity	Environmental Loss and Reversibility	Buildings & Infrastructure
	on the surrounding areas.	affect a moderate number of individuals.	causing temporary unemployment.	but not leading to any irreversible losses.	repairs, temporary loss of utilities, or disruptions to transportation that affect daily operations but are recoverable in the medium term.
Minor Adverse	The impact is highly localized, affecting only small parts of the development with no significant spillover.	Causes minor health issues that are easily reversible and affect only a small number of individuals.	Results in minor economic disruptions that have a limited impact on the overall economic health of the development.	Leads to minor environmental impacts that are easily mitigated or reversed, with minimal effect on biodiversity or habitat.	Minor or superficial damage to buildings and infrastructure, with limited impact on their functionality or safety. Repairs are easily manageable and can be quickly addressed, causing only temporary and minor disruptions to services and daily activities.
Negligible	The impact is negligible or virtually non-existent, with no discernible effects on the development or its surroundings.	Poses no risk or only a negligible risk to human health, with no measurable effects.	Has a negligible impact on economic activity, with no significant or measurable effects on employment or business operations.	Causes no measurable environmental damage, with no effect on species, habitats, or biodiversity.	No or negligible impact on buildings and infrastructure. The development's structures and services remain fully functional with no need for repairs or interventions. There is no disruption to the normal operations and services provided by the infrastructure.

Assessing the Sensitivity of Receptors

GHG Impact Assessment

15.2.61 There are no local receptors for GHG emissions. All global cumulative GHG emissions sources are relevant to climate changes because there is no correlation between where GHGs are released and where climate change is felt. Therefore, the receptor of GHG is the **global atmosphere** (the atmospheric concentration of GHGs), impacted by the atmospheric concentration of GHGs, evaluated as having a **high sensitivity**, given the severe consequences of global climate change on natural ecosystems, societies, economies, lives and livelihoods around the world. This is in line with IEMA guidance[2].

CCRA

15.2.62 Sensitivity of receptors is taken into consideration when determining the magnitude of impact (see previous section). The higher the sensitivity of a receptor, the less resilient it will be to climate change risks. The sensitivity of the receptor is determined by the relationship between susceptibility and vulnerability:

- Susceptibility e.g. ability to be affected by a change (the opposite of resilience)
- Vulnerability e.g. potential exposure to a change.

15.2.63 The greater the susceptibility and/or vulnerability of the receptor, the greater the likelihood that receptor would also be of higher sensitivity.

15.2.64 The approach for determining the sensitivity of the receptors has been completed in accordance with IEMA's guidance[9] following the scales in **Table 15.8** and **Table 15.9**.

Table 15.8: CCRA – Criteria for assessing the susceptibility of receptors

Susceptibility	Criteria
High	Receptor has no ability to withstand/not be substantially altered by the projected changes to the existing/prevailing climatic factors (e.g. lose much of its original function and form).
Moderate	Receptor has some limited ability to withstand/not be altered by the projected changes to the existing/prevailing climatic conditions (e.g. retain elements of its original function and form).
Low	Receptor has the ability to withstand/not be altered much by the projected changes to the existing/prevailing climatic factors (e.g. retain much of its original function and form).

Table 15.9: CCRA – Criteria for assessing the vulnerability of receptors

Vulnerability	Criteria
High	Receptor is directly dependent on existing/prevailing climatic factors and reliant on these specific existing climate conditions continuing in future (e.g. river flows and groundwater level) or only able to tolerate a very limited variation in climate conditions.
Moderate	Receptor is dependent on some climatic factors but able to tolerate a range of conditions (e.g. a species which has a wide geographic range across the entire UK but is not found in southern Spain).
Low	Climatic factors have little influence on the receptors

15.2.65 The CCRA accounts for impacts to high and moderate sensitivity receptors. The following sensitive receptors have been assessed for the Development in respect of CCRA:

- Community and people (construction workforce, site users): evaluated as receptors of high sensitivity
- The built environment, infrastructure systems and services (construction site activities, proposed buildings, road and supporting infrastructure): evaluated as receptors of moderate sensitivity

- The natural environment (landscaped green spaces, trees and wildlife): evaluated as receptors of moderate to high sensitivity.

15.2.66 Assessing the significance of climate change effects on a scheme is fundamentally different to the assessment of impacts arising from the scheme in other EIA topics, since it focusses on the effect of an external factor (climate change) on the Development, rather than the effect of the Development on environmental receptors[9].

15.2.67 The significance of effect has been assessed by identifying the climate hazards (events) potentially impacting sensitive receptors of the Development and then evaluating the likelihood and magnitude of impact arising from the climate hazard for these receptors.

15.2.68 The criteria in **Table 15.10** are used to determine the likelihood of an event occurring, based on its probability and frequency of occurrence.

Table 15.10: CCRA - Likelihood Criteria

Vulnerability	Criteria
Very High	The event occurs multiple times during the lifetime of East Hemel (60 years), e.g. approximately annually, typically 60 events.
High	The event occurs several times during the lifetime of East Hemel (60 years), e.g. approximately once every five years, typically 12 events.
Medium	The event occurs limited times during the lifetime of East Hemel (60 years), e.g. approximately once every 15 years, typically 4 events.
Low	The event occurs during the lifetime of East Hemel (60 years), e.g. once in 60 years.
Very Low	The event may occur once during the lifetime of East Hemel (60 years).

15.2.69 The significance of effect was then evaluated using a combination of the likelihood of the event occurring and the magnitude of its impact on the receptor, using the matrix in **Table 15.11**. The matrix for determining the significance of effect is based on an example significance matrix presented in Appendix 1 of the IEMA guidance[9].

15.2.70 Major and major/moderate adverse effects are considered **significant** for CCRA in EIA terms; moderate, minor and negligible effects are not considered significant for CCRA EIA terms. This is different to the assessment of other environmental topics and follows IEMA guidance. Where an effect is assessed as moderate/minor or major/moderate professional judgement is used to determine the significance of effect.

Table 15.11: CCRA - Matrix for Determining the Significance of Effect

		Magnitude of Impact				
		Very Large Adverse	Large Adverse	Moderate Adverse	Minor Adverse	Negligible
Likelihood	Very High	Major Adverse	Major Adverse	Major Adverse	Major / Moderate Adverse	Moderate Adverse
	High	Major Adverse	Major Adverse	Major / Moderate Adverse	Major / Moderate Adverse	Moderate Adverse
	Medium	Major Adverse	Major / Moderate Adverse	Moderate Adverse	Moderate Adverse	Minor Adverse
	Low	Major / Moderate Adverse	Major / Moderate Adverse	Moderate Adverse	Minor Adverse	Minor Adverse
	Very Low	Moderate Adverse	Moderate Adverse	Minor Adverse	Minor Adverse	Minor Adverse

15.3 Relevant Baseline Conditions

GHG Impact Assessment (GHGIA)

15.3.1 The baseline condition, in terms of greenhouse gas impacts, includes the greenhouse gas emissions and carbon sequestration associated with the current activities onsite, prior to the construction of the Development.

15.3.2 In summary, this includes the carbon sequestration related to agricultural land use and the operational energy of existing buildings within the Development boundary (**Table 15.12**).

15.3.3 The elements scoped in and out of the baseline assessment are detailed in **Table 15.1**.

15.3.4 The future baseline condition is the same as the baseline, as there are no other uses proposed within the Study Area other than the existing.

Table 15.12: Baseline GHG Emissions

Type of emissions	Baseline (tCO_2e)
Embodied Carbon emissions In-use and End-of-Life [RICS Modules B1-B5, C1-C4]	220
Operational energy use emissions (excl. PV) [RICS Module B6]	110
Carbon Sequestration from current agricultural land use	-6,212
Total	**-5,882**

Climate Change Resilience Assessment (CCRA) – Baseline

15.3.5 The baseline condition, in terms of climate change resilience, is defined by the historic climate conditions (e.g. temperature, rainfall, wind, cloud cover, etc) to which the Development might be vulnerable to. Current conditions are based on the 20-year average of 1981-2000 from the HadUK grid at spatial resolution of 25sqkm[10].

15.3.6 **Table 15.13** presents the 20-year average of climate variables calculated from historical data which form the existing baseline to be compared to the future baseline.

15.3.7 The 25sqkm grid square containing the entire Site has been selected for weather data to ensure consistency with the future projection data.

[10] Met Office, 2024. HadUK-Grid Datasets. [online] Available at: https://www.metoffice.gov.uk/research/climate/maps-and-data/data/haduk-grid/datasets [Accessed 29 July 2025].

Table 15.13: Historic Weather Data for the Site

Parameter	1981-2000 Baseline
Mean annual temperature (°C)	9.85
Mean winter temperature (°C)	1.29
Mean summer temperature (°C)	16.06
Mean winter daily minimum temperature (°C)	1.29
Mean summer daily maximum temperature (°C)	20.97
Mean total winter precipitation (mm)	180.98
Mean total summer precipitation (mm)	160.12

Climate Change Resilience Assessment (CCRA) – Future Baseline

15.3.8 The future baseline conditions will differ from the existing baseline and will consider how the impact of climate change will exacerbate the severity of weather patterns and the local environment's resilience.

15.3.9 The future baseline is based on UKCP18 25 sqkm probabilistic projections using the Representative Concentration Pathways (RCP) 8.5 emissions scenario for the decades for completion of 2040 (2030-2049) and latest available decade 2090 (UKCP18 2080-2099), which reflects the lifespan of the assessment, in line with IEMA's guidance for future climate scenarios[11].

15.3.10 The UKCP results find a number of trends[12]. Long-term UK-wide trends are summarised as follows:

- Increased annual average temperatures, particularly in summer;
- Hot summer days to become more frequent and intense;
- Fewer days with frost and snow;
- Drier summers with more intense rainfall events that extend into autumn; and
- Wetter winters.

15.3.11 By 2070 the average warming from the RCP 8.5 scenario for the whole of the UK is expected to be up to 5.1°C in summer and 3.8°C in winter. Based on the same data, precipitation is expected to be up to 45% lower in summer and up to 39% higher in winter.

[11] IEMA, 2017. Guidance for Future Climate Scenarios.

[12] Met Office, 2022. UK Climate Projections: Headline Findings. [online] Available at: https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/summaries/headline-findings [Accessed 29 July 2025].

15.3.12 **Table 15.14** is a summary of expected changes in extreme temperatures in the 25sqkm grid containing the Site (Study Area) based on the RCP 8.5 scenario compared to a baseline of 1981-2000[8].

15.3.13 Overall, the projected changes to climatic parameters are expected to change more by 2090 than they are by 2040.

15.3.14 By 2040, the largest increase in mean temperature is expected to be in summer which will increase from 16.1°C in the 1981-2000 baseline by 1.8°C to 17.9°C. In the same period, mean summer precipitation is expected to decrease by 8.8% from 160.1mm to 146mm. The combination of these two factors is likely to lead to decreased soil moisture and a higher likelihood of drought conditions.

15.3.15 By 2090, the increase in mean summer temperature is expected to be 5.7°C higher than the 1981-2000 baseline, increasing to 21.8°C. In this time frame, mean summer precipitation is expected to decrease by 39.4% to 97mm.

15.3.16 In the meantime, winter precipitation within the Study Area is expected to increase from 181mm by 10% and 23.8% by 2040 and 2090 respectively.

15.3.17 The increase in extremes of summer temperatures is expected to be the largest difference compared to baseline levels. By 2090, mean maximum daily temperatures are expected to increase from 21.0°C by 6.4°C to 27.4°C.

Table 15.14: UKCP18 Climate Change 25 km grid (within the Study Area) Probabilistic Projections (Changes from 1981-2000 baseline)

Parameter		2030-2049	2080-99
Temperature	Mean annual temperature (°C)	+1.42	+4.3
	Mean winter temperature (°C)	+0.9	+3.6
	Mean summer temperature (°C)	+1.8	+5.7
	Mean daily maximum summer temperature (°C)	+2.0	+6.4
	Mean daily minimum winter temperature (°C)	+1.2	+3.6
Precipitation	Mean winter precipitation (%)	+10.0%	+23.8%
	Mean summer precipitation (%)	-8.8%	-39.4%

15.4 Likely Effects of the Development and their Significance

The Works

GHG Impact Assessment

15.4.1 The results of the carbon assessment for the Works stage of the Development are summarised in **Table 15.15** below and further detailed in **Appendix 15.2**. The construction stage emissions are estimated to be around 560,336 tCO2e. Most emissions (circa 96% of total) are expected to come from the construction of buildings; another 4% from main infrastructure elements and the remainder to be emitted during demolition and earthworks.

15.4.2 Based on the current assumptions, an estimated 560,336 tCO_2e (100% of total construction emissions) would be emitted by 2044 considering the BaU scenario.

Table 15.15: GHG Impact Assessment Results - Construction Stage Proposal with BaU Benchmarks

Construction Emissions	Baseline [tCO_2e]	Proposal [tCO_2e]	Net Impact [tCO_2e]
Demolition [RICS Module A5.1]	-	190	190
Earthworks [part of RICS Module A5.2]	-	6,056	6,056
Buildings [RICS Modules A1-A3, A4, A5]	-	533,916	533,916
Infrastructure [RICS Modules A1-A3, A4, A5]	-	20,165	20,165
Total	-	**560,336**	**560,336**

15.4.3 The absence of detail building design limits the ability to further improve on reducing upfront (A1-A5) carbon for The Works stage as no embedded mitigation measures are in place.

15.4.4 However, the Applicant aspires to minimise emissions in line with policy SP2 Responding to the Climate Emergency and DBC Climate and Ecological Emergency Strategy and has considered site-wide embedded mitigation measures. These include green and blue infrastructure, valleys with multi-value SuDS ponds, retained hedgerows and woodlands, green corridors, the Nickey Line, and two new parks as SANGs which will support climate resilience and carbon reduction as shown in the Green Infrastructure Parameter Plan (250604_EHUK_PRP_XXX_XXX_DR_T_00002-Green Infrastructure Parameter Plan).

CCRA

15.4.5 It is noted that no significant effects have been identified for the construction stage. Construction is due to complete by 2040 decade. Due to the shorter timeframe of the construction period and the cumulative effects of climate change, the risks to the Site are reduced compared to the operational stage. As can be seen from **Table 15.14**, climate change projections show significantly greater changes between 2040 and 2090 than between the baseline and 2040. There will still be increased risk compared to the current conditions but most of the construction period will occur before the change values in the table are reached and so are assessed to be not significant. Risks can be managed through the CEMP, which will be covered by a suitably worded planning condition.

The Completed and Operational Development

GHG Impact Assessment

15.4.6 The results of the carbon assessment for the operational stage of the Development are summarised in **Table 15.16** and further detailed in **Appendix 15.2**. The results of the carbon sequestration assessment for the Development in comparison with the Baseline is summarised in **Table 15.17.**

15.4.7 The net operational stage emissions are estimated to be around 1,946,400 tCO_2e. The in-use and end-of-life embodied carbon emissions associated with buildings comprise (12%, 229,060 tCO_2e) of operational stage emissions. Transport impacts contribute another 84% of operational stage emissions (1,639,940 tCO_2e), whilst waste management emissions make another 3% (51,860 tCO_2e). It is noted that waste management emissions account for a very conservative estimate, as the decarbonisation of waste logistics (i.e. electric vehicles transporting waste off-site), as well as potential societal, cultural, economic and technological shifts that would impact waste generation, circular economy and waste management practices in the future are not accounted for.

15.4.8 Operational energy emissions and operational water use emissions are of a relatively much smaller scale, contributing 0.8% (14,880 tCO_2e) and 0.5% (10,660 tCO_2e) of the operational carbon impact, respectively.

Table 15.16: GHG Impact Assessment Results - Operational Stage Proposal with BaU Benchmarks

Operational Emissions	Baseline [tCO_2e]	Proposal [tCO_2e]	Net Impact [tCO_2e]
Embodied Carbon emissions In-use and End-of-Life [RICS Modules B1-B5, C1-C4]	220	229,280	229,060
Operational energy use emissions (excl. PV) [RICS Module B6]	110	14,990	14,880
Operational water use emissions [RICS Module B7]	-	10,660	10,660
User activities - Transport [RICS Module B8]	-	1,639,940	1,639,940
Operational waste management emissions [not part of RICS]	-	51,860	51,860
Total	**330**	**1,946,730**	**1,946,400**

15.4.9 Under BAU scenario total net operational emissions accounts for approximately 1,946,400 tCO_2e. This high impact is primarily driven by conservative assumptions applied across multiple categories.

15.4.10 Operational waste management emissions account for 51,860 tCO_2e, due to the conservative default assumptions regarding waste generation and treatment processes for this early stage.

15.4.11 Transport-related emissions from user activities contribute a further 1,639,940 tCO_2e, reflecting generic travel distances and modes without accounting for potential modal shifts or behavioural changes.

15.4.12 Energy use emissions (14,880 tCO_2e) and water use emissions (10,660 tCO_2e) are also elevated due to standardised consumption profiles that do not reflect modern efficiency measures or site-specific data. Additionally, embodied carbon emissions in use and end-of-life stages account for 229,060 tCO_2e.

15.4.13 The baseline carbon sequestration potential of the Site is estimated to be approximately -6,212 tCO_2e, primarily associated with existing land uses such as arable and agricultural land.

15.4.14 Following the operation of the Development, the carbon sequestration potential could increase significantly to -23,784 tCO_2e over the assessment period, due to the introduction and maturity of green infrastructure, landscaping, and habitat creation. This results in a net increase in sequestration of approximately 17,572 tCO_2e, representing a substantial enhancement in the Site's capacity to store carbon over the assessment period.

Table 15.17: GHG Impact Assessment Results - Land Use Change (LUC) Emissions

Sequestration Emissions	Baseline [tCO_2e]	Proposal [tCO_2e]	Net Impact [tCO_2e]
Sequestration	-6,212	-23,784	-17,572
Total	-6,212	-23,784	-17,572

15.4.15 The BaU scenario for the completed and operational Development results in a net impact of 1,946,400 tCO_2e, with an additional potential benefit of offsetting -17,572 tCO_2e from sequestered carbon through large green area in the site.

15.4.16 The adjusted total emissions for the Development would equate to 1,928,828 tCO_2e, representing a 0.9% reduction. This modest but meaningful improvement underscores the value of integrating natural assets and green infrastructure early on which will contribute to offsetting part of the operational emissions.

Contextualisation of carbon emissions

St Alban's Local Energy Carbon Budget

15.4.17 The operational energy emissions of the Development have been contextualised against the energy-only carbon budget for St Albans, estimated by Tyndall Centre[13]. The Tyndall Centre's climate change targets are derived from the "*commitments enshrined in the Paris Agreement, informed by the latest science on climate change and defined in terms of science-based carbon setting*".

15.4.18 It is noted that the CO_2 emissions in the carbon budget include emissions from fossil combustion within the region and a share of the emissions from national electricity generation. Based on this boundary of the carbon budget, it is the Development's operational energy emissions [B6] that are contextualised against St Alban's carbon budget.

15.4.19 The estimated operational energy emissions of the Development are provided in **Table 15.18**. Overall, the estimated operational energy emissions of the Development are estimated to comprise 0.9% of St Alban's carbon budget for the period of 2028-2105.

15.4.20 For the period between 2043-2047, the Development is expected to contribute 2.5% of the available budget. For the period of 2048 to 2100, the Development would contribute to 11.4% of St. Alban's available budget. The operational energy emissions of the Development do not currently account for the contribution of on-site PV, so the carbon impact from the Development is somewhat overestimated, especially for the earlier years of operation. This represents a reasonable scenario, as some phases of the Development are expected to be operational well before 2044, during a period when the grid is more carbon-intensive and the potential offset from on-site renewable generation would have a more significant impact.

[13] Tyndall Centre for Climate Change Research. Local and Regional Carbon Budgets Aligned with the Paris Agreement. The University of Manchester, 2025

Table 15.18: Contextualisation of operational energy emissions: Tyndall centre's recommended carbon budget for St Albans

Carbon Period	Energy Budget for St Albans [tCO_2e]	Proposal Operational Energy Emissions [B6] [tCO_2e]	% Local Budget
2028-2032	900,000	0	0.00%
2033-2037	400,000	0	0.00%
2038-2042	200,000	0	0.00%
2043-2047	100,000	2,569	2.50%
2048-2100	100,000	11,367	11.40%
2100+	0	1,045	0.00%
Total 2028-2105	**1,700,000**	**14,981**	**0.9%**

Policy alignment and Guidance

15.4.21 Embodied carbon emissions are currently not regulated in SADC's Draft Local Plan (LP). Emerging policy SP2 in the SADC LP requires that developments demonstrate mitigation and adaptation to Climate Change, including pursuing the reduction of whole life-cycle carbon emissions (both operational and embodied). However, it does not set expected benchmarks for new developments to adhere to.

15.4.22 Several research organisations and construction industry bodies, including the UKGBC, RIBA, LETI and the emerging UK Net Zero Carbon Building Standard (UKNZCBS) advocate for benchmarks or limits to be set for upfront and lifecycle embodied carbon emissions of new developments, to ensure the construction industry contributes towards the UK meeting its interim and long-term decarbonisation commitments. LETI together with RIBA have also established a rating system of performance for embodied carbon emissions of new developments, indicating the benchmarks that constitute current good practice (Band C) and the benchmarks that should be targeted for projects completed at 2030 (Band B) and beyond (Band A). The RIBA & LETI benchmarks for lifecycle embodied and upfront carbon (Bands A-C) can be seen in **Table 15.19** and **Table 15.20**.

Table 15.19: Lifecycle Embodied Carbon (A-C) Performance Benchmarks recommended by RIBA & LETI

Modules A-C Target [$kgCO_2e/m^2.GIA$]	Residential	Office	Education	Retail
A (LETI 2030 design target)	<450	<530	<400	<380
B (RIBA 2030 built target)	<625	<750	<540	<535
C (Current best-practice)	<800	<970	<675	<690

Table 15.20: Upfront Carbon (A1-A5) Performance Benchmarks recommended by RIBA & LETI

Upfront A1-A5 Target [$kgCO_2e/m^2$.GIA]	Residential	Office	Education	Retail
A (LETI 2030 design target)	<300	<350	<300	<300
B (RIBA 2030 built target)	<400	<475	<400	<425
C (Current best-practice)	<500	<600	<500	<550

15.4.23 The pilot version of the UK Net Zero Carbon Buildings Standard (September 2024) has been collaboratively developed by a wide range of stakeholders in the UK's built environment industry (including RIBA and LETI) to create a unified definition for 'Net Zero Carbon Aligned Buildings', underpinned by an evidence-based reporting methodology. The pilot version of the standard includes targets for upfront carbon of buildings for a range of use classes; the targets for some of the use classes of the Development are provided in **Table 15.21** below as indicative.

Table 15.21: Upfront Carbon (A1-A5) Performance Benchmarks for different building types recommended by the UK's Net Zero Carbon Buildings Standard (pilot version)

Upfront A1-A5 Target [$kgCO_2e/m^2$.GIA]	2028	2030	2035	2040
Flats	450	380	250	160
Houses	345	290	190	125
Healthcare	670	590	390	250
Offices (shell & core)	400	355	230	150
Science & Technology	640	565	370	240
Schools	450	395	260	170
Retail	610	535	350	225
Industrial (Storage and distribution)	540	475	315	200

15.4.24 The above guidance will be used to contextualise the Development carbon emissions for The Works (modules A1-A5) and The Completed and Operational Development (modules A-C) against a net zero carbon aligned trajectory to define the significance of effect following the criteria set out in **Table 15.6**.

Embedded Mitigation

15.4.25 Embedded mitigation measures are presented in detail in the various reports submitted as part of the planning application and can also be cross-referenced in the following documentation:

- Development Specification and Spatial Principles;
- Green Infrastructure Parameter Plan;
- Land Use Parameter Plan;
- Access and Movement Parameter Plan;

- **ES Volume 2, Chapter 5: The Development**;
- **ES Volume 2, Chapter 10: Transport and Access**; and
- **ES Volume 2, Chapter 17: Water Resources and Flood Risk**.

15.4.26 An overview of the key embedded mitigation measures is provided below.

Transport

15.4.27 The embedded mitigation measures that contribute to limiting user transport emissions (RICS module B8) are presented in detail in **ES Volume 2, Chapter 10: Transport and Access** and the Development Specification submitted as part of the Outline Planning Application.

15.4.28 The Development aims to support the Hemel Garden Communities' goal for over 60% of trips to be undertaken via sustainable modes (e.g. public transport, walking and cycling) by 2050. Transport improvements have been designed in to improve connectivity and safe crossings for pedestrians via the A414 Bridge, and safeguard key routes and access points for a sustainable transport corridor (STC). This can be seen in the Heights Testing Plan which sets out a height strategy to allow for increased density at key points along the STC as per principles of transport-oriented development.

15.4.29 The Development promotes a mix of uses as shown in the Land Use Parameter Plan, which adopts principles of walkable neighbourhoods, aiming for most buildings to be within walking distance of key services and the STC. A parking strategy will be in place to reduce reliance on private vehicles over time and increase uptake in public transport journeys and use of car clubs, for example.

Operational Energy

15.4.30 The Spatial Principles set out by the Development Specification submitted alongside the Outline Planning Application covers the embedded mitigations which contribute to limiting operational energy use emissions, these include:

- Heights Testing Plan sets out a height strategy alludes to the principles of a compact development and show locations where density can potentially be increased, therefore laying out the foundations for future typologies with lower form factor.
- The Demolition Testing Plan identifies the buildings to be retained, and the energy strategy recognises the opportunity for retrofit improvements to uplift the energy and carbon performance of those listed and retained buildings (see Spatial Principles).

Embodied Carbon

15.4.31 Minimising earthworks by placing development zones away from steeper points. This is demonstrated by the Parameter Plans which show no development zones within the low valleys and north-east of the Site, where the north Country Park is proposed.

Operational and Construction Waste

15.4.32 The Spatial Principles included in the Development Specification, set out design standards for the delivery of allotments and food growing areas across the Development. This will contribute to grow local food, reduce food waste and foster composting practices on-site.

15.4.33 Construction waste will be managed following the waste management hierarchy, as per Outline Site Waste Management Plan (SWMP) and CEMP in place. A detailed SWMP should be prepared prior to commencing works on-site.

CCRA

15.4.34 **Appendix 15.3** presents the CCR Risk Assessment in detail, capturing for every climate hazard and receptor, an overview of embedded mitigation, the likelihood and magnitude of impact and the corresponding significance of effect in accordance with

15.4.35 **Table** 15.11**.**

15.4.36 Embedded mitigation measures include**:**

- Drainage systems designed for sufficient rainfall events including expected climate change increases.
- Green infrastructure, multi-value SuDS features, retained woodlands and Country Park areas incorporated in the design, reducing impermeable areas, managing water flows and providing cooling effects.
- No residential property within flood risk zone

15.4.37 The significance of effect per climate hazard and sensitive receptor for the operational stage of the Development, has been evaluated as follows:

- Flooding from extreme rainfall events (surface water flooding) presents a **major / moderate adverse** (**significant**) risk for the natural environment, and a **moderate adverse** (**not significant**) **risk** for the built environment and community;
- Wetter winters and increased prolonged humidity present a **moderate adverse** (**not significant**) risk for the built environment, community and natural environment;
- Subsidence or ground movement presents a **minor adverse** (**not significant**) risk for the built environment, community and natural environment;
- Drought presents a **moderate adverse** (**not significant**) risk for the built environment, community and natural environment;
- Heatwaves present a **major / moderate adverse** (**significant**) risk for all receptors, i.e. the community, the natural and built environment;
- Warmer summers and increased solar radiation likewise presents a **major / moderate adverse** (**significant**) risk for all receptors, i.e. the community, the natural and built environment;
- Extreme winds present a **moderate adverse** (**not significant**) risk for all receptors.

15.4.38 Major / moderate adverse effects are deemed significant in EIA terms in line with

15.4.39 **Table** 15.11 and Paragraph 15.2.70. These risks require additional mitigation, discussed in Section 15.5.

15.4.40 Both moderate adverse and minor adverse effects are deemed not significant in EIA terms, in line with **Table 15.11** and Paragraph 15.2.69.

Significance of Effect

GHG Impact Assessment

15.4.41 The carbon assessment considering the BaU scenario does not fully align with a net zero carbon aligned trajectory under The Works, therefore the effects are considered to be **major adverse**, which is a **significant adverse** effect in EIA terms.

15.4.42 Operational energy emissions contribute to less than 1% of St. Albans Local Energy Budget for the assessment period. However, this contribution accounts for 2.5% between 2043-2047, and 11.4% between 2048 to 2100, when the grid is expected to have been significantly decarbonised and emissions should not be as high as those stated. Therefore, it can be considered to have a **moderate adverse** effect, which is a **significant adverse** effect in EIA terms.

15.4.43 There is no standard method for contextualising operational water emissions, so the significance has been interpreted based on the scale of the total emissions for a typical water consumption scenario. Operational water emissions contribute to less than 0.6% of the total operational emissions. Therefore, it can be considered to have a minor adverse effect, which is not significant in EIA terms.

15.4.44 Operational transport emissions account for 84% of the total lifecycle emissions, therefore it can be considered to have a **major adverse effect** on GHG emissions, which is a **significant adverse** effect in EIA terms.

15.4.45 Additional mitigation measures are proposed in Section 15.5.

CCRA

15.4.46 The significance of effect for each of the CCRA topics is shown in Paragraph 15.4.37.

15.4.47 The climate change resilience assessment demonstrates that strategic measures have been taken to reduce the risks of climate change on the Development. However, as the proposed design is indicative at plot level, specific measures cannot be considered embedded at this stage, and this assessment has identified climate change risks that remain **significant**. Additional mitigation measures will need to be incorporated within the plot and building design, submitted in the Reserved Matters Applications. Suggested additional mitigation measures are detailed in Section 15.5.

15.5 Additional Mitigation / Enhancement and Likely Residual Effects of the Development and their Significance

15.5.1 As significant adverse likely effects have been identified for GHG emissions and CCRA in the previous section, this section presents additional mitigations for the Works and the Operational and Completed Development.

The Works

GHG Impact Assessment

15.5.2 The 'Aspirational' benchmarks for upfront carbon emissions of buildings have been used to demonstrate improvement against a business-as-usual scenario, following best practice guidance to align with a net zero carbon pathway.

15.5.3 **Table 15.22** shows that the aspirational scenario achieves a 61% reduction in total construction emissions in comparison with the BaU scenario, demonstrating substantial improvements in the building's embodied carbon performance. This improvement shifts the building's classification from LETI Band E to Band C.

Table 15.22: GHG Impact Assessment results - Construction Stage Proposal with Aspirational benchmarks

Construction Emissions [tCO_2e]	Baseline	Proposal 'BaU'	Proposal 'Aspirational'	Net Impact (against Baseline)
Demolition [RICS Module A5.1]	-	190	190	190
Earthworks [part of RICS Module A5.2]	-	6,056	6,056	6,056
Buildings [RICS Modules A1-A3, A4, A5]	-	533,916	190,937	190,937
Infrastructure [RICS Modules A1-A3, A4, A5]	-	20,165	20,165	20,165
Total	**-**	**560,336**	**217,348**	**217,348**

15.5.4 This reduction demonstrates that the Development would likely align partially with a net zero carbon pathway. Therefore, the recommended additional mitigation for the Development is for future plots to align LETI Band C, where possible, or latest and more relevant benchmarks, such as the upper limits established by the UK Net Zero Carbon Building Standard.

15.5.5 Demolition and infrastructure carbon would account for circa 12% of the total emissions for the aspirational scenario, as no additional mitigations are proposed under this scenario. Therefore, a carbon management

approach following PAS 2080 would be beneficial for future development to identify further opportunities in reducing carbon emissions at an early stage.

15.5.6 For each phase of the Development, as evidence to demonstrating mitigation of greenhouse gas emissions as per policy SP2 of the SADC Draft Local Plan, a detailed Whole Life Carbon Assessment should be undertaken at Reserved Matters Application to verify the carbon performance of the detailed proposals of the infrastructure works and building plots. This could evidence compliance with policy requirements applicable at the time of the Tier 2 of the Planning Approach, as a minimum.

15.5.7 In terms of reducing the embodied carbon emissions of future building plots, the principles of the embodied carbon hierarchy should be followed at the detailed design development stages. These design principles include:

- Establishing development parcels that respond to topography so that earthworks can be optimised at detailed stage.
- Maximising reuse of existing material on site, wherever possible.
- Adopting lean design to reduce material demand.
- Design for flexibility, adaptability and longevity; and
- Follow building in layer principles, wherever possible.

15.5.8 Where feasible, the Development should seek to exceed minimum policy requirements and aspire to align with emerging policy and/or recommended good or best practice embodied carbon and EUI performance standards that apply to the timeline of construction of each Phase. For example, this can be done by aligning with the UK's Net Zero Carbon Buildings Standard recommended performance limits that apply to the timeline of construction of each Phase.

15.5.9 The detailed Whole Life Carbon Assessment submitted for the RMAs will also demonstrate actions taken to reduce the carbon impact of infrastructure elements against a baseline performance.

CCRA

15.5.10 It is proposed that the Detailed Framework CEMP and any subsequent CEMPs submitted for the RMAs include a risk assessment for climate hazards and their potential impacts to the construction workforce and natural environment and puts together detailed proposals on risk mitigation to alleviate risks for these sensitive receptors.

The Completed and Operational Development

15.5.11 An Outline Water Conservation Strategy (OWCS) has been prepared and is included as part of the Outline Planning Application. The Strategy responds to the local issue of water stress and sets out principles for water conservation by reducing demand without sacrificing user experience, prioritizing innovative rainwater harvesting with minimal carbon impact, and offering flexibility to implement tailored solutions and emerging water-efficient technologies for each development plot.

15.5.12 The OWCS sets out how water use and thus associated operational water emissions for domestic building uses (excluding process water) can be significantly reduced compared to typical current practices.

15.5.13 Through efficiency measures alone it is predicted that water demand can be reduced from business-as-usual levels by up to 25% for residential areas and a conservative reduction of 40% to take into account the variety of non-residential uses on Site has been considered in the assessment. Further reductions to meet the proposed benchmarks will be achieved through smart water management, rainwater harvesting or greywater recycling.

15.5.14 The OWCS provides benefits for reducing GHG emissions for operational water use, as well as contributing to climate change resilience.

15.5.15 Additionally, future design proposals should demonstrate that the urban form and massing have responded to the site context's environmental conditions, such as sunlight, overshadowing and prevailing wind and embedded passive design features to promote low carbon, low energy and climate resilient design. This could be done at the RMA stage of the Outline Planning Application.

GHG Impact Assessment

15.5.16 As regards operational emissions, the 'Aspirational' benchmarks for energy use intensity for buildings have been used to demonstrate improvement against a business-as-usual scenario, following best practice guidance to align with a net zero carbon pathway.

15.5.17 **Table 15.23** shows the aspirational scenario delivers a modest overall improvement of 1.6% in total operational emissions, with significant reductions in embodied carbon (8.5%), operational energy use (57%) and water use (32%) when compared to BaU. Other categories remain unchanged as they are not affected by the additional mitigations proposed, indicating potential areas for further mitigation.

Table 15.23: GHG Impact Assessment results - Operational Stage Aspirational

Operational Emissions [tCO2e]	Baseline	Proposal 'BaU'	Proposal 'Aspirational'	Net Impact (against Baseline)
Embodied Carbon emissions In-use and End-of-Life [RICS Modules B1-B5, C1-C4]	220	229,280	210,090	209,870
Operational energy use emissions (excl. PV) [RICS Module B6]	110	14,990	6,340	6,230
Operational water use emissions [RICS Module B7]	-	10,660	7,229	7,229
User activities - Transport [RICS Module B8]	-	1,639,940	1,639,940	1,639,940
Operational waste management emissions [not part of RICS]	-	51,860	51,860	51,860
Total	**330**	**1,946,730**	**1,915,459**	**1,915,129**

CCRA

15.5.18 Climate hazards must be further considered at a plot level during the next stage of design and additional, plot specific measures should be incorporated at the detailed design stage. Significant risks from flooding, heatwaves and warmer summers and increased solar radiation need to be mitigated. An emergency preparedness plan for climate related events such as wildfires should be considered at detailed design stage.

15.5.19 Measures for the natural environment could include consideration of flooding and dryer areas for planting palettes and of flood tolerant / resistant species and drought resistant species, and provision of shading.

15.5.20 Measures for community and people could include further consideration of orientation, natural ventilation, shading and cooling, and water efficiency.

15.5.21 Measures for the built environment could include specification of appropriate materials considering the likely impacts of climate change and including sufficient monitoring and maintenance schedules for climate impacts in design codes.

15.5.22 It is also proposed that a long-term landscape maintenance plan is submitted for the RMAs, outlining the operational strategy to safeguard the health and resilience of the existing and newly established ecosystems and natural environment in East Hemel to be secured by planning condition. The landscape maintenance plan will need to consider the likely effects of climate change and incorporates proactive strategies to reduce risks to trees and other habitats during periods of extreme heat, prolonged hot weather, intense rainfall and stormy/windy conditions, and prolonged wet weather.

Significance of Residual Effect

GHG Impact Assessment

15.5.23 Given the rate of decarbonisation that the construction industry needs to achieve in the coming years, the Development's long construction programme, the uncertainty over the emergence and evolution of the regulatory context for embodied carbon emissions of new developments (in national, regional or local policy) and the potential gap between regulations, industry progress and the required decarbonisation trajectory; there is likely to be a moderate adverse residual effect due to the construction (upfront) and operational stage (in-use) embodied carbon emissions.

15.5.24 The carbon assessment considering the Aspirational scenario may partially align with a net zero carbon aligned trajectory under The Works, therefore the effects are considered to be **moderate adverse**, which is a **significant adverse** effect in EIA terms.

15.5.25 The Aspirational scenario demonstrates significant reductions in operational energy emissions. Should it be re-contextualised against the overall St. Albans Local Energy Carbon Budget it would equate to less than 6% of the Budget for the assessment period. Therefore, operational energy emissions can be considered to have a minor adverse effect, which is **not significant** in EIA terms.

15.5.26 The aspirational performance benchmarks included in Section 15.5 cannot be considered embedded at this stage as the proposed plots' design is indicative and does not reflect detailed design proposals that will only become available at the RMA stage.

15.5.27 Operational water emissions could be reduced further after additional mitigations resulting in a minor adverse effect, which is not significant in EIA terms.

15.5.28 Operational (user) transport and waste management emissions remain unchanged. The sustainable transport measures are already accounted for as embedded mitigations, and the waste emissions cannot have reductions estimated at this stage due to lack of detail. The magnitude of these two emissions sources can largely be attributed to the major scale of this development.

15.5.29 The residual effects of the Development in terms of user transport and waste management carbon emissions are found to be **major adverse** effect, which is a **significant adverse** effect in EIA terms. With regards to these operational aspects, the Development should embed best practice mitigation measures which safeguard resources use and enable sustainable transport and waste management approaches, aiming to reduce vehicle trips as much as possible and demonstrating compliance with the waste hierarchy and upcoming Waste Regulations.

15.5.30 The residual effect of the Development in terms of operational energy, operational water is found to be minor adverse, which is **not significant** in EIA terms. However, this would be subject to detailed design and confirmation for plot-based approaches to energy efficiency and water conservation.

CCRA

15.5.31 Considering the additional mitigation measures per climate hazard and sensitive receptor the significance of effect can be considered as follows:

- Flooding from extreme rainfall events (surface water flooding) presents a **major / moderate adverse** (**significant**) risk for the natural environment, and a moderate adverse risk (not significant) for the built environment and community;
- Wetter winters & increased prolonged humidity present a **minor adverse** (**not significant**) risk for the built environment, community and natural environment;
- Subsidence or ground movement presents a **minor adverse** (**not significant**) risk for the built environment, community and natural environment;
- Drought presents a **moderate adverse** (**not significant**) risk for the built environment, community and natural environment;
- Heatwaves present a **major / moderate adverse** (**significant**) risk for all receptors, i.e. the community, the natural and built environment;
- Warmer summers and increased solar radiation likewise present a **major / moderate adverse** (**significant**) risk for all receptors, i.e. the community, the natural and built environment; and
- Extreme winds present a **moderate adverse** (**not significant**) risk for all receptors.

15.5.32 The residual effects that remain significant in EIA terms is flooding from extreme rainfall events for the natural environment and heatwaves and warmer summers for all receptors.

15.5.33 All other residual effects are minor adverse, and therefore, not significant in EIA terms.

The Works

15.5.34 A summary of the residual effects proposed additional mitigation and enhancement measures is presented in Error! Reference source not found..

Table 15.24: Summary of Residual Effects for the Development during the Works

Receptor	Potential Effect	Significance of Effect	Proposed Additional Mitigation and Enhancement	Significance of Residual Effect	Duration	Direct / Indirect
GHG Impact Assessment						
Global Climate	Embodied carbon emissions associated with the construction (upfront carbon A1-A5) of the Development, including buildings and infrastructure works.	Major adverse	**Additional mitigation to be secured by a suitably worded planning condition:** Whole Life Carbon Assessment for Planning to be submitted for Tier 2 of the Planning Approach for each Phase to verify the carbon performance of the detailed proposals in alignment with net zero carbon trajectory. Compliance with policy requirements applicable at the time of the RMA stage and for the duration of construction of each Phase to be secured as a minimum. Set out low carbon design principles to demonstrate proposals respond to topography and microclimate conditions, as well as adopting a low carbon design.	Moderate adverse **Significant effect**	Long-term	Indirect
CCRA						
Community and people; the built environment, infrastructure systems and services; and the natural environment	Surface water flooding; Wetter winters and increased, prolonged humidity; Extreme wind & storms; Subsidence or ground movement; Drought; Heatwaves; Warmer summers and increased solar radiation	Moderate adverse	**Enhancement Measure recommended to be secured by a suitably worded planning condition:** Detailed Framework CEMP and any subsequent CEMPs submitted for the RMAs to include a risk assessment for climate hazards and their potential impacts to the construction workforce and natural environment and incorporate detailed proposals on mitigation measures to alleviate risks for these sensitive receptors.	Minor adverse **Not significant**	Short-term	n/a

The Completed and Operational Development

15.5.35 A summary of the residual effects, proposed additional mitigation and enhancement measures is presented in

15.5.36 **Table 15.25**.

Table 15.25: Summary of the Residual Effects of the Completed and Operational Development

Receptor	Potential Effect	Significance of Effect	Proposed Additional Mitigation and Enhancement	Significance of Residual Effect	Duration	Direct / Indirect
GHG Impact Assessment						
Global Climate	Operational carbon emissions of the Development (B6), including impacts from buildings.	Major adverse	Set out low carbon design principles to demonstrate proposals respond to topography and microclimate conditions, as well as adopting a low carbon design. Implementing post-occupancy evaluation (POE) and real-time energy monitoring systems to ensure buildings perform as designed. Operational energy use will be regularly audited, and performance will be benchmarked against industry standards such as LETI and the UK Net Zero Carbon Buildings Standard. These measures will be secured through planning conditions and monitored throughout the operational life of the development to ensure continuous improvement and alignment with evolving best practice.	Major adverse **Significant effect**	Long-term	Direct

Receptor	Potential Effect	Significance of Effect	Proposed Additional Mitigation and Enhancement	Significance of Residual Effect	Duration	Direct / Indirect
Global Climate	Embodied carbon emissions associated with the operation and end of life emissions of the Development (B1-B5, C1-C4 lifecycle embodied), including impacts from buildings and infrastructure works.	Major adverse	**Additional mitigation to be secured by a suitably worded planning condition:** As above for the Works.	Major adverse **Significant effect**	Long-term	Direct and indirect
CCRA						
Natural Environment	Flooding from extreme rainfall events (surface water flooding); Heatwaves and overheating; Warmer Summers and Increased Solar Radiation due to less cloud coverage	Major / moderate adverse	Further mitigations at plot level required, including detailing of the planting species that can be resilient to flood and drought conditions. Emergency preparedness plan which considers climate-related events, such as wildfires for the natural environment receptors on site as well as means of escape for community.	Major / moderate adverse **Significant effect**	n/a	n/a
Natural Environment	Flooding from extreme rainfall events (surface water flooding); Heatwaves and overheating; Warmer Summers and Increased Solar Radiation due to less cloud coverage	Major/ moderate adverse	**Additional measure recommended to be secured by a suitably worded planning condition:** Long-term landscape maintenance plans to be submitted for the RMAs, which also consider the potential effects of climate change and incorporate proactive strategies to reduce risks to trees and all other natural ecosystems and habitats against flooding from rainfall events, periods of extreme heat, prolonged hot	Moderate adverse **Not significant**	n/a	n/a

Receptor	Potential Effect	Significance of Effect	Proposed Additional Mitigation and Enhancement	Significance of Residual Effect	Duration	Direct / Indirect
			weather, intense rainfall and stormy/windy conditions, and prolonged wet weather.			
Community and People; Built Environment, Infrastructure systems and services	Heatwaves and overheating; Warmer Summers and Increased Solar Radiation due to less cloud coverage	Major/ moderate adverse	Further mitigations at plot level required, including considerations for shading, cooling, material specifications with high albedo and water efficiency. Maintenance and monitoring considerations related to the heat risk resilience for infrastructure and buildings to be considered in Tier 2 of the planning application.	Moderate adverse **Not significant**	n/a	n/a

15.6 Likely Residual and Cumulative Effects and their Significance

15.6.1 Cumulative Schemes have not been considered in this assessment. GHG emissions are cumulative in nature, thereby GHG emissions in relation to committed developments outside the Site have not been considered as there is no basis for selecting cumulative projects.

15.6.2 As regard to climate change, the assessment considers the effect of climate on the Development, therefore no inter-project cumulative effects are anticipated. Climate change adaptation effects and impacts are specific to the development and will not result in impacts to neighbouring development[9].

15.7 Conclusions

15.7.1 This Chapter assessed the likely significant effects of East Hemel's greenhouse gas emissions on the environment (GHG Impact Assessment) and the effect of climate change on the Development (CCRA). The assessment has been completed in line with national, regional and local policy and legislative requirements for the construction and operation phases of East Hemel and is supported by a GHG Assessment (**Appendices 15.1-15.2**) and CCRA (**Appendix 15.3**).

15.7.2 Major and major / moderate adverse effects were deemed significant in EIA terms, while moderate adverse and minor adverse effects were deemed not significant in EIA terms.

15.7.3 The Development has strategically embedded a number of mitigation measures for climate change resilience which will also reduce emissions. These include safeguarding green infrastructure across the site, with ponds for

surface water flooding resilience located at the bottom of the dry valleys, retaining ecological corridors and woodlands and providing two new major parks which will contribute to increasing the Development's carbon sequestration compared to the Baseline condition.

15.7.4 Further work is required to mitigate climate change emissions and risks at the detailed design stage.

15.7.5 Most of the specific mitigation measures aimed at reducing GHG emissions and climate change vulnerability cannot be considered embedded at this outline stage. The proposed plots and design are indicative and do not reflect detailed design proposals that will only become available at the stage of Reserved Matters Applications.

15.7.6 As additional mitigation, and for each phase of the Development, mitigation measures tackling upfront and lifecycle carbon must be identified at plot level and captured in a detailed Whole Life Carbon Assessment. This assessment should be undertaken at the Reserved Matters Applications (RMA) to verify the carbon performance of the detailed proposals of the building plots and demonstrate compliance with policy requirements applicable at the time of the RMA, as a minimum.

15.7.7 Given the rate of decarbonisation that the construction industry needs to achieve in the coming years and the Development's long construction programme; there is uncertainty over the emergence and evolution of the regulatory context for embodied carbon emissions of new developments (in national, regional or local policy). A potential gap between regulations, industry progress and the required decarbonisation trajectory, it is likely there will be a moderate adverse residual effect due to the construction (upfront) and operational stage (in-use) embodied carbon emissions. This is considered a **significant adverse** effect in EIA terms.

15.7.8 The GHGIA assessed two scenarios: a BAU Scenario and an Aspirational Scenario based on embodied carbon benchmarks for reducing GHG emissions during the Works and for the Completed and Operational Development. These benchmarks are intended to align the industry with a net zero trajectory. Additional mitigation measures are proposed for future development.

15.7.9 The residual effects of the Development in terms of user transport and waste management carbon emissions are found to be major adverse, which is a **significant adverse** effect in EIA terms.

15.7.10 Operational energy and operational water emissions are found to be minor adverse, which is **not significant** in EIA terms. However, this would be subject to detailed design and confirmation for plot-based approaches to energy efficiency and water conservation, as well as the assumed decarbonisation of grid electricity.

15.7.11 It is noted that the CCRA identified no significant effects for the construction stage. Due to the shorter timeframe of the demolition and construction period and the cumulative effects of climate change, the risks to the Site are reduced compared to the operational stage. As an enhancement measure, it is proposed that the Detailed Framework CEMP and any subsequent CEMPs submitted for the RMAs include a risk assessment for climate hazards and their potential impacts on the construction workforce and natural environment, followed by detailed proposals on risk mitigation to alleviate risks for these sensitive receptors. This element of the CEMP is proposed to be covered by a suitably worded planning condition.

15.7.12 The CCRA evaluated the significance of effect per climate hazard and sensitive receptor for the Completed and Operational Development as follows:

- Flooding from extreme rainfall events (surface water flooding) presents a major / moderate **(significant)** adverse risk for the natural environment, and a moderate adverse risk for the built environment and community;
- Wetter winters & increased prolonged humidity present a moderate adverse (not significant) risk for the built environment, community and natural environment;
- Subsidence or ground movement presents a minor adverse risk (not significant) for the built environment, community and natural environment;
- Drought presents a moderate adverse (not significant) risk for the built environment, community and natural environment;
- Heatwaves present a major / moderate (**significant**) adverse risk for all receptors, i.e. the community, the natural and built environment;
- Warmer summers and increased solar radiation likewise present a major / moderate **(significant)** adverse risk for all receptors, i.e. the community, the natural and built environment; and
- Extreme winds present a moderate adverse (not significant) risk for all receptors.

15.7.13 Additional mitigation measures are proposed beyond the embedded mitigation measures.

15.7.14 Embedded mitigation measures are listed in Paragraph 15.4.36. The drainage system is designed for rainfall events including expected climate change increases. Measures such as ponds, green infrastructure and SuDS features will help alleviate flooding and provide cooling effects, but resilient planting needs to be selected to reflect projected conditions within and around those features. Significant provision of these features at parameter plan level has been provided but further details at plot level are required to ensure they are effective at mitigating the climate risks identified.

15.7.15 Additional mitigation measures for the detailed proposals at plot level should be produced to address the impacts of climate change. These additional measures should be detailed through future RMAs.