

14 Climate Change and Sustainability

14.1 Introduction

- 14.1.1 This chapter presents the findings of an assessment of the likely significant effects of the Proposed Development on:
- the impact of the Proposed Development on climate change ('Greenhouse Gas Emissions Assessment'); and
 - the impact of climate change on the Proposed Development ('Climate Change Risk Assessment').
- 14.1.2 These assessments have different policy contexts, guidance documents, methodologies, baseline conditions, potential impacts and mitigation measures. This Chapter therefore presents the Greenhouse Gas Emissions Assessment and Climate Change Risk Assessment separately. Following this introduction, this Chapter is structured as follows:
- **Part 1: Greenhouse Gas (GHG) Emissions Assessment** – a qualitative assessment of the Proposed Development's impacts on climate change by its potential to emit GHGs. This section also outlines what mitigation measures have been embedded within the Proposed Development to reduce GHG emissions during construction and operation.
 - **Part 2: Climate Change Risk Assessment (CCRA)** – outlines the projected climatic changes in the region, identifies receptors vulnerable to climate change, and the mitigation measures to address climate change, embed adaptation measures and improve resilience.
 - Summary and References.
- 14.1.3 In accordance with Regulation 18(5) of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017, a statement outlining the relevant expertise and qualifications of competent experts appointed to prepare this ES is provided in **Appendix A.4**.
- 14.1.4 For context and further information regarding the mitigation outlined in this chapter, this ES Chapter should be read alongside other technical chapters within this ES including **Chapter 12 (Biodiversity)** and **Chapter 8 (Transport and Access)** along with the **Energy Strategy and Sustainability Statement** (Ramboll, 2022) and **Flood Risk Assessment** (Jubb, 2022) submitted with the Planning Application.
- 14.1.5 The appendices associated with this chapter are:
- **Appendix I.1:** Climate Change Policy and Guidance
 - **Appendix I.2:** Figures
 - **Appendix I.3:** Climate Projections Data

14.2 Policy, Legislation, Guidance and Standards

National Policy and Legislation

- 14.2.1 The following legislation and policy has informed the assessment of effects within this section. Further details are provided in **Appendix I.1**.

- The Paris Agreement, 2015
- Climate Change Act (CCA) 2008
- Carbon Budget Orders 2009, 2011, 2016 and 2021
- Town and County Planning (Environmental Impact Assessment) Regulations 2017
- National Planning Policy Framework (NPPF) 2021
- Planning Practice Guidance (PPG) 2019
- The Glasgow Climate Pact 2021
- COP26 Climate Pact 2021
- The Road to Zero 2018
- A Green Future: Our 25 Year Plan to Improve the Environment 2018
- The Ten Point Plan for an Industrial Revolution, 2020
- Transport Decarbonisation Plan, 2021
- UK Climate Change Risk Assessment 2021 (CCC, 2021)
- The National Adaptation Programme (Defra, 2018).

Local Policy

Climate Emergency

14.2.2 Following the Government's declaration of a Climate Emergency in May 2019, South Gloucestershire Council (SGC) declared their own Climate Emergency in July 2019. The Council have pledged to:

- Provide the leadership to enable South Gloucestershire to become carbon neutral by 2030; and
- Set out an area wide Climate Emergency Action Plan each year until 2030.

Climate Change Strategy and Action Plans

14.2.3 South Gloucestershire Council have produced a Climate Strategy (SGC, 2020) document with a 10 year lifespan (2020-2030). It provides an introduction to their annual Climate Emergency Action Plans and explains the Council's principles and general approach to delivering the aim of South Gloucestershire being carbon neutral by 2030. The document is jointly owned by the Council and South Gloucestershire Local Strategic Partnership; the local strategic partnership set up in 2002.

14.2.4 The partnership brings together many different public, private, community and voluntary organisations to work with the community to identify and tackle key issues in a more co-ordinated way which enables both strategic decisions and local action. The Climate Strategy sits under the South Gloucestershire Sustainable Community Strategy.

14.2.5 Each year over the 10 years from 2020 to 2030 the council will produce and deliver an annual Action Plan, reporting in December each year on the progress that has been made. The latest Action Plan to be published is for the period 2022/2023 and sets out several actions which

seek to reduce GHG emissions, including improving public transport infrastructure, delivering carbon neutral housing, and promoting climate change awareness.

Sustainable Community Strategy

- 14.2.6 The Sustainable Community Strategy: South Gloucestershire 2036: A great place to live and work (SGC, 2016), sets out the shared vision and key priorities for the future of the area and is one of the ways which the South Gloucestershire Partnership use to identify and be responsive to local needs; it also provides direction to the partners' work to improve integration, sustainability and service quality; to focus resources and work more efficiently together for the benefit of the people of South Gloucestershire.
- 14.2.7 The strategy aims to find the best ways of meeting today's requirements without damaging the ability of future generations to meet their needs and is committed to making sure that in 2026 South Gloucestershire is a place where everyone is fulfilling their potential and experiencing an excellent quality of life. The Partnership addresses issues that local communities feel are important to their social, economic and environmental well-being in a way which draws on the energy and expertise of all in our communities.
- 14.2.8 This strategy sets the direction for the work of the partners and the context for many other strategies and plans. It is aligned to the Local Development Framework which takes forward the spatial aspects of the Sustainable Community Strategy. Performance indicators and targets will be set around the priorities of the strategy and achievement of these will contribute to the improvement of South Gloucestershire's quality of life.

South Gloucestershire Core Strategy 2006 - 2027 (2013)

- 14.2.9 Chapter 5 of the South Gloucestershire Core Strategy (SGC, 2013) High Quality Design and Responding to Climate Change is of particular relevance to this chapter. It states that "*High quality urban design, the provision of Green Infrastructure, and new renewable and low-carbon energy sources, all have a key role to play in responding to climate change, as well as creating distinctive, linked places that support social inclusion and healthy sustainable lifestyles.*"
- 14.2.10 A summary of the most relevant policies within Chapter 5 is provided below:
- **Policy CS1 High Quality Design** requires development proposals to "assist in meeting climate change and health and well-being objectives".
 - **Policy CS4a Presumption in Favour of Sustainable Development** notes that "when considering proposals for sustainable development, the council will take a positive approach. It will work pro-actively with applicants to find solutions so that sustainable development can be approved wherever possible".
- 14.2.11 **Policy CS1** sets out 11 criteria for the assessment of high-quality design in new development. In particular, through Design & Access Statements, "*development proposals should demonstrate a clear understanding of both the site and locality's historic, archaeological, ecological and landscape context in drawing up development proposals*". The policy also sets out key design priorities and a standard against the established national assessment methodology, 'Building for Life' (BfL12), that residential development proposals will be expected to achieve. Information required from applicants should be proportionate to the scale, significance and impact of a proposal.
- 14.2.12 The Core Strategy allocates the Site within **Policy CS5 Location of Development**. This Policy identifies land in the Cribbs Causeway, Patchway and Filton area as having the potential to accommodate new dwellings and associated facilities. For further information, see reference to the Cribbs / Patchway New Neighbourhood Development Framework Supplementary Planning Document (SPD) 2014 below.

14.2.13 **Policy CS26** sets out the key principles of development for new neighbourhoods in this area. In relation to climate change, this policy includes requirements for *“a co-ordinated approach to carbon reduction, and new renewable and low-carbon energy generation and distribution networks”*

14.2.14 During the plan-making process, a Sustainability Appraisal (SA) has been carried out as an iterative and ongoing process to inform decision making for implementing the Local Plan. The SA process is carried out to assess the economic, social and environmental impact of emerging policies. The SA was undertaken in accordance with Government guidance and considered the likely significant effects of the implementation of the Local Plan on the sustainability objectives for the South Gloucestershire authority area. This included a number of objectives to which climate change was taken account of. These include:

- **Objective 3: Develop the economy in ways which meets people’s needs.** The objective aims to (inter alias) *“Reduce the vulnerability of the economy to climate change and harness opportunities arising.”*
- **Objective 5: Maintain and improve environmental quality and assets.** The objective aims to (inter alias) *“Protect and enhance habitats and species (taking account of climate change) (and) Reduce vulnerability to flooding and sea level rise (taking account of climate change)”*
- **Objective 6: Minimise pollution and consumption of natural resources.** The objective aims to (inter alias) *“Reduce non-renewable energy consumption and “greenhouse emissions”, Keep water consumption within local carrying capacity limits (taking account of climate change), Minimise consumption and extraction of minerals, Reduce waste not put to any use, (and) Minimise land, water, air, light, noise, and generic pollution.”*

SGC Policies, Sites and Places Plan (2017)

14.2.15 The Policies, Sites and Places Plan (PSP) (SGC, 2017) forms part of the Local Plan. The PSP was adopted on 8th November 2017. The document is split into two parts, with part one covering policies for managing new development, and part two covering the allocation and protection of Sites and places within South Gloucestershire.

14.2.16 Section 3 of the PSP contains 6 policies which are intended to be read alongside those in Chapter 5 of the Core Strategy such that, together, they form the Local Plan policies on responding to climate change and high-quality design. Within these 6 policies, Policy PSP 6: On Site Renewable and Low Carbon Energy states the following:

“All development proposals will:

1. be encouraged to minimise end-user energy requirements over and above those required by the current building regulations through energy reduction and efficiency measures, and in respect of residential for sale and speculative commercial development offer micro renewables as an optional extra, and

2. be expected to ensure the design and orientation of roofs will assist the potential siting and efficient operation of solar technology”

Cribbs / Patchway New Neighbourhood Development Framework Supplementary Planning Document (SPD) (2014)

14.2.17 The Site is located within an area of allocated land in the Local Development Plan, the Cribbs / Patchway New Neighbourhood (CPNN).

14.2.18 The CPNN Development Framework SPD (SGC, 2014), sets out how the allocation for a mixed-use development including 5,700 new homes, 50ha of employment land and a range of

community services and facilities should be developed. The main requirements for the new neighbourhood are set out in Policy CS26 of the Core Strategy.

14.2.19 The SPD sets out development principles for a number of aspects relating to the proposed new neighbourhood including access and movement; community infrastructure; green and blue infrastructure; land use; and utilities and renewable energy.

14.2.20 Chapter 9 of the SPD notes that *“The Cribbs Patchway New Neighbourhood has the opportunity to be a practical exemplar of sustainable development through coordinated efficiencies in utility infrastructure provision, and through an approach to reducing energy demand and use of low carbon energy solutions”*. In relation to low carbon and renewable technologies it also recommends a combination of technologies that suit specific areas of development, such as localised Combined Heat and Power for high density areas, solar photovoltaic (PV), solar water heating and ground source heat pumps for lower density areas.

14.2.21 It also provides key considerations for landscape, biodiversity and water, noting *“Strategic Green and Blue Infrastructure (GI & BI) will need to comprise a substantial, interconnected and multi-functional network of spaces (both green and blue assets), protecting and enhancing the existing ecological habitats, trees and hedgerows, and their integration through the use of SUDS and the treatment of waste water from buildings.”*

South Gloucestershire New Local Plan

14.2.22 SGC are currently gathering evidence for and preparing a new Local Plan that will include a new strategy and policies to guide and manage growth and change in the area over at least the next 15 years. Phase 2 of the consultation was open at the time of writing. SGC note that this is an important opportunity to (inter alia) *“have positive impacts on climate change, inequalities and encourage a green economy”*.

14.2.23 A working draft of the Climate Change Adaptation and Mitigation policy was issued consultation during Phase 1. The draft policy states:

“Development proposals are required to demonstrate how they will mitigate and adapt to climate change and help deliver radical reductions in greenhouse gas emissions and generate renewable and/or low carbon energy proportionate to their scale and type. All development proposals must:

- *Contribute to achieving the target of South Gloucestershire becoming carbon neutral by 2030 (or the latest updated target set out in the climate change strategy) and the UK statutory target for reducing greenhouse gas emissions (set out in the Climate Change Act 2008, as amended); and*
- *Maximise the generation of energy from renewable and/or low carbon sources; and*
- *Integrate building-level and site-level measures into the design of the development to adapt to climate change impacts that are likely to occur over the lifetime of the development. Measures that lead to increases in energy use and carbon dioxide emissions should be avoided.*

Information proportionate to the scale of the development proposed must be submitted with any planning application to demonstrate how the proposal addresses climate change mitigation and adaptation.”

14.2.24 Joint evidence is being gathered by the West of England unitary authorities to explore the best way of reducing carbon emissions from new development through local plan policies. These include studies on the cost of carbon reduction in new buildings and the practicalities of implementing a potential carbon offsetting local plan policy. Evidence is also being gathered on whether it is feasible to incorporate Electric Vehicle (EV) charging in local planning policy.

Guidance

14.2.25 Several standards and guidance documents have been used to inform the GHG emissions assessment methodology and the CCRA methodology. Full details of how the following documents have been considered in this chapter is provided in **Appendix I.1**.

- Environmental Impact Assessment (EIA) Guidance on assessing greenhouse gas emission and significance (IEMA, 2022).
- Publicly Available Standard (PAS) 2080:2016 Carbon management in Infrastructure (British Standards Institute (BSI), 2016).
- World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI) Greenhouse Gas Protocol guidance (WBCSD and WRI, 2004).
- EIA Guidance on Climate Change Resilience & Adaptation (IEMA, 2020)
- UKCP18 Guidance: How to use the UKCP18 Land Projections (Met Office, 2018)

14.3 Consultation

14.3.1 The EIA Scoping Report (**Appendix A.10**) identified the proposed scope and approach of the GHG emissions assessment. SGC provided its EIA Scoping Opinion for Brabazon in February 2022 (**Appendix A.11**). SGC's comments regarding GHG emissions, climate resilience and adaptation are set out in **Table 14.1**.

Table 14.1: SGC Scoping Opinion and Response

SGC Scoping Comments	Response
In terms of the Climate Risk and Resilience Assessment (CCRA) the proposed baseline of 2036 is too early (i.e. should be set at a later date) when considering the implications of anticipate changes in the local climate on subsequent development at Filton Airfield. SGC's working assumption is that new development will have an operational life of 60 years i.e. be functioning/operating in 2080. Accepting that future predictions become less certain with time and are dependent on actions taken between now and then, I still think the timeline for considering the direct impacts of climate change on the new development should be extended to 2080. This 2080 timeframe would align the EIA with the analysis we ask developers to provide for current planning applications in order to demonstrate climate resilience. It also aligns with emerging policy on climate adaptation.	Although future predictions become less certain with time, it is crucial to consider the direct impacts of climate change on the new development in future years as this enables the developer to design for climate resilience. The Climate Change Risk Assessment set out in Part 2, reviews the current baseline (2022), the future baseline (2036; see Chapter 5 (Assessment Method) for reference) and in intervals thereafter i.e. 2050, 2075 and 2099. Assumptions and limitations to the CCRA are outlined in Section 14.14.
Overheating analysis of new development run against 2080 weather files commonly shows it failing (i.e. to be at risk of overheating), however, we request this to establish whether amendments are needed to designs to	Increased temperatures are considered within the Climate Change Risk Assessment in Part 2. This includes current baseline (2022) and future baselines 2036, 2050, 2075 and 2099. The matter is acknowledged as

SGC Scoping Comments	Response
increase future resilience to overheating (and allow mitigation measures to be retrofitted) or whether additional mitigation measures can be added as part of normal maintenance/refurbishment cycles during the lifetime of the scheme. It is acknowledged that the specific detailed assessment will be dealt with at detailed design state however the matter should be acknowledged as part of the mitigation section of the assessment. Noting the proposal to use UK Climate Projections 2018 (UKCP18) produced by the UK Met Office (Met Office, 2018). UKCP18 projections run to 2100. When asking developers to consider overheating risk we ask for this to take account of the design life of new construction which is assumed to be 60 years, i.e. to 2080.	part of the baseline section of the assessment in Section 14.13. It is noted in the approved Design Code (YTL, 2021) for the extant planning consent that TM52 and TM59 overheating assessments are to be carried out at the Reserved Matters stage.
I disagree with the proposal (section 15) to exclude Sustainability from the EIA and think this should be included (<i>in the ES</i>) The nature of the built environment is such that sustainability and climate change (impact on and adaptation to) are interconnected and cannot easily be separated. Therefore, both should be considered within the EIA.	It should be noted that the topic of Sustainability is included within this chapter but is not included as a stand-alone ES chapter. As the Proposed Development is seeking parameter consent there is limited scope at this stage to influence specific building and plot design, and it is the intention to address this at the reserved matters stage particularly in the light that there is likely to be a suite of new emerging policies available at this time. However, the Proposed Development is covering site-wide principles relating to sustainability in many of the ES chapters, including the Chapter 3 (Proposed Development), Chapter 8 (Transport and Access) and Chapter 12 (Biodiversity). Sustainability is also covered in the Outline Masterplan Design and Access Statement (DAS) (YTL, 2022) and in the Approved 2021 Eastern Framework Design Code (YTL, 2021) and can be addressed on a phase-by-phase basis through that condition.
Adaptation: The impact on the built environment of changes in the local climate is likely to be very significant. It is essential that the design of new development at Filton Airfield takes these changes into account and that climate adaptation is included within and is integral to	As noted above, the impact on the Proposed Development resulting from changes in local climate is considered within the Climate Change Risk Assessment in Section 14.11 onwards. A series of mitigation measures have been embedded within the design which will help

SGC Scoping Comments	Response
the design process from the outset. This includes the EIA. Localised impacts include increases in average and peak summer temperatures, increased frequency of heat wave events and longer duration heat wave events, and increased intensity of rainfall. These will impact the built environment, public health and productivity.	the built environment to adapt to changes in local climate, see Section 14.16. Other mitigation measures will be addressed at detailed design through, for example, establishing the orientation and footprint of buildings and selecting appropriate glazing. At the outline planning stage, these measures are considered within the ‘further mitigation’ section of this chapter in Section 14.18 but specific detail will need to be secured at detailed design.
Heat network study: SGC is undertaking a Techno-economic study of a heat network at Filton Airfield (for which YTL is a stakeholder). This will have a bearing on the energy and climate change strategy and design of subsequent phases of development at FA up to 2048 and should therefore be included within the EIA.	An Energy Strategy (Ramboll, 2022) has been produced and submitted with the application for the Proposed Development. This examines the commercial viability of an autonomous heat network solution within the Site and is discussed under the further mitigation section (Section 14.8) of the GHG Assessment. SGC have also commissioned a techno-economic feasibility for the Airfield which has not been available for consideration in this chapter. This is due to be finalised April 2022.
Section 14.8.1 states that ‘During the construction phase it is anticipated that the risk of climate hazards, for example from heatwaves or periods of heavy precipitation may increase however it is expected that these will be managed through standard construction and health and safety practices, such as securing material/equipment and not undertaking works during periods of extreme rainfall’. I suggest that this section is expanded and considered in more detail within the EIA.	Ways in which the construction of the Proposed Development responds to the risk of climate hazards is discussed in Section 14.16.

14.3.2 Natural England also provided a response to the Climate Change section of the Scoping Opinion as follows:

“The ES should identify how the development affects the ability of the natural environment (including habitats, species, and natural processes) to adapt to climate change, including its ability to provide adaptation for people. This should include impacts on the vulnerability or resilience of a natural feature (i.e. what’s already there and affected) as well as impacts on how the environment can accommodate change for both nature and people, for example whether the development affects species ability to move and adapt. Nature-based solutions, such as providing green infrastructure on-site and in the surrounding area (e.g. to adapt to flooding, drought and heatwave events), habitat creation and peatland restoration, should be considered. The ES should set out the measures that will be adopted to address impacts.

Further information is available from the Committee on Climate Change's (CCC) Independent Assessment of UK Climate Risk, the National Adaptation Programme (NAP), the Climate Change Impacts Report Cards (biodiversity, infrastructure, water etc.) and the UKCP18 climate projections.

The Natural England and RSPB Climate Change Adaptation Manual (2020) provides extensive information on climate change impacts and adaptation for the natural environment and adaptation focussed nature-based solutions for people. It includes the Landscape Scale Climate Change Assessment Method that can help assess impacts and vulnerabilities on natural environment features and identify adaptation actions. Natural England's Nature Networks Evidence Handbook (2020) also provides extensive information on planning and delivering nature networks for people and biodiversity.

The ES should also identify how the development impacts the natural environment's ability to store and sequester greenhouse gases, in relation to climate change mitigation and the natural environment's contribution to achieving net zero by 2050. Natural England's Carbon Storage and Sequestration by Habitat report (2021) and the British Ecological Society's nature-based solutions report (2021) provide further information."

- 14.3.3 **Part 2** of this chapter considers the natural environment as a receptor and climate change and nature-based solutions such as providing green infrastructure including planting and the provision of public open spaces is considered as mitigation in **Section 14.16** and **Section 14.18**. Further information can be found in **Chapter 12 (Biodiversity)** and **Chapter 11 (Landscape and Visual)**.

Part 1: GHG Emissions Assessment

14.4 Methodology

Study Area

- 14.4.1 The GHG emissions assessment study area includes the Site and extends to include activities that occur beyond the Site boundary, such as the generation of electricity off site. As GHG impacts are global and cumulative with all other sources of emissions, no specific geographical study area is defined for the identified GHG emission sources that are set out in **Table 14.2**.

Baseline Data Collection

- 14.4.2 As noted in **Section 5.9** of this ES, the assessment of construction effects has been undertaken against the current 2022 baseline and the assessment of operation effects has been undertaken against the 2036 baseline.
- 14.4.3 A high-level review of existing land use and associated activities on Site has been undertaken to identify the 2022 baseline GHG emissions. This includes a review of **Chapter 11 (Air Quality)** and the supporting appendices, along with the UK Carbon Budget Orders and UK local authority GHG inventory data (DBEIS, 2021).
- 14.4.4 The 2036 Baseline takes into consideration the carbon budgets for this time period, which the UK Government is legally bound to achieve, and policy changes such as revisions to Approved Document Part L of the Building Regulations; and the two new Approved Documents F and O, which will come into effect in June 2022. In addition, the 2036 Baseline considers several technological advances which are extremely likely to come forward, including the progressive decarbonisation of the National Grid, and increased uptake of Electric Vehicles. However, it is acknowledged under the Limitations section below that it is not possible to anticipate all technological advances which may come forward and result in changes to GHG emissions.

Sensitive Receptors

- 14.4.5 GHG emissions have a global effect rather than directly affecting specific local receptors to which levels of sensitivity can be assigned. The global climate has therefore been treated as a single receptor. Given the global scale and severe consequences of climate change and limited recoverability, the receptor sensitivity is considered to be high.

Assessment Methodology

- 14.4.6 There is no nationally adopted method for assessing climate change within EIA and therefore the assessment approach draws upon IEMA guidance (IEMA, 2022). It identifies that all new GHG emissions contribute to a negative environmental impact and contribute to climate change, thus might be considered significant. This is set out further in **paragraphs 14.4.18-14.4.20**. It therefore suggests the impact of a development on climate should be based on its potential to emit GHGs.
- 14.4.7 The GHG emissions assessment has been based on the description of the Proposed Development as outlined in **Chapter 3 (Proposed Development)**.
- 14.4.8 The construction and operation scope of the assessment has been based on the anticipated 4 phases of development (see **Chapter 4: Construction and Site Management**). Phase 1a is the first phase of the extant 2018 planning consent and is currently under construction which is taking place between 2020 and 2024.
- 14.4.9 IEMA guidance emphasises the need for proportionality in the context of national, sector and local GHG emissions. Given the outline nature of the application, a qualitative approach to assessing the GHGs of the Proposed Development has been undertaken. The guidance recognises that qualitative assessments are acceptable, particularly where mitigation measures are agreed early on in the design stage and is agreed during the EIA scoping stage with stakeholders. Taking a qualitative approach has been agreed with SGC as appropriate and proportionate for the Proposed Development at scoping. The sources of emissions that are considered within this assessment, in line with IEMA Guidance, are discussed below in **Table 14.2**.
- 14.4.10 The Proposed Development has embedded several measures to reduce GHG emissions associated with the construction and operation of the Site, outlined in **Section 14.6** below.
- 14.4.11 The GHG Protocol (WBCSD and WRI, 2019) categorises direct and indirect emissions into three broad scopes:
- **Scope 1:** all direct GHG emissions;
 - **Scope 2:** indirect GHG emissions from the generation of purchased electricity, heat, or steam; and
 - **Scope 3:** other indirect emissions, such as the extraction and production of purchased materials and fuels, electricity-related activities not covered in Scope 2, outsourced activities, waste disposal, etc.
- 14.4.12 The scope of the GHG Emissions assessment is set out in **Table 14.2** below.

Table 14.2: GHG Emissions Sources and Qualitative Scope

Stage of Development	GHG Protocol	Activity Assessed
Demolition/ Construction	Scope 1	Enabling activities such as breakup of the runway (of which materials will be re-used on Site), land clearance and construction processes such as emissions resulting from the combustion of fuels for vehicles, plants or equipment used for construction of the Proposed Development and emissions released by soil movement
	Scope 2	Emissions associated with electricity needed for plant and welfare facilities.
Operation	Scope 1	Emissions associated with transport.
	Scope 2	Emissions associated with purchased electricity from the National Grid and distribution network during operation of the Proposed Development, for example emissions associated with the Energy Strategy.

14.4.13 Indirect Scope 3 emissions are emitted from activities which are predominantly outside of the Applicant's control, for example, waste disposal and emissions related to the supply chain of construction materials. It is therefore difficult to assess these accurately and meaningfully at the early stage of a project and it is not considered appropriate or proportionate in the context of the Proposed Development and the EIA Regulations. IEMA guidance recognises that the assessment of GHGs should be proportionate in the context of EIA. Therefore Scope 3 emissions have been scoped out of further assessment as it is not considered proportionate to the Proposed Development within the context of the EIA. This approach was agreed with SGC through EIA Scoping. Embedded and further mitigation that reduces GHGs, including indirect Scope 3 emissions, associated with the Proposed Development are considered within the assessment.

14.4.14 Due to the nature of the Proposed Development (mixed-use residential, commercial and industrial), it has not been designed with a fixed lifetime and therefore the end-of-life stage, or demolition, is difficult to define. In addition, it is anticipated that the construction and operation of the Proposed Development will have the greatest potential to emit GHGs compared to the end-of-life stage, particularly when considering the trend of national decarbonisation over time and the legislative requirement for the UK to meet carbon neutral targets by 2050. It is therefore anticipated that, when the Proposed Development will reach end-of-life, there will be a zero-carbon economy and principles for a circular economy will be utilised. Emissions associated with the end-of-life stage of the Proposed Development are therefore scoped out of the assessment.

14.4.15 A review has been undertaken of relevant reports that will be submitted with the planning application including the Energy Strategy and Waste Strategy. Where information from reporting outside the ES has been considered, all relevant information to inform the assessment of likely significant effects on the environment has been summarised within this Chapter.

Determining Significance

14.4.16 There is an absence of a defined threshold for determining the significance of effects resulting from GHG emissions in EIA. Significance of effect is therefore determined using professional judgement, and consideration of the following elements:

- Appraisal of the Proposed Development's emissions in the context of national, regional and local emissions.
- IEMA EIA Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance (IEMA, 2022).
- How the Proposed Development has embedded design features to reduce GHG emissions and identified opportunities for further mitigation in the Proposed Development's design and delivery.

14.4.17 IEMA guidance identifies three underlying principles to inform the assessment of significance:

- *"The GHG emissions from all projects will contribute to climate change, the largest interrelated cumulative environmental effect"*
- *The consequences of a changing climate have the potential to lead to significant environmental effects on all topics in the EIA Directive (e.g. human health, biodiversity, water, land use, air quality)*
- *GHG emissions have a combined environmental effect that is approaching a scientifically defined environmental limit; as such any GHG emissions or reductions from a project might be considered to be significant."*

14.4.18 The UK has set a legally binding GHG reduction target for 2050 which, according to the CCC, is compatible with the magnitude and rate of GHG emission reductions required in the UK to meet the goals of the Paris Agreement. Given this, IEMA guidance states that *"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"*.

14.4.19 This assessment has applied the following significance criteria that is set out in the IEMA (2022) guidance.

Table 14.3: GHG Significance (IEMA, 2022)

Significance	Measure of Impact
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

Significance	Measure of Impact
	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.

14.4.20 Major or moderate adverse effects and beneficial effects are considered to be 'significant'. Minor adverse and negligible effects are considered to be 'not significant'.

Limitations and Assumptions

14.4.21 Given the outline nature of the application, the assessment has been based on high level information outlined in **Chapter 3** of the ES. This has been taken into consideration through the use of a qualitative approach to assessing the GHGs of the Proposed Development.

14.4.22 The trajectory of GHG emissions into the future is dependent on influences outside of the Applicant's control, for example Government policy and global technology and economic shifts, which are difficult to predict. The UK carbon budgets are legally binding and the Government have an array of policies and levers to be deployed if the carbon budgets are not likely to be met.

14.4.23 It is important to note that whilst it is not considered a form of mitigation, emissions from transport and energy are predicted to decline in the coming decades and this is considered within the GHG assessment. This assessment has assumed that the uptake of electric vehicles (EVs) and the decarbonisation of the National Grid will occur as set out in national strategies that have been adopted by the UK Government. For example, the uptake of EVs and hydrogen is anticipated to increase in line with Government policies, as petrol and diesel car sales will be banned by 2030. It is projected that the proportion of mileage driven by EVs for example is anticipated to almost double from 7.5% in 2030 to 14.1% in 2035 (NAEI, 2019). It is therefore assumed that an increase in EV uptake will result in a reduction in transport emissions associated with the Proposed Development in the long term, as vehicles will be powered by lower (or zero) emitting electricity sources.

14.5 Baseline Conditions

Current State of the Environment

National and Regional Emissions

- 14.5.1 This section establishes the existing GHG emissions at a national and regional level. GHG emissions do not have a local receptor as, once they are emitted, they are not limited to geographic boundaries.
- 14.5.2 **Table 14.5** sets out the UK carbon budgets from 2008 until 2022. Both the first and second carbon budgets were met, culminating in a 31% reduction below 1990 carbon emissions. The period for the third carbon budget is up to the end of 2022 and therefore emissions over this time are not yet available.

Table 14.5: 2008-2022 UK Carbon Budget

UK Budget	Carbon budget level (million tonnes carbon dioxide equivalents - MtCO ₂ e)	Target Reduction below 1990 levels	UK Emissions
1st carbon budget (2008 to 2012)	3,018 MtCO ₂ e	25%	2,982 MtCO ₂ e
2nd carbon budget (2013 to 2017)	2,782 MtCO ₂ e	31%	2,398 MtCO ₂ e
3 rd carbon budget (2018 – 2022)	2,544 MtCO ₂ e	37%	N/A*

*The UK emissions associated with the 3rd carbon budget will be published in 2023.

- 14.5.3 From a national perspective, in 2020 UK total GHG emissions were estimated to be 414.4 million tonnes carbon dioxide equivalents (MtCO₂e), a decrease of 10.7% compared to 2019 (DBEIS, 2021). National GHG emissions in 2020 had decreased by 48.8% since 1990 (DBEIS, 2021). The decrease of emissions in 2020 is primarily due to the large reduction in the use of road transport during the nationwide lockdowns and the reduction in business activity.
- 14.5.4 The Department for Business, Energy & Industrial Services (DBEIS, 2021) sets out the CO₂ emissions estimates from a number of sources for 2005-2019 and is the most up to date available figures for the UK and South Gloucestershire. The CO₂ estimates for 2019 are presented in **Table 14.6** below.

Table 14.6: National, South Gloucestershire CO₂ estimates for 2019

	Industry and Commercial (ktCO ₂)	Domestic (ktCO ₂)	Transport (ktCO ₂)	Land Use, Land Use Change and Forestry (ktCO ₂)	Total (ktCO ₂)
UK	111,123.9	94,378.5	124,303.5	1,197.9	344,797.6

	Industry and Commercial (ktCO ₂)	Domestic (ktCO ₂)	Transport (ktCO ₂)	Land Use, Land Use Change and Forestry (ktCO ₂)	Total (ktCO ₂)
South Gloucestershire	351.8	367.6	916.6	-16.5	1,660.1

14.5.5 South Gloucestershire accounts for approximately 0.48% of the total UK emissions.

Local Emissions

14.5.6 The Site encompasses 141.7 ha of land and comprises the former Filton Airfield and associated buildings. There are currently limited greenhouse gas emissions associated with the Sites former use given that it is no longer operational. There is limited vegetation within the Site. Apart from areas of concrete hardstanding forming the runways, ground cover within the Site boundary is predominantly mown grassland, consistent with the former use as an airfield, with areas of more substantial vegetation and trees north of the runway, the most notable of which is the Filton Wood Site of Nature Conservation Interest (SNCI). This vegetation may provide a limited amount of carbon sequestration on Site.

14.5.7 There are 302 dwellings currently under construction as part of Brabazon Phase 1 under the extant planning consent. This phase of development is due to be complete by 2024. There will be some level of GHG emissions emitted relating to the construction of the Phase 1 from, for example, the use of construction equipment and transport of materials and employees to Site.

2036 Baseline

National and Regional Emissions

14.5.8 The Climate Change Act 2008, as amended, requires the government to set five-yearly carbon budgets, after taking advice from the Committee on Climate Change (CCC). The budgets are fixed in advance and set five-year caps on the total GHG emissions allowed to ensure the UK meets its emissions reductions commitments.

14.5.9 The carbon budgets enable net increases in emissions to be managed within the carbon budgets by balancing with performance in other sectors. Governments can use an array of policies and levers to achieve the net reductions necessary to meet the carbon budgets whilst taking an economy-wide and national approach to securing overall emissions reductions whilst facilitating other objectives including economic growth, energy security and levelling up.

14.5.10 The carbon budget for England for the period 2023-2026 is set to reduce GHG emissions by an average of 51% lower than the 1990 baseline emissions, as set out in **Table 14.7** below. The 6th carbon budget, for the period 2033-37, was accepted by the Government in April 2021 and adopted into law in July 2021. It is the first budget to consider the UK's net zero target by 2050 with a trajectory that is consistent with the Paris Agreement. The 2036 future baseline year, when full occupancy is assumed, falls within this carbon budget.

Table 14.7: 2018-2037 UK Carbon Budget Targets

UK Budget	Carbon budget level (million tonnes carbon dioxide equivalents - MtCO ₂ e)	Reduction below 1990 levels
4 th carbon budget (2023 to 2027)	1,950 MtCO ₂ e	51% by 2025
5 th carbon budget (2028-2032)	1,725 MtCO ₂ e	57% by 2030
6 th carbon budget (2033-2037)	965 MtCO ₂ e	78% by 2035

Local Emissions

- 14.5.11 As set out in **Chapter 5 (Assessment Method)**, the 2036 baseline comprises the consented Brabazon Mixed Use Development and other local approved developments (see **Appendix A.13**).
- 14.5.12 Due to the scale and use class, if fully implemented the extant planning consent would generate GHG emissions.
- 14.5.13 The extant planning consent will need to “*build to Building Regulations and local planning policy compliant renewable energy measures current at the time of the commencement of construction of that phase*” as per the notice of decision issued in March 2018 (PT14/3867/O). An uplift to the energy efficiency requirements of buildings set by the Building Regulations Part L (conservation of fuel and power) has been published and is due to be adopted in June 2022. The update includes an uplift to the energy efficiency standards and requirements, ‘tightening’ the current building standards. It aims to reduce the energy demand of buildings through higher standards of building fabric and insulation. This would reduce the GHG emissions associated with the heating and cooling of buildings.
- 14.5.14 Sources of GHG emissions would include emissions associated with transport. By 2036, it is anticipated that emissions from the transport sector will have declined, (DBEIS, 2021). In 2018, 97% of final energy consumption in transport was from fossil fuels, however by 2035 this is projected to fall to 93% due to the update of EVs and increased use of biofuels.
- 14.5.15 In 2018, the UK Government launched the Road to Zero strategy, which sets out its ambition to reduce emissions from vehicles on UK roads and promote the uptake of zero emissions vehicles (DfT, 2018). Proposed support mechanisms to facilitate this transition include increasing the supply and sustainability of low carbon fuels in the UK through a legally-binding 15-year strategy, offering grants for plug-in vehicles and introduce a voluntary industry-supported commitment to reduce Heavy Goods Vehicles GHG emissions by 15% by 2025, from 2015 levels.
- 14.5.16 In March 2020, the Electric Vehicles and Infrastructure paper was published, which outlined how the infrastructure for EVs have been planned for and what incentives are available to encourage growth. In November 2020, the UK Government announced that the sale of new petrol and diesel cars will be stopped in the UK by 2030 (DfT, 2020). The two phased process will see the phase out date for the sale of new petrol and diesel cars and vans be brought forward to 2030, and all new cars and vans to be fully zero emissions at the tailpipe from 2035. This target is also supported by DfT’s Transport Decarbonisation Plan (July 2021), as set out in **Appendix I.1**. Significant investment has been allocated to support the greater uptake of zero emission vehicles, including £1.8 billion to build more charge points, as well as £582 million in grants.

- 14.5.17 The extant planning consent would also generate emissions associated with purchased electricity from the National Grid during operation of the Proposed Development, for example for lighting. The National Grid is currently decarbonising, which is anticipated to continue over the next decade. This is an outcome of the continued uptake of renewable energies and the decline of coal-fired power stations across the UK. The increasing share of low carbon, renewable energy sources with a corresponding decrease in the use of fossil fuels, is termed “decarbonisation”. This change is significant as it encourages the use of grid-supplied electricity systems, such as air source heat pumps, over gas-fired plant. Furthermore, technologies generating on-site electricity (such as gas-engine combined heat and power (CHP)) will not achieve the carbon savings they have to date (because they are offsetting less ‘carbon’ as the grid decarbonises). Therefore, the emissions per unit of electricity generated (grams of carbon dioxide per kilowatt hour) is reducing. The Government’s policy paper ‘Transitioning to a net zero energy system: smart systems and flexibility plan’ (July 2021), see **Appendix I.1**, further supports the decarbonisation of energy across the UK. As a result, GHG emissions within the extant planning consent from elements dependant on grid energy, including EV charging, would reduce.
- 14.5.18 Planting associated with the first phases of the extant planning consent will have matured and will provide some level of carbon sequestration on Site, however planting associated with later stages are unlikely to be in a mature condition as part of the 2036 Baseline.

14.6 Embedded Mitigation

- 14.6.1 As noted in **Chapter 3** of the ES and in accordance with Reg 18(3)(c) of the EIA Regulations and guidance from IEMA, this assessment takes account of embedded mitigation which is inherent in the scheme design.

Construction

Construction Environmental Management Plan

- 14.6.2 All construction activity will be governed by a Framework Construction Environmental Management Plan (CEMP) (**Appendix A.9**) and compliance with the CEMP requirements will be mandatory for all principal contractors appointed for those delivering phases of the Proposed Development.
- 14.6.3 The CEMP has been prepared and submitted with the planning application for the Proposed Development. The CEMP will be agreed with SGC prior to the commencement of construction works at the Site and secured by way of a Planning Condition. The CEMP includes mitigation measures covering transport, materials, waste and air quality during construction. Measures that will reduce GHG emissions during construction include, for example, no unnecessary idling of engines, maintenance of plant equipment to check they are operating optimally and efficient use of materials to reduce waste.

Operation

Sustainable Transport

- 14.6.4 The Proposed Development has been designed to create a “15 minute neighbourhood”, which aims to encourage a walkable and cyclable neighbourhood that reduces the need to rely on cars, and in turn reduces GHG emissions associated from transport during operation.
- 14.6.5 The following measures have been embedded into the design and can be found on the Access Parameter Plan (**Appendix A.2**):
- Multiple transport nodes to reduce queues and traffic congestion including:

- Several dedicated pedestrian and cycle routes connecting the Proposed Development internally and to the surrounding area;
 - A new train station connection to the southeast of the Site which will have a direct link to Bristol Temple Meads;
 - A local bus route, as well as a Metro bus network with various stops across the Site;
 - Pedestrian boulevards to manage people flow and create a walkable, pedestrian friendly urban centre.
 - Focus on maximising internal movements by providing a mix of homes, jobs, education and amenities within walkable distances.
- 14.6.6 A Framework Travel Plan which appends the **Transport Assessment (Appendix C.1)** has been prepared which sets out modal share targets, measures to encourage travel by sustainable modes of transport, and a robust monitoring and review programme. This will be secured via a Section 106 (S106) agreement or a Planning Condition. A Full Travel Plan would be targeted to be developed within six months of the commencement of Transport Phase 1, once it is fully understood how and why people travel to and from the Proposed Development.
- 14.6.7 The provision of a high quality, fully segregated and accessible pedestrian and cyclist routes would encourage and enable travel by low-carbon, sustainable modes.
- 14.6.8 A Design Code (YTL Developments, 2021) was produced for the Eastern Framework in 2021. This Design Code was prepared in direct response to Planning Condition 5 of the extant planning permission and has been re-submitted with this application. This Design Code will be updated to reflect the application for the Proposed Development over the summer of 2022, and therefore not before submission of this application. Approval of this Design Code by the Council will be a prerequisite, secured by way of a Planning Condition, of the submission of any forthcoming Reserved Matters Applications for individual developments within the area of land to which it relates, as per the extant 2018 planning consent.
- 14.6.9 The Design Code discusses embedded transport mitigation, including but not limited to:
- Provision of electric charging points at or more than the minimum requirements set out by SGC;
 - Residential parking will be provided below the minimum parking standards set by SGC;
 - Commercial parking will be below the maximum parking standards set by SGC;
 - Commercial cycle parking shall be provided at or above the minimum standards set by SGC;
 - Three MetroBus stops proposed through the primary road network and will comply with MetroBus type B
 - Parking spaces within commercial areas will allow electric car charging points to be installed in line with the growth in the number of electric vehicles; and
 - Electric charging points on commercial premises shall be provided at or more than the minimum standards set by South Gloucestershire Council.
- 14.6.10 In line with the Design Code, micro mobility hubs will be provided within the multistorey car-parks located in the Site, providing different transport modes including car club bays and parking spaces for e-scooters and e-bikes. Micromobility Hubs will enhance last mile

connections within the Masterplan and encourage the use of sustainable modes of transport, particularly active travel. This will reduce the level of GHG's emitted when compared to the alternative use of petrol or diesel vehicles.

Energy

14.6.11 The Design Code (YTL, 2021) outlined above also notes, in accordance with the Energy Hierarchy, the Proposed Development has adopted a "Fabric First" approach to building design (enhancing the performance of the components and materials that make up the building fabric itself, such as improving insulation and reducing cold bridging), with the specification of fabric efficiencies of 10% better than Building Regulations. This approach will be used before considering the use of mechanical or electrical services systems and renewable/low carbon technologies.

14.6.12 The Design Code also notes that the following should be incorporated:

- *"Renewable energy from PVs included on all properties;*
- *Utilise high quality Award Winning Architects to design the first phases, to deliver long term high quality schemes and mixed-use neighbourhoods;*
- *Optimised orientation, shading and glazing design maximizing natural daylight opportunities;*
- *LED lighting throughout;*
- *Standard specification of new houses includes PV, energy efficient appliances (A+), LED lighting, and smart technology, Nest - or equivalent - central heating control;*
- *Optimised natural ventilation openings and controls to maximise passive ventilation and cooling opportunities; and*
- *TM52 and TM59 overheating assessments to be carried out including against climate data for at least 2050 and ideally 2080".*

14.6.13 As outlined in the Energy Strategy (Ramboll, 2022), on-site PV generation is estimated to provide 20% of the Site's total power requirements.

14.6.14 Applicable Building Regulations adopted at the time of construction will be strictly adhered to and this will be secured by way of a standard Planning Condition.

Retention and Creation of Habitats, Green Infrastructure and Open Space

14.6.15 The Strategic Landscape Parameter Plan (**Appendix A.2**) outlines the proposals for the incorporation of green infrastructure including water bodies and natural open space, retention of existing woodland and grasslands and proposed new woodland edge planting. The Strategic Landscape Parameter Plan shows strategic green linkages located throughout the Site, as well as 35 hectares (ha) of Public Open Spaces (POS) including a Neighbourhood Green in the west and a large linear park (Brabazon Park) in the centre of the Site linking with the existing Hayes Wood to the north and running south towards the Brabazon Hangar (the recently consented YTL Arena (Planning Application Reference 19/05500/P). The north-south linear parks are typically 30m wide with a 50m wide north-south corridor located adjacent to the school sports pitches, functioning as a primary ecological connector corridor. The character of the green linkages will vary from more natural spaces in the west to a more formal character in the east.

14.6.16 Filton Wood forms a key landscape feature within the locality and provides a mature block of woodland on Site, offering a mixed species woodland which has a mainly clear understorey.

The existing woodland will be enhanced by substantial 'buffer' planting where possible, notably on the southern and western edges of the retained woodland. Hayes Wood to the north will be extended to create a 30m wide Green Infrastructure (GI) buffer to the proposed development.

- 14.6.17 The incorporation of green infrastructure and natural open space will provide evaporative cooling at night and help to reduce the heat island effect. The permeability of green spaces throughout the Proposed Development will help to facilitate air movement, enhance natural ventilation and will help provide shading and local cooling of the microclimate. This will assist in passively reducing the energy demands, and therefore the GHG emissions, of the Proposed Development. In addition to this, the incorporation of substantial green infrastructure across the Site will provide greater carbon sequestration benefits in comparison to the baseline environment.

14.7 Assessment of Likely Effects

- 14.7.1 The assessment of likely effects outlined below consider embedded mitigation only. Residual effects, outlined in **Section 14.9**, account for further mitigation anticipated to be discussed with SGC and secured via a Planning Condition or S106 agreement.

Construction

Scope 1

- 14.7.2 The main sources of direct GHG emissions during construction relate to the combustion of fossil fuels during the transportation of building materials and waste by Heavy Goods Vehicles (HGV) to and from the Site, as well as powering construction plant engines and equipment. The implementation of the CEMP will help to manage and reduce GHG emissions associated with construction vehicles, plant and equipment.
- 14.7.3 The enabling and land clearance activities required for the construction of the Proposed Development will result in direct GHG emissions released from movement and disturbance of soil on Site.

Scope 2

- 14.7.4 The temporary construction office and welfare facilities for construction workers and temporary lighting on the Site will require electricity purchased from the National Grid. This will result in indirect GHG emissions generated from the burning of fossil fuels to deliver electricity to the National Grid. Construction is anticipated to come forward as the National Grid continues to decarbonise. Additionally, the implementation of a CEMP will help to manage and control the use of electricity on Site.

Significance

- 14.7.5 While it is considered that the Proposed Development meets the applicable adopted policy during construction, it would not contribute to decarbonisation in line with the 2050 net zero trajectory. The emissions generated from construction are partly mitigated through the implementation of the CEMP but only through 'business as usual' measures that are not fully in line with the UK net zero trajectory. Given the carbon intensive nature of construction over a long term construction period and with consideration of the GHG emission sources noted above alongside the embedded mitigation set out in **Section 14.6**, it is considered that the Proposed Development will have a **Moderate Adverse**, and therefore **Significant**, effect without further mitigation.

Operation

Scope 1

Transport

- 14.7.6 The Proposed Development will not generate an increase in traffic volumes through the Site against the 2036 baseline. **Chapter 8 (Transport and Access)** outlines the anticipated changes to traffic flows, which is limited to changes in distribution rather than volume (**paragraphs 8.4.8 – 8.4.9 of Chapter 8**).
- 14.7.7 The proposed densification of the Proposed Development is to be achieved through modal shift from car use to sustainable modes of transport, to be achieved through the delivery of multiple public transport schemes, as outlined above in **Section 14.6**. Further details of the additional public transport provision is outlined within **Chapter 8** of the ES.
- 14.7.8 In addition to additional public transport provision, modal shift is to be achieved through the design of the parameter plans that has been designed as a 15-minute neighbourhood and the provision of infrastructure that encourage the use of active modes of transport (cycling and walking).
- 14.7.9 As a result of the provisions outlined above, it is expected that the densification will not generate an increase in traffic volumes in comparison to the volumes consented within the Cribbs Patchway New Neighbourhood (CPNN) SPD. However, the relocation of 1,000 homes consented on the Patchway Trading Estate to the Site will result in local redistribution of those vehicle trips. As a result, GHG emissions associated with transport from the Proposed Development are anticipated to be similar to that of the consented development.
- 14.7.10 It is worth noting that the amount of GHGs released from transport is anticipated to decrease within the next 10 years as a result of the UK Government's Ten Point Plan which commits to a ban on selling diesel and petrol vehicles by 2030.

Land Use

- 14.7.11 The Strategic Landscape parameter plan shows indicative areas of green infrastructure planting, including a woodland extension of Hayes Wood to the north. It is typical for planting to take approximately 15 years to mature and, once established, these new woodland areas will also sequester and store carbon.

Scope 1 and 2 from Energy

- 14.7.12 Emissions will arise from electricity and energy demand during the operation of the Proposed Development for heating, powering appliances and maintaining lighting on the Site. Under current Part L of the Building Regulations 2013 standards, the Proposed Development may utilise a mix of natural gas heating and electricity purchased from the national grid. Therefore, it is anticipated that emissions from energy demand may be a mix of Scope 1 and Scope 2 emissions.
- 14.7.13 As noted above, the amount of GHGs to be released as a result of generating electricity for the National Grid is anticipated to decrease over the next 10 years as a direct result of the rapid decarbonisation.

Significance

- 14.7.14 It is considered that the Proposed Development is fully consistent with existing and emerging policy requirements (as outlined in **Section 14.2** and in more detail within the Planning Statement for the application) and good practice design standards for projects of this type through the implementation of the embedded mitigation set out in **Section 14.6**. Commitment

to including renewable energy from PVs on every property and limiting traffic generation to that of the consented development is considered to be in line with adopted policy requirements, however this may not include measures necessary to achieve the UK's trajectory towards net zero without further mitigation that is dealt with at detailed design stage. Therefore, it is anticipated that there will be a **Moderate Adverse** and therefore **Significant** effect, without further mitigation.

14.8 Further Mitigation

14.8.1 The below further mitigation alongside the embedded mitigation outlined above **Section 14.6**, is in line with local policy, including Policy CS1 of SGCs Local Plan which requires new development to assist in meeting climate change and health and well-being objectives by:

- Incorporating energy efficiency: **Paragraph 14.8.7**;
- Utilising renewable and low carbon energy (including decentralised energy) where appropriate, taking into account the latest building regulations: **Paragraphs 14.8.7-13**.
- Ensuring the layout is connected to the wider network of foot, cycle and public transport links: **Paragraph 14.8.14**; and
- Safeguarding landscape, nature conservation, heritage and amenity value and taking account of green infrastructure objectives: **Paragraph 14.8.20**;

Construction

Construction Traffic Management Plan

14.8.2 All construction activity will be governed by Construction Traffic Management Plans (CTMP). They will be prepared prior to the commencement of construction works at the Site and would be secured through a planning condition as part of the CEMP. The CTMP will set out the routing plans for working and deliveries, scheduling and timing of deliveries, and logistics plans. compliance with the CEMP requirements will be mandatory for all principal contractors appointed for those delivering the Proposed Development.

14.8.3 The CTMP will help to improve the efficiencies of vehicle movements during operation and in turn, reduce GHG emissions associated with construction traffic.

14.8.4 The Framework CEMP that has been taken into account as embedded mitigation in **Section 14.6**, will be taken forward and developed as a detailed CEMP, for which the CTMP will be part of.

Materials and Waste

14.8.5 Recycled materials will be utilised where possible, with the consideration of using materials that go through less energy-intensive processes and that can be sourced locally. There are a number of UK organisations promoting the review and reduction of embodied carbon and supply chain emissions associated with construction as part of their sustainability initiatives. These include WRAP, the UK Green Building Council and the Green Construction Board. The Waste Management Plan (PBA, 2017) includes measures on material procurement and the use of material suppliers with environmental standards where possible. These measures will help to reduce embodied carbon.

14.8.6 Condition 18 of the extant planning consent sets out the requirements on a phase-by-phase basis for waste management. It is therefore anticipated that this will be replicated for the Proposed Development.

- 14.8.7 Given the topography of the Site, construction of the Proposed Development will not generate significant cut material or require the importation of significant fill material. The Proposed Development has been designed to keep such cut or fill requirements to a minimum. Any site-won material (i.e. the Filton Airfield Runway) will be re-used on-site to avoid landfill where possible. This will also reduce the volume of material required to construct the Proposed Development, thereby reducing embodied carbon.
- 14.8.8 This design element will be implemented via the Waste Management Strategy (WMS) which was submitted in 2017 (PBA, 2017) for the extant planning consent. This has been resubmitted with the Proposed Development as no changes were considered necessary for the Proposed Development. The WMS aims to ensure that the waste produced during the construction phase and other phases of the Proposed Development are dealt with in accordance with the duty of care provisions in the Environmental Protection Act (1990). The adoption of the principles of the waste management hierarchy will be implemented throughout. This will help to reduce GHG emissions associated with waste management.

Operation

Energy Efficiency

- 14.8.9 As per Condition 9 of the extant planning consent (see paragraph 14.8.14 below), it is anticipated that SGC will require the developers of the Proposed Development to ensure the highest standards of urban design and comprehensively planned development via a similar condition, in accordance with Policies CS1 and CS26 of the SGC Local Plan and the CPNN SPD.
- 14.8.10 On the above basis, the Proposed Development will be built out according to the relevant Building Regulations and standards that are applicable at the time. As a result of the uplifts in energy efficiency standards, it is anticipated that buildings at the Proposed Development will be built out to a high level of energy efficiency, thereby reducing the GHG emitted associated with heating and cooling of buildings.
- 14.8.11 The energy efficiency requirements of the Building Regulations are set out in Part L of Schedule 1, as well as in a number of specific building regulations. Approved Documents L1A and L2A set out the requirements for conservation of fuel and power in new dwellings and non-domestic buildings, respectively. Updates to Approved Documents Part L1A and L2A were released in 2021, however the changes will not apply until 15 June 2022. These changes will therefore apply to the Proposed Development and will be considered in each Reserved Matters Application (RMA) that comes forward.
- 14.8.12 As well as changes to Part L of the Building Regulations, a new Approved Document; Part O: Overheating has been introduced. Again however, although the changes will not apply until 15 June 2022, it is anticipated they will apply to the Proposed Development. Part O looks at mitigating solar gain (heating due to direct sunlight) but also other causes of overheating due to uninsulated heating pipes, cylinders or lack of heating system controls.
- 14.8.13 Abiding to the applicable Building Regulations will ensure that the Proposed Development is built with energy efficiency at the forefront, reducing GHG's associated with the burning of fossil fuels to heat and cool dwellings.
- 14.8.14 It should also be noted that a Future Homes Standard (see **Appendix I.1**) will be coming forward and introduced by 2025. This will provide a pathway to highly efficient homes and non-domestic buildings which are “zero carbon ready, better for the environment and fit for the future”. Two phases of consultation were undertaken, with the outcomes of this consultation to be implemented through a statutory instrument and new Approved Documents (June 2022).

14.8.15 The Design Code for the Eastern Framework (YTL, 2021) and the Energy Strategy (Ramboll, 2022) states a number of zero and / or low carbon solutions to be studied for possible inclusion. These include, but are not limited to the following:

Residential

- Air source heat pumps for heating and domestic hot water for an all electric-solution;
- Solar thermal “top up system” for the domestic hot water to the apartments;
- Home heat recovery ventilation (MVHR) where required;
- House battery storage system to store off peak power and enabling less energy to be used at peak times;
- Communal heating, including possible CHP, within areas of high density development; and
- Waste water heat recovery.

Commercial

- Heat networked with ambient loop to future residential;
- Solar thermal; and
- Waste water heat recovery.

14.8.16 Condition 9 for the extant planning consent (Planning Application Reference: 21/02390/RVC) aims to achieve improved energy conservation and protect environmental resources in accordance with the Local Development Plan and the Cribbs/Patchway New Neighbourhood Development Framework SPD. It notes

“Except for reserved matters applications for the first site access road infrastructure within a phase, applications for approval of reserved matters within each geographical phase that include buildings identified in the approved Phasing Plan submitted pursuant to condition 4 above shall not be approved until an Energy Statement for the phase in question has been submitted to and approved by the Local Planning Authority. The Energy Statement shall be updated for each phase and shall also include, for the airfield site as a whole, the emerging CPNN District Heating Feasibility Study. It shall also commit to requiring developers to build to Building Regulations and local planning policy compliant renewable energy measures current at the at the time of the commencement of construction of that phase. The Energy Statement as well as all reserved matters applications shall comply with the requirements of the Utilities and Renewable Energy chapter within the adopted Cribbs/Patchway New Neighbourhood Development Framework SPD and be in accordance with Policy CS4 of the South Gloucestershire Local Plan - Core Strategy and the prevailing development plans policy at the time.

Applications for approval of reserved matters shall be in accordance with the relevant approved Energy Statement, and the development of each phase shall be implemented in all respects in accordance with the relevant approved Energy Statement. All reserved matters applications (including applications without buildings) shall take into account of the emerging CPNN District Heating Feasibility Study.”

14.8.17 The same condition is expected for the Proposed Development application. The condition will be addressed on a phase by phase basis. Each Energy Statement will include targets for emissions reductions and savings through energy demand reduction measures and discuss

the feasibility of other energy saving measures. This will assist in reducing energy demands, and therefore the GHG emissions, of the Proposed Development.

Thermal Energy Networks

14.8.18 Within the Energy Statement provided by Ramboll (2022), a review of the Proposed Development has been undertaken with respect to the feasibility of installing an autonomous thermal energy network which provides heating and cooling to both the residential and commercial developments throughout the Site. The work to date has established that a thermal energy network would provide a viable pathway to net zero through the integration of zero carbon heat sources and low carbon technologies. Whilst a thermal energy network would provide a more efficient carbon reduction solution, the adoption of building level low carbon technologies also presents a viable pathway to net zero. Further feasibility and project development work is required to determine the optimal solution, particularly in the context of the phased delivery of the Proposed Development.

14.8.19 The Energy Strategy (Ramboll, 2022) identifies three solutions that are under consideration relative to the provision of heating and cooling across the Site. As it is not confirmed which solution will be taken forward at detailed design stage, these solutions have not been relied upon within the impact assessment. The three solutions are:

1. Standalone Solution (Building level);
2. Network Scenario 1: 4th Generation 4-Pipe Heat Network and District Cooling Scheme; and
3. Network Scenario 2: 5th Generation Ambient Temperature Thermal Energy Network (ATTEN)

14.8.20 All scenarios will make use of zero carbon heat sources (ambient air, ground source, wastewater heat recovery, heat rejection heat recovery etc.) and will make use of these sources by means of low carbon technologies (predominantly Air Source Heat Pumps and Water Source Heat Pumps). The heat generated from the zero carbon heat sources shall be maximised through the integration of suitably sized thermal storage vessels. The exception is 'Network Scenario 1' where it is proposed that a bio-gas Combined Heat and Power (CHP) Unit be used to contribute to the heat network's ability to generate heating/domestic hot water (DHW), though the intention is that the CHP will be phased out after a single lifecycle and replaced with a low/zero carbon alternative. By virtue of this approach both the residential and commercial elements of the Proposed Development will have access to low carbon heating/domestic hot water.

14.8.21 The CHP Unit will be connected to the local natural gas grid, but the emissions associated with the unit will be offset through the purchase of Renewable Gas Guarantee of Origin (RGGO) certificates. Should one of these options be taken forward, there will be limited Scope 1 emissions associated with energy demand on the Site.

14.8.22 Heat networks form an important part of the government's plan to reduce carbon and cut heating bills for customers. They are one of the most cost-effective ways of reducing carbon emissions from heating, and their efficiency and carbon-saving potential increases as they grow and connect to each other. They provide a unique opportunity to exploit larger scale – and often lower cost – renewable and recovered heat sources that otherwise cannot be used. It is estimated by the CCC that around 18% of UK heat will need to come from heat networks by 2050 if the UK is to meet its carbon targets cost effectively.

Renewable and Low Carbon Technology

14.8.23 The Energy Strategy (Ramboll, 2022) for the Proposed Development has identified a number of opportunities for incorporating renewable and low carbon energy generation technologies.

The most suitable technologies are anticipated to be building integrated photovoltaic panels (PV), the utilisation of zero carbon heat sources such as ground source and heat recovery from process cooling activities and wastewater systems, and the promotion of net zero ready heat pumps (both air source and water source) and chillers.

14.8.24 Whilst the preferred sitewide energy solution still needs to be defined, and therefore the impact assessment has not considered this to reduce emissions, should these options come forward, GHG emissions could be further reduced, particularly in the context of natural gas led heating systems.

14.8.25 It should also be noted that the use of the CHP engine noted in 'Network Scenario 1' discussed earlier (**paragraph 14.7.13**), is seen as a short-term solution, no longer than a single lifecycle (15 years), which provides the Proposed Development with a high degree of flexibility in terms of the reliance upon grid generated electricity. The lifecycle will allow for a sustained period of energy monitoring across the Site to better understand the evolving energy demands, particularly power. This will allow for more informed discussions with the Distribution Network Operator (DNO) if, and when, additional grid capacity needs to be secured to support later phases of the Proposed Development and minimises the short-term requirement for reinforcement works to support the constrained local electricity infrastructure. The bio-gas CHP also allows the Brabazon development to continue whilst retaining the option to easily integrate a connection to Bristol City Council's (BCC) Strategic Heat Main (SHM) at some point in the short-medium term.

14.8.26 The **Outline Masterplan DAS** (YTL, 2022) details an Urban Design Framework which should be used to inform future Design Codes and detailed design proposals. The Framework details a 'Low Carbon Masterplan' which states that "Development of the Brabazon masterplan will span beyond 2030, so is planning for a Net Zero Carbon future now with heat networks, renewable energy generation and storage, and micro-grid distribution'. It states that individual plots and buildings that come forward in RMA's should submit an energy statement, as outlined above, and the use of gas should be avoided if possible.

14.8.27 As noted above and in the **Outline Masterplan DAS** (YTL, 2022) each RMA will need to submit an Energy Statement to SGC and conform to the prevailing requirements, with the implementation of these technologies considered and confirmed. This will assist in reducing GHG emissions across the Site.

Transport

14.8.28 As discussed in the Transport Assessment (**Appendix C.1**), it is proposed that the number of car parking spaces will be capped to limit the number of vehicular traffic coming into the Site and suppress trips. Each Transport Phase will be delivered at a reduced level of car parking, serving to reduce the overall site parking ratio over time. This will be secured via a S106 agreement or a Planning Condition.

14.8.29 The following information outlines a number of strategies to discourage car use that are to be discussed with SGC and will be secured by way of a Planning Condition or S106 agreement to produce a Detailed Car Parking Management Plan:

- Provide car club parking spaces;
- Controlled Parking Zone (CPZ) to be implemented to minimise parking overspill on-street;
- Car parking provision to be provided at a level below the car parking requirements stipulated by SGC

14.8.30 The Applicant is proposing additional strategies that could be secured by way of a S106 agreement or Planning Condition with SGC. These include:

- Providing incentives / subsidy to encourage the use of public transport to potentially, residents and staff (commercial and industrial sites);
- Providing Micro-mobility hubs with private and for hire e-scooters and e-bikes and associated parking spaces (on-street and within plot); and
- Deliveries could be transferred to a micro-fulfilment centre within the Site and then distributed to plots within the masterplan using a vehicle / cargo bike that will operate at full capacity. This strategy will reduce the number of delivery vehicles within the Site

14.8.31 Another Approved Document of the Building Regulations; Part F: Infrastructure for Charging Electric Vehicles was published in 2021. Again however, the changes will not apply until 15 June 2022. This document focusses on electric vehicle charging points, noting that as petrol and diesel vehicles get phased out, having charge points properly planned and installed is important. As set out in the emerging Building Regulation Part F document, the requirement to install electric vehicle charge points applies for each associated parking space where both of the following apply:

- The associated parking space is not within a covered car park; and
- The average connection cost for each electric vehicle charge point connection is less than £3,600.

14.8.32 When RMAs for individual plots come forward, this building regulation will be applicable and therefore the Proposed Development will be built out accordingly. These measures will help to reduce GHG emissions resulting from transport.

Landscape and Ecology

14.8.33 As outlined in **Chapter 12 (Biodiversity)**, an Ecological Mitigation and Management Strategy (EMMS) will be prepared for the Site that will be secured by way of a Planning Condition. Due regard will be given to the Natural England and RSPB Climate Change Adaptation Manual (2020) when preparing the EMMS, as well as Natural England's Carbon Storage and Sequestration by Habitat report (2021) and the British Ecological Society's nature-based solutions report (2021). The strategy will include consideration of the maintenance / management measures associated with onsite ecological networks and features that are to be retained, enhanced and created within the Proposed Development. The overall aim of the EMMS will be to deliver a significant long term beneficial ecological effect for the proposal.

14.8.34 Condition 22 of the extant planning consent states that prior to the commencement of development, a strategic Landscape and Ecological Management Plan (LEMP) shall be drawn up and agreed with the Council in writing. It is anticipated that a similar condition will be applied to the Proposed Development.

14.8.35 These documents will help to ensure maturation of existing retained and proposed woodland and hedgerow planting which will continue to sequester carbon on-site.

Water Use

14.8.36 At detailed design, measures to reduce water demand and increase water efficiency in line with Building Regulations Part G will be considered which in turn will provide GHG emission savings. These measures may include measures such as:

- Dual flush toilets and leak detection systems - to reduce water consumption and thereby reduce GHG emissions associated through the supply of water;
- Flow control devices - to reduce the flow rate of kitchen sink and bathroom basin taps and thereby reduce GHG emissions associated through the supply of water;

- Installing pulsed water meters with pulsed output and fitting sub-meters – to reduce the energy demands associated with water heating; and
- Using water-efficient appliances (e.g. those with an 'A' or 'B' rating as defined by the European Water Label).

14.9 Residual Effects

Construction

- 14.9.1 The assessment identified a moderate adverse significant effect resulting from Scope 1 and Scope 2 GHG emissions, which include emissions from the combustion of fossil fuels on Site during construction activities, land clearance and enabling activities and purchased electricity for welfare facilities and lighting. While the implementation of a CTMP provides further mitigation, as identified in **Section 14.8**, it is considered that the effect will remain as **Moderate Adverse** and **Significant**, in keeping with IEMA guidance.

Operation

- 14.9.2 The assessment identified a moderate adverse effect resulting from Scope 1 and Scope 2 GHG emissions during the operation stage as a result of transport emissions and purchased electricity. Several further mitigation measures have been identified to be secured through the Design Code for the Eastern Framework (YTL, 2021) and through detailed design where it is anticipated that the most up to date Building Regulation standards will be adopted. This will uplift energy performance standards and consider the UK net zero trajectory. The mitigation for the Proposed Development is therefore considered to be in line with local policy and measures necessary to achieve the UK's trajectory towards net zero. There will however be residual emissions and it is therefore considered that the effect will be **Minor Adverse** and **Significant**, in keeping with IEMA guidance.

14.10 Monitoring

- 14.10.1 Moderate Adverse, and therefore Significant residual effects are identified during construction resulting from Scope 1 and 2 GHG emissions. As per the EIA Regulations 2017, proportionate monitoring of these effects are required.
- 14.10.2 Construction activities, including transport, energy consumption and plant emissions will be monitored and managed through the CEMP. The CEMP will be updated to ensure the document continues to fulfil its objectives to reduce environmental effects. This will include a review of current legislation, standards, plant, processes, etc. Revised copies of the CEMP will be available to SGC as appropriate.
- 14.10.3 In addition, consideration will be given to regular environmental audits of the construction works to ensure compliance with the CEMP. The scope of the audits include Waste Management & Duty of Care; Dust; Construction traffic; Fuel storage; Pollution; and Compliance with planning conditions.
- 14.10.4 No significant effects were identified during operation following the implantation of further mitigation, however, the travel patterns of future occupiers of the Proposed Development will be monitored through travel surveys, as identified in the Framework Travel Plan.
- 14.10.5 Energy use will be regulated as each phase comes forward in more detail, detailing how the energy commitments have been met through the design for each Phase, and building regulations will certify the Proposed Development to be delivered in accordance with the regulatory requirements.
- 14.10.6 Monitoring of the existing retained and proposed planting will be undertaken as part of the EMMS.

Part 2: Climate Change Risk Assessment

14.11 Introduction

14.11.1 This section presents the assessment of likely significant effects of climate change upon the Proposed Development. Assessing climate change resilience and adaptation aims to determine the vulnerability of key environmental receptors to climate change, the likely significant effects climate change would have on these receptors and outline the mitigation measures that the Proposed Development takes to adapt to the projected climate change effects. The Climate Change Risk Assessment (CCRA) is presented in **Table 14.11**.

14.12 Methodology

Study Area

14.12.1 The CCRA uses the UK Climate Change Projections 2018 (UKCP18) provided by the UK Met Office (Met Office, 2018) for the 25 km grid cell within which the Site is located (SP 362500, 187500), although the area of influence for potential climate vulnerability impacts is expected to be limited to the Site and the immediate surrounding area.

Baseline Data Collection

14.12.2 As noted in **Section 5.9** of this ES, the assessment of construction effects has been undertaken against the current 2022 baseline and the assessment of operation effects has been undertaken against the 2036 baseline. However, both assessments also consider projected future climate scenarios for a number of intervals up to 2099.

14.12.3 The following data sources were reviewed to establish the baseline conditions:

- Met Office historic climate data (Met office, N.Da) – to identify the historic trends of relevant climatic factors for the geographic area of the Proposed Development.
- UKCP18 (Met Office, 2018 – to identify the climate projections for the geographic area, including the 2036 baseline, and appropriate temporal scope of the Proposed Development.
- A literature review of relevant publications which are referenced where relevant within Part 2 of this chapter, for variables for which UKCP18 does not provide information (for example, wind direction).

14.12.4 In addition, a review was undertaken of the following chapters within this ES and additional assessments, which directly feed into the CCRA:

- Chapter 8: Transport and Access
- Chapter 11: Landscape and Visual
- Chapter 12: Biodiversity
- Flood Risk Assessment (Jubb, 2022)

UKCP18

14.12.5 The UKCP18 produced by the UK Met Office (Met Office, 2018) is the main source of information for the 2036 Baseline and other future baselines (2050, 2075 and 2099).

14.12.6 UKCP18 uses observations of weather and climate combined with climate models to create a range of climate projections for different emissions scenarios. UKCP18 builds upon previous projections to provide information on how the climate of the UK may change over the rest of this century, describing how climatic conditions, long term seasonal averages and extreme weather conditions may change over future decades. The baseline data is complemented a literature review of relevant publications for variables for which UKCP18 does not provide information (for example, wind direction).

14.12.7 UKCP18 uses Representative Concentration Pathways (RCPs) to develop projections and consider factors such as economic activity, population growth and land use change, which will result in a different range of global mean temperature increases until 2099. RCP8.5 is the most conservative, highest-impact scenario. The scenario reflects an average increase in global mean surface temperature compared to the pre-industrial period of 4.3°C by 2081-2099. IEMA guidance (2020) generally recommends that the high emission scenario, RCP8.5, is used for climate change risk assessments. This is also considered the most appropriate scenario for assessing the impact of climate change on the Proposed Development based on policy and legislation for the UK to achieve net zero carbon by 2050, which is in line with limiting global temperature increases to 1.5°C, and professional judgement.

14.12.8 IEMA guidance recommends that the climatic baseline should consider extremes in short-term weather events, such as heatwaves; long-term climatic variability, such as seasonal changes in precipitation; and average climate norms, such as ambient temperature.

14.12.9 A review of the following data from this projection has been undertaken:

- Average Summer Precipitation (% change);
- Average Winter Precipitation (% change);
- Average Annual Precipitation (% change);
- Maximum Average Summer Temperature;
- Minimum Average Winter Temperature; and
- Annual Mean Temperature.

14.12.10 The projections (**Appendix I.2** and **I.3**) show the potential change in temperature and precipitation above or below the observed temperature/precipitation for 1981-2000.

Assessment Methodology

14.12.11 In accordance with IEMA guidance, the vulnerability and resilience of the Proposed Development to climate change has been identified by undertaking a risk assessment that includes:

- *“Identifying potential climate change risks to a scheme or project;*
- *Assessing these risks (potentially prioritising to identify the most severe); and*
- *Formulating mitigation actions to reduce the impact of the identified risks.”* (IEMA, 2020)

14.12.12 The risk assessment considers the likelihood of a hazard occurring that could result in an impact on sensitive receptors. In addition, the magnitude of effects on the Proposed Development will depend on the severity of the consequence of the impact, and the vulnerability of the receptor itself. The definitions of these terms can therefore be summarised as follows (IEMA 2020):

- **Hazard** is an effect of climate change which has the potential to cause an impact on sensitive receptors associated with the Proposed Development;
- **Magnitude** is the likelihood of impact occurring and the consequence of the impact of a hazard; and
- **Vulnerability** is the degree to which receptors are susceptible to adverse impacts and is influenced by sensitivity, adaptive capacity, and exposure to climate hazards.

Identification of Receptors

14.12.13 Receptors that may be affected by climate change have been identified with consideration of both extreme weather events and gradual climatic changes in the study area for the Proposed Development. In accordance with IEMA guidance, the sensitivity of receptors to climate change effects during operation is described in **Table 14.8**. In ascribing the sensitivity of receptors in relation to potential climate change effects, the susceptibility of the receptor (e.g. ability to be affected by a change) and the vulnerability of the receptor (e.g. potential exposure to a change) must be taken into account. These are defined in IEMA (2020) guidance as follows:

“The susceptibility of the receptor can be determined using the following scale:

- *High susceptibility = receptor has no ability to withstand/not be substantially altered by the projected changes to the existing/prevaling climatic factors (e.g. lose much of its original function and form).*
- *Moderate susceptibility = receptor has some limited ability to withstand/not be altered by the projected changes to the existing/prevaling climatic conditions (e.g. retain elements of its original function and form).*
- *Low susceptibility = receptor has the ability to withstand/not be altered much by the projected changes to the existing/prevaling climatic factors (e.g. retain much of its original function and form).*

The vulnerability of a receptor can be defined using the following scale:

- *High vulnerability = receptor is directly dependent on existing/prevaling 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 vulnerability = 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 vulnerability = climatic factors have little influence on the receptors.”*

Table 14.8: Receptor Sensitivity

Receptor	Sensitivity	Reasoning
Construction		
Construction workers	Moderate	During the construction phase, it is anticipated that the risk of climate hazards (e.g. heatwaves or periods of heavy precipitation) may increase.

Receptor	Sensitivity	Reasoning
Construction Equipment	Moderate	Construction equipment is not directly dependent on climatic factors but could be affected by some changes to climate.
Existing Ecology, Landscaping and Planting	Moderate	Species identified within and surrounding the Site (see Chapter 12 for details) are generally considered to have widespread geographical ranges and the Site is not within the edge of their range.
Land Stability	Moderate	Earthworks during demolition and construction may expose soil and leave it vulnerable to erosion.
Operation		
Future users of the Site (residents, employees, students)	Moderate to High	Some future users of the Site will be more susceptible to climate change than others, depending on a range of factors such as age (children, young people and the elderly) and existing poor health.
Infrastructure including buildings and roads	Moderate	Infrastructure across the Proposed Development ranges in value. Critical infrastructure, such as energy and water pipes/cables are considered to be of moderate susceptibility given that it can tolerate some changes in climate but is critical for the operation of the Proposed Development.
Ecology, Landscaping and Planting	Moderate	The habitats that have been identified on-site are representative of typical lowland landscapes including woodlands, hedgerows and grasslands (see Chapter 12 for details) are not considered to be of high vulnerability to the broad effects of climate change such as changes in average temperatures or changes to the hydrology. The protected / notable species recorded within the Site are not considered to be significantly sensitive to the effects of climate change in terms of their current distribution or climatic tolerances, and the majority of species recorded are widespread regionally, nationally or internationally (e.g. northern and central Europe).

Assessment of Significance

- 14.12.14 There is an absence of significance criteria for determining the significance of effects resulting from climate change. IEMA guidance states that receptor vulnerability and uncertainties must be considered. Significance has therefore been determined by IEMA guidance and professional judgement.
- 14.12.15 Effects that are described as 'minor' or 'negligible' are determined to be 'Not Significant' and effects that are described as 'moderate', 'major' or 'substantial' are determined to be 'Significant'.

Limitations

- 14.12.16 Scientific evidence shows that our climate is changing. However, there are significant uncertainties in the magnitude, frequency and spatial occurrence within the climate projections utilised in this assessment. The UKCP18 are not predictions or forecasts but simulations of potential scenarios of future climate under a range of hypothetical emissions scenarios and assumptions, and therefore cannot be treated as exact or factual, but projection options. The projections are dependent on future global GHG emissions and, while several different scenarios are provided, it cannot be reliably predicted which (if any) emission scenario will occur over the next 80 years (Fung et al., 2018).
- 14.12.17 Additionally, projections after the 2040s increasingly diverge between scenarios and provide greater confidence for long-term climate averages than extreme events. For example, there is greater confidence around changes in temperature than there is in relation to wind. Levels of confidence and certainty are considered when assessing the likelihood and consequence of climate hazards.
- 14.12.18 This ES chapter reports the climate change risk assessment which has used the latest information sources available at the time of submission (March 2022). New climate information is published regularly as more in-depth analysis of climate changes is completed, which may supersede the information used to inform this assessment.
- 14.12.19 The assessment is largely qualitative, with the exception of assessments relevant to drainage assets and flood risk, which have been informed by the Environment Agency climate change allowances for increases in peak river flow and rainfall intensity
- 14.12.20 There is often uncertainty in the relationship between changes in climate hazards and the respective response in terms of scheme performance. This uncertainty has been assessed qualitatively.
- 14.12.21 The assessment assumes that mitigation will be effectively implemented.

14.13 Baseline Conditions

Current State of the Environment

UK Observations

- 14.13.1 Observed climate changes over the UK include:
- The most recent decade (2009-2018) has been on average 0.3 °C warmer than the 1981-2010 average and 0.9 °C warmer than 1961-1990. All of the top ten warmest years have occurred since 2002 (Lowe *et al.*, 2019);
 - In the past few decades there has been an increase in annual average rainfall over the UK. However, natural variations are also seen in the longer observational record (Lowe *et al.*, 2019);
 - The period since 2000 accounts for two-thirds of hot-day records, and close to half of wet-day records, in monthly, seasonal, and annual observations since 1910 (Kendon, 2014);
 - Winters in the UK, for the most recent decade (2009-2018), have been on average 5% wetter than 1981-2010 and 12% wetter than 1961-1990. Summers in the UK have also been wetter, by 11% and 13% respectively (Met Office, 2019a);
 - The frequency of severe autumn and winter wind storms increased between 1950 and 2003 (Alexander et al., 2005), although storminess in recent decades is not unusual in the

context of longer European records dating back to the early 20th century (Metulla et al., 2008); and

- Widespread and substantial snow events have occurred in 2018, 2013, 2010 and 2009, but their number and severity have generally declined since the 1960s (Met Office, N.Db).

Regional Observations

14.13.2 Historic climate averages during the period 1991-2020 for the closest climate station to the Site (Filton), obtained from the Met Office website (Met office, N.Dc), indicates the following:

- Average annual maximum temperature was 14.5°C;
- Warmest month on average was July (mean maximum temperatures of 21.7°C);
- Coldest month on average was February (mean minimum temperature of 2.4°C);
- Average total annual rainfall was 819.01 mm;
- Wettest month on average was November (average monthly rainfall of 89.99 mm); and
- Driest month on average was April (average monthly rainfall of 47.87 mm).

14.13.3 The Flood Risk Assessment (FRA) submitted with the ES (Jubb 2022), sets out the existing conditions with regards to flood risk. The Site is designated as Flood Zone 1, identified as being at low risk of fluvial or tidal flooding. The Site is not at risk of flooding from reservoirs or sewers, however flood maps indicate some small areas at risk of flooding from surface water as result of natural drainage paths for pluvial flows onto the Site.

Future Baseline

14.13.4 This section presents the future climate simulations extracted from UKCP18 up to 2099. **Figures I.2.1 – I.2.6 in Appendix I.2** show the grid square projections for average summer, winter and annual precipitation, maximum average summer temperature, minimum average winter temperature and annual mean temperature. A summary of the projections is provided below. This is supported by data extracted from the probabilistic projections which is presented in **Appendix I.3**, a summary of which is provided in **Table 14.9** below.

Table 14.9: 50th Percentile Climate Projections at 25 km grid square 362500, 187500 using baseline 1981-2000 scenario RCP 8.5

Date	Climate Variable at 50th Percentile					
	Mean air temperature anomaly* at 1.5 m (Å°C)	Annual Precipitation rate anomaly (%)	Maximum Summer air temperature anomaly at 1.5 m (Å°C)	Average Summer Precipitation rate anomaly (%)	Minimum Winter air temperature anomaly at 1.5 m (Å°C)	Average Winter Precipitation rate anomaly (%)
2021	0.73	-1.09	1.04	-13.91	0.66	10.91
2022	0.74	0.73	1.12	-12.92	0.62	11.71
2036	1.12	1.05	1.41	-16.56	1.13	8.52
2050	1.74	1.59	2.72	-23.39	1.59	11.43

Date	Climate Variable at 50th Percentile					
	Mean air temperature anomaly* at 1.5 m (°C)	Annual Precipitation rate anomaly (%)	Maximum Summer air temperature anomaly at 1.5 m (°C)	Average Summer Precipitation rate anomaly (%)	Minimum Winter air temperature anomaly at 1.5 m (°C)	Average Winter Precipitation rate anomaly (%)
2080	3.39	-0.77	5.47	-37.96	2.77	20.81
2099	4.90	-3.45	7.93	-46.41	4.10	27.13

*Anomaly refers to the change compared to the baseline. The projections are not absolute values.

14.13.5 The projections show an almost continuous increase in annual average temperature over the next 80 years (**Figure I.2.1 in Appendix I.2**). Annual precipitation is shown to vary year on year, with some years being dryer or wetter than previous years (**Figure I.2.2 in Appendix I.2**).

14.13.6 The projections suggest that summers will become warmer and drier, with an expected increase in maximum summer temperatures and overall decline in summer precipitation (**Figures I.2.3 and I.2.4 in Appendix I.2**). Natural variations may mean that some cooler and/or wet summers will occur.

14.13.7 Winters may become milder and wetter, with an overall increase in both minimum winter temperature and winter precipitation. Natural variations may mean that some cold and/or dry winters may still occur (**Figure I.2.5 and 15.6 in Appendix I.2**).

14.13.8 In the UK, the heaviest snowfalls tend to occur when the air temperature is between zero and 2°C (Met Office, N.Dd). There is less certainty in the magnitude of change to snow occurrence and amount, although climate models do show a downward trend in both falling and lying snow over time.

14.13.9 As outlined in Section 4.1 of the FRA (Jubb, 2022), there are no records of tidal or fluvial flooding affecting the existing Site. The identified flood risk associated within the Site is fluvial in nature and is minimal, with only the isolated Henbury Trym corridor and Stoke Brook culvert inlet identified as susceptible to minimal flood risk when assessed against climate change allowances. As a result, it is anticipated that the likely impact sea level rise will have on the Site for the 2036 baseline scenario is estimated to be minimal.

14.13.10 The FRA (Jubb, 2022) states that there are no records of overland or surface water flooding affecting the existing Site and the risk of flooding from surface water at the Site is 'very low – low'. The main risk of surface water flooding/overland flooding appears to be caused through local retention of onsite rainfall. Due to the relatively large size of the existing Site large amounts of surface water runoff is expected to be generated onsite during predicted rainfall events, which is conveyed and collected in localised sags or valleys. As the extant planning consent required implementation of a Surface Water Management Strategy to serve the Proposed Development and manage rainfall on Site, as per Condition 24, it is assumed that surface water flood risk on Site for the 2036 baseline scenario will be very low. Risk from groundwater and reservoir flooding also remains unchanged from the current state of the environment.

Extreme Weather Events

Heatwaves

14.13.11 A heatwave is an extended period of hot weather relative to the expected conditions of the area at that time of year, which may be accompanied by high humidity. For the UK, the Met Office defines a heatwave as “*when a location records a period of at least three consecutive days with daily maximum temperatures meeting or exceeding the heatwave temperature threshold*” (Met Office, N.De). The threshold varies by county and have been calculated using the 1981-2010 climatology of daily maximum temperature at the mid-point of the meteorological summer (15 July), which for the Site is 27°C. As outlined in **Table 14.9** above, temperatures are projected to increase by 4.9°C by 2099.

14.13.12 Research has found that the likelihood of heatwave events in the UK is about 10 times higher due to climate change (Vautard R. *et al.*, 2019). As discussed above, the maximum summer air temperature and annual average air temperature is expected to increase over the next 80 years, which could result in more intense and more frequent heatwaves.

Extreme Cold Snaps

14.13.13 It is projected that winters may become increasingly milder, with minimum temperatures set to rise by over 4°C by 2099. Natural variations may mean that some cold and/or dry winters may still occur.

Heavier Rainfall

14.13.14 Heavy rainfall that may lead to flooding is hard to predict in the long term. A study has shown that an extended period of extreme winter rainfall in the UK is now about seven times more likely due to human-induced climate change (Christidis and Stott, 2015), although the largest changes in heavy rainfall since 1961 have occurred in Scotland and northern England.

14.13.15 The climate projections for the Site show there will be an increase in average winter precipitation (**Figure 1.2.6** in **Appendix I.2**). There is also a pattern of larger increases in winter precipitation over southern and central England toward 2099.

14.13.16 While projections indicate a trend that summers will become dryer toward the end of the century, there is also evidence that summer rainfall events may become more intense when they do occur.

Low Rainfall and Drought

14.13.17 Droughts are natural events which occur when a period of low rainfall creates a shortage of water. The UKCP18 projections show a trend toward drier summers on average, although the uncertainties of these are wide ranging. Research on the influence of climate change on drought in the UK is limited and given the several different factors that influence droughts (meteorological, hydrological, and societal), it is challenging to identify whether drought events will become more common and prolonged in the future.

High Winds

14.13.18 On average throughout the year, near-surface wind speeds are projected to decrease. However, during the winter season, where more significant impacts of winds are experienced (Met Office, 2019), near-surface winds speeds are projected to rise towards the second half of the 21st Century.

14.13.19 However, these projections are modest compared to natural variability from month to month and season to season. Projections of future wind and storm occurrence and intensity are uncertain and confidence in projections is low. Research has shown that there are no compelling trends in maximum gust speeds over the last four decades (Kendon *et al.*, 2019) and therefore there is no evidence that link climate change and storms.

- 14.13.20 Due to the little evidence that storms may increase in frequency or severity as a result of climate change, likely significant effects resulting from storms and high winds are scoped out of further assessment.

Summary of Projected Climatic Changes

- 14.13.21 In summary, it is anticipated that the Proposed Development will experience the following climatic changes:

- An increase in average annual temperature
- An increase in maximum temperature, particularly in the summer
- More extreme rainfall events
- An increase in winter rainfall
- A reduction in summer rainfall

14.14 Embedded Mitigation

- 14.14.1 The Proposed Development has been designed to incorporate mitigation and adaptation measures to address climate change. This section provides a summary of these measures below, many of which have been addressed in full in other chapters within this ES:

- **Construction Environmental Management Plan (CEMP):** All construction activity will be governed by a CEMP and compliance with the CEMP requirements will be mandatory for all principal contractors appointed for those delivering the Proposed Development. The CEMP includes standard construction and health and safety practices, such as securing material / equipment and not undertaking works during periods of extreme rainfall.
- **Flood risk, SuDS and Water Efficiency:** An outline drainage strategy has been prepared (Jubb, 2022), which has been designed to manage runoff up to the 1 in 100 year storm event, plus a 40% increase in peak rainfall intensity to account for the likely effects of climate change. Although not strictly mitigation, all infrastructure will be located in areas at low probability of flooding (Flood Zone 1).

The strategy will establish a simple and robust system of water collection, water attenuation and distribution to maximise opportunities for reuse and therefore reduce water demand and increase water efficiency. Priority will be given to above-ground features that can be integrated within Public Open Space.

The final nature of each source control treatment train for each parcel will need to be formalised to suit the Proposed Development at reserved matters stage. The following SuDS features will be considered within each parcel and assessed for their suitability for inclusion:

- Bio-retention facilities;
- Swales;
- Green Roofs;
- Filter Strips;
- Permeable Paving;
- Rain Gardens;

- Rainwater Harvesting;
- Attenuation/Detention Basins; and
- Ponds.

Integrating SuDS features across the Site will provide alternatives for clean water sources should there ever be periods of drought and provide adaptation actions to reduce the potential for flooding, thereby increasing the Proposed Developments resilience to the effect of climate change.

- **Retention and Creation of Habitats, Green Infrastructure and Open Space:** the incorporation of green infrastructure including landscape corridors and natural open space as shown on the Strategic Landscape Parameter Plan (**Appendix A.2**), will provide connection to wider assets such as strategic green infrastructure in the surrounding area. This will aid in reversing habitat fragmentation and create an interconnected ecosystem, in turn, improving local biodiversity's level of climate resilience. Green infrastructure will also provide evaporative cooling at night and passive shading, helping to reduce the potential for a heat island effect.
- **High Winds:** The airfield currently has considerable exposure to dominant westerly and south-westerly winds from the Bristol Channel. The **Outline Masterplan DAS** proposes to integrate tree belts which will act as wind breaks and wind shelters to provide valuable microclimate benefits and shelter from prevailing winds.
- **Building Regulations:** Applicable Building Regulations adopted at the time of construction will be strictly adhered to and this will be secured by way of a standard Planning Condition.

14.15 Assessment of Likely Effects

Construction Effects

- 14.15.1 There is anticipated to be an increase of average annual temperature and decrease in average annual precipitation over the construction period. Climate hazards have the potential to disrupt or delay the construction programme and affect suitable working hours due to unsafe conditions for workers and potential damage to equipment or works. The risk of climate hazards, for example from heatwaves or periods of heavy precipitation may increase during the construction period however it is expected that these will be managed through standard construction and health and safety practices outlined in the CEMP, such as securing material/equipment and not undertaking works during periods of extreme rainfall. The effect of climate change on the Proposed Development during the construction phase is therefore likely to be **negligible**. The impact of climate change on the Proposed Development during demolition and construction is therefore considered to be **Not Significant**.

Operation Effects

- 14.15.2 **Table 14.10** outlines the potential significant effects from climate on the identified receptors within the Proposed Development. **Moderate** effects have been identified on future users of the Site as a result of increased frequency and intensity of heatwaves. There is potential for a **Moderate** effect on habitats, planting and landscaping as a result of more intense and frequent heatwaves and droughts as no embedded mitigation was identified. Without the implementation of further mitigation (**Section 14.16**) significant effects on future users of the Site and habitats, planting and landscaping from climate change were identified.

Table 14.10: Climate Change Risk Assessment

Climate Condition / Hazard	Receptor	Receptor Vulnerability	Potential Impact (with embedded mitigation)	Significance
Long Term Changes to Climate Norms	Future Users of the Site	Moderate to High	Increased temperatures and drier summers may affect human behaviour with, for example, an increase in outdoor activity. The Proposed Development includes a network of open spaces, including footpaths, recreational cycle routes and areas for informal recreation. The warmer winters and reduced risk of cold snaps may have potentially positive outcomes for those with circulatory and respiratory impacts.	Negligible
	Infrastructure	Moderate	Infrastructure may require more maintenance and repair as changes to climatic norms may cause increased stress on, for example, below ground cables and pipes. This will be managed at the detailed design stage, where risk assessments will be undertaken to manage risks from future climate change in accordance with nationally accepted standards and guidance.	Negligible
	The Natural Environment (Ecology, Landscaping and Planting)	Moderate	Warmer, drier summers and milder wetter winters are likely to have a long term impact on species' ranges, potentially causing flora and fauna to relocate to more tolerable climate conditions. The changes in annual and seasonal averages may also impact the timing of seasonal biological activities, such as migrating birds. Chapter 12 identifies that important habitat and species present are generally considered to be widespread and the Site is not near the edge of their ranges.	Negligible
Heatwaves	Future Users of the Site	Moderate to High	Increased frequency and intensity of heatwaves may adversely impact human health by increasing the risk of mortality and morbidity due to heat (HPA, 2012). Embedded mitigation in the design of the Proposed Development, for example the provision of open space will help to provide evaporative cooling at night. This will help to reduce the risk of building overheating and maintain thermal comfort during periods of extreme heat should promote healthy lifestyles for all members of the community and provide evaporative cooling at night.	Moderate
	Infrastructure	Moderate	Extremes in temperatures have the potential to damage infrastructure, for example causing tarmac to soften, melt and be more susceptible to damage. As a result, additional maintenance and emergency repairs may be required.	Negligible

Climate Condition / Hazard	Receptor	Receptor Vulnerability	Potential Impact (with embedded mitigation)	Significance
			This will be managed at the detailed design stage, where risk assessments will be undertaken to manage risks from future climate change in accordance with nationally accepted standards and guidance.	
	The Natural Environment (Ecology, Landscaping and Planting)	Moderate	Increased frequency of extreme weather events such as heatwaves could change the type and structure of vegetation without the implementation of further mitigation.	Moderate
Low Rainfall and Drought	Future Users of the Site	Moderate to High	Periods of low rainfall and drought have the potential to adversely affect public water supply. Water companies have a statutory duty to maintain a secure water supply during a drought and to produce Water Resources Management Plans (WRMP), which consider climate change and drought.	Negligible
	Infrastructure	Moderate	Reduction in rainfall could cause soil moisture deficits, which may affect soil stability. This may increase risk of damage to infrastructure without the implementation of further mitigation.	Minor
	The Natural Environment (Ecology, Landscaping and Planting)	Moderate	Increased frequency of low rainfall and droughts combined with higher average temperatures may adversely impact the productivity, function and structure of ecosystem services by, for example, causing an increase in erosion as soils and substrates dry out.	Moderate
	Land Stability	Minor	Reduction in rainfall could cause soil moisture deficits, which may affect soil stability without the implementation of further mitigation.	Minor
Heavy Rainfall and Flooding	Future Users of the Site	Moderate to High	Flooding has the potential to isolate future users of the Site, disrupt service provision, damage homes and increase risk to human health, in particular mental health. The FRA submitted with the planning application (Jubb, 2022) assesses the likely significant effects of flood risk and states that should the Proposed Development areas be kept within FZ 1 areas (as proposed) there	Negligible

Climate Condition / Hazard	Receptor	Receptor Vulnerability	Potential Impact (with embedded mitigation)	Significance
			will be no risk from tidal or fluvial flood events. A proposed drainage strategy will also be designed to accommodate all surface water flows from the new hardstanding areas of the Proposed Development.	
	Infrastructure	Moderate	Increased precipitation during the winter and more intense rainfall events are likely to increase flood risk and surface water run-off. This could prevent the use of and/or damage infrastructure and also adversely affect water quality. The FRA (Jubb, 2022) assesses the likely significant effects of flood risk and states that there is no risk from tidal or fluvial flood events should the Proposed Development be located within areas of FZ 1 as proposed. A proposed drainage strategy will also be designed to accommodate all surface water flows from the new hardstanding areas of the Proposed Development.	Negligible
	The Natural Environment (Ecology, Landscaping and Planting)	Moderate	Flooding has the potential to damage planting and habitats on Site. The proposed drainage strategy will be designed to accommodate all surface water flows and mimic as closely as practical the natural flow routes of the existing Site, therefore, as effects are expected to be Negligible.	Negligible
	Land Stability	Moderate	The impact of heavy rainfall events and flooding may lead to an increased risk of slope and embankment instability. As the Site is largely on flat terrain, and the residential-led Proposed Development is not anticipated to include steep slopes or embankments, there is limited potential for landslide events. Furthermore, the FRA outlines how climate change is embedded within the flood risk mitigation measures and drainage design. Consideration of land stability with regards to the foundations of structures and buildings is taken into account during the detailed design stages.	Negligible

14.16 Further Mitigation

- **Building Regulations:** As each plot comes forward in more detail, measures to reduce water demand and increase water efficiency in line with Building Regulations Part G will be considered to further increase resilience to droughts. This will in turn, also provide GHG emission savings. These measures may include measures such as:
 - Dual flush toilets - to reduce water consumption
 - Leak detection systems
 - Flow control devices - to reduce the flow rate of kitchen sink and bathroom basin taps
 - Installing pulsed water meters with pulsed output and fitting sub-meters – to reduce the energy demands associated with water heating
 - Using water-efficient appliances (e.g. those with an 'A' or 'B' rating as defined by the European Water Label).
- **Retention and Creation of Habitats, Green Infrastructure and Open Space:** As outlined in **Chapter 12 (Biodiversity)**, an Ecological Mitigation and Management Strategy (EMMS) will be prepared for the Site to be secured by way of planning condition. This report will include consideration of the maintenance / management measures associated with onsite ecological networks and features that are to be retained, enhanced and created within the Proposed Development. This would increase the long-term resilience of habitats and species within the Site and managing areas that may be affected by droughts.
- The **Outline Masterplan DAS** (YTL, 2022) and **Eastern Framework Design Code** (YTL, 2021) both establish the need to consider climate change, native species, resilience and biosecurity as important factors in selecting species. Selected species will include those tolerant to higher temperatures, drought resistant and need less irrigation. This will increase resilience and reduce pressure on water supply during a drought.
- **Design and Land Stability:** The design of foundations and drainage within the Site will take into consideration the ground conditions and any sensitive clay soils with higher swell potential and will be designed in accordance with UK standards for the soil type and condition found on Site. Risk assessments will be undertaken to manage risks from future climate change in accordance with nationally accepted standards and guidance. This will be secured by way of a suitably worded Planning Condition.
- **Overheating:** As noted in the Design Code for the Eastern Framework (YTL, 2021), TM52 and TM59 overheating assessments are to be carried out at the Reserved Matters stage which would identify mitigation measures to reduce adverse effects on future users of the Site.

14.16.1 While noted in **Section 14.12** that there is no evidence to link climate change to storms, further mitigation for high winds are detailed in **Chapter 13 (Wind Microclimate)**. These measures will be specifically designed and verified at suitable stages of the Proposed Development via further testing, particularly during reserved matters of individual plots / zones as needed. Examples of mitigation that may be effective would include, but would not be limited to, the following:

- Recessing entrances by at least 1.5m if this was compatible with the design of the building, or the introduction of side screens
- Introduction of soft landscaping elements such as tree planting, green screens and planters to the thoroughfares or any recreational areas that exceed comfort criteria

- Where required, screens, canopies and other architectural features may also be implemented.

14.17 Residual Effects

- 14.17.1 The moderate adverse effect on human health as a result of the increased likelihood and frequency of heatwaves would be further mitigated by the implementation of overheating assessments for each individual plot or building as they come forward in a RMA. Therefore the likely effect can be reduced to Minor Adverse and Not Significant. Mitigating these effects beyond the further mitigation proposed above is reliant on aspects outside the scope of the Proposed Development, such as increasing the resilience of health services and availability of emergency services.
- 14.17.2 Potential moderate adverse effects to the natural environment resulting from heatwaves and droughts would be managed through the implementation of the EMMS and Planting Strategy. The likely effect is therefore considered to reduce to Minor Adverse and Not Significant.
- 14.17.3 Minor Adverse effects to land stability resulting from low rainfall and drought will be managed at detailed design stage when the design of foundations and drainage within the Site will thoroughly consider ground conditions to ensure any potentially unstable land is appropriately remediated prior to construction. The likely residual effect is therefore Negligible and Not Significant.

In-Combination Effects

- 14.17.4 There is potential for in-combination climate change effects to exacerbate other environmental effects identified in other topic chapters without mitigation. There is a need to deliver a co-ordinated approach to the climate change mitigation measures to provide climate resilience within the Proposed Development. The proposed embedded mitigation measures have been outlined in **Section 14.14**. It is considered that, with the implementation of these embedded mitigation measures and careful consideration of climate change mitigation and adaptation measures at the design stages, the effects identified within the topic chapters will not be exacerbated as a result of climate change. In-combination effects are therefore **Negligible and Not Significant**.

14.18 Monitoring

- 14.18.1 No significant residual effects have been identified in relation to climate vulnerability and resilience, therefore no monitoring is proposed. However, monitoring of the existing retained and proposed planting will be undertaken as part of the EMMS.

14.19 Summary

- 14.19.1 This Chapter has assessed the likely significant effects of the Proposed Development on climate change, and the likely significant effects of climate change on the Proposed Development, with due regard to IEMA guidance.

GHG Emissions Assessment

- 14.19.2 The GHG emissions assessment provided a qualitative description of the anticipated GHG emissions arising during the construction and operational phases of the Proposed Development. During construction, a Moderate Adverse Significant effect was identified in relation to emissions from the combustion of fossil fuels on Site during construction activities, land clearance and enabling activities and purchased electricity for welfare facilities and lighting. During the operational phase, a Minor Adverse and Not Significant effect was identified in relation to transport emissions, carbon sequestration and electricity purchased from the national grid.

- 14.19.3 Embedded mitigation measures to reduce GHG emissions associated with the Proposed Development includes the implementation of a CEMP, energy efficiency measures set out in the Design Code for the Eastern Framework (YTL, 2021), and an extensive green infrastructure network. Further mitigation measures to reduce GHG emissions include energy efficiency design principles (**Section 14.8.6** and **Section 14.18.2**) and consideration of additional sustainable transport strategies (**Section 14.8.13**) which can be secured by way of a Planning Condition and / or a S106 agreement.

Climate Change Risk Assessment

- 14.19.4 UKCP18 climate projections were used to establish evolving baseline climate conditions up to 2099. It is expected that the Proposed Development may experience warmer, drier summers, and milder, wetter winters, along with an increase in frequency and intensity of extreme weather events such as droughts or heatwaves. This has the potential to adversely affect receptors within the Proposed Development, including future users of the Site, buildings and infrastructure, and ecology.
- 14.19.5 The climate resilience assessment identified key environmental receptors to climate change and determined their sensitivity to the projected climate change impacts. During the operational phase, infrastructure such as buildings and roads, and ecology, landscaping and planting were determined to be moderately vulnerable, while construction workers and future users of the Site including residents, employees and students, were determined to be moderately to highly vulnerable to climate change. The effects of climate change on the Proposed Development are determined to be Not Significant (Minor-Negligible), with the exception of low rainfall / drought on the natural environment and heatwaves on both future users of the Site and the natural environment. These were determined to experience a Moderate Adverse effect without the implementation of further mitigation.
- 14.19.6 Embedded mitigation to address climate change includes the development of a surface water management strategy to address flood risk, and the retention and creation of habitats, green infrastructure and public open space. The Design Code (YTL, 2021) also notes that TM52 and TM59 overheating assessments are required to be carried out at the Reserved Matters stage including against climate data for at least 2050 and ideally 2080. This will enable buildings to be designed to mitigate against the long-term changes in climate norms. Further mitigation includes the implementation of a CTMP, an EMMS and Planting Strategy and consideration of water efficiency measures.
- 14.19.7 Following the implementation of the above measures, residual effects on future users of the Site and ecology, landscaping and planting reduce to Minor Adverse and Not Significant in EIA terms.

14.20 References

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