14 CLIMATE CHANGE

14.1 Introduction

14.1.1 This chapter of the ES considers the likely effects of the proposed development in terms of climate change and risk mitigation in the context of the site, the surrounding area and the wider environment, recognising that climate change is a global issue. This chapter is presented in two parts to cover the following:

- **Part A: Assessment of impacts on climate:** An impact assessment that focuses on the potential effects of the proposed development (i.e. greenhouse gas emissions (GHG) on the climate through an assessment of whole life carbon). This includes an overview of how the proposed development aids in the mitigation of climate change; and
- **Part B: Assessment of climate resilience:** A review of the resilience of the proposed development to the potential effects arising from projected changes in future climate. This includes a qualitative discussion of the vulnerability and sensitivity of the proposed development to climate change impacts, with an assessment of the magnitude of potential effects.

14.1.2 This chapter and its associated figures and appendices are not intended to be read as a standalone assessment and reference should be made to the descriptive chapters at the front end of this ES (Chapters 1 – 5), as well as the final chapter, 'Summary of Effects (Chapter 20).

14.2 Legislation, Policy and Guidance

14.2.1 The relevant legislation, policy and guidance in relation to climate change is outlined in Appendix 14.1.

Legislative framework

14.2.2 The applicable legislative framework is summarised as follows:

- The Town and Country Planning (Environmental Impact Assessment (EIA)) Regulations 2017;
- The Climate Change Act 2008 (2050 Target Amendment) Order 2019; and
- Building Regulations including:
  - Implementation of 2021 Interim Uplift to Part L (energy efficiency) and Part F (ventilation);
  - Proposed implementation of Future Buildings Standard for Part L and Part F

from 2025;

- New Part O effective from June 2022 to mitigate against overheating;
- New Part S effective from June 2022 for the provision of infrastructure for electric vehicle charging; and
- Industry concept for amendment Part Z proposed in April 2022 to mandate the assessment of whole life carbon and setting limits on embodied carbon emissions for all major building projects.

14.2.3 In terms of the context for the proposed development, the UK Government is committed to achieving 'net zero' by 2050, as set out in the Climate Change Act (as amended in 2019). Across the European Union, road traffic is estimated to be responsible for 24% of the total carbon dioxide (CO_2) emissions[1] and hence there is a need to decarbonise transport and move away from internal combustion engines towards hybrid and electric vehicles.

14.2.4 The UK Government is requiring that by 2030 80% of all new cars and 70% of new vans sold should be set to be zero emission increasing to 100% by 2035[2]. Given that the sale of new petrol and diesel cars will end by 2035 there is going to be a huge demand for electric vehicles. The Faraday Institution's report *"UK Electric Vehicle and Battery Production Potential to 2040"* (June 2022) predicts that by 2030 around 100 GWh of supply will be needed in the UK to satisfy the depend for batteries for electric vehicles and that by 2040, it is predicted that demand will rise to nearly 200 GWh.

14.2.5 In this context and as mentioned above, it is reasonable to assume that if the development is not provided here it will be provided elsewhere to help meet this demand. Further details of the demand and need for the development are discussed in the Green Belt: Very Special Circumstances Report which accompanies this planning application for AESC Plant 3.

Planning Policy

14.2.6 The site sits within the administrative boundary of Sunderland City Council (SCC).

14.2.7 The applicable national and local planning policy is summarised as follows:

1 https://climate.ec.europa.eu/eu-action/transport/road-transport-reducing-co2-emissions-vehicles_en#:~:text=Light%2Dduty%20vehicles%20(cars%20and,the%20EU%27s%20CO2%20emissions. [Accessed February 2024].
2 https://www.gov.uk/government/news/government-sets-out-path-to-zero-emission-vehicles-by-2035 [Accessed February 2024].

- The National Planning Policy Framework (NPPF) (As amended, 2023);
- Sunderland Core Strategy & Development Plan 2015-2033 (Adopted 2020);
- IAMP Area Action Plan (AAP) 2017-2032 (Adopted 2017);
- Development Management Supplementary Planning Document (SPD);
- Sunderland City Council Low Carbon Framework (2020); and
- Sunderland City Council Low Carbon Action Plan (2020).

Guidance

14.2.8 The applicable guidance is summarised, below; the climate change impact assessment will primarily be based on the latest EIA guidance published by the Institute of Environmental Management and Assessment (IEMA).

14.2.9 Part A of the assessment will primarily follow the *'Environmental Impact Assessment: Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance'* (2022)[3]. This is the most recent guidance available and is applicable to the UK. It is also considered to be the most holistic method of assessing greenhouse gas (GHG) emissions as it applies a whole lifecycle methodology, incorporating not just the construction and operational phase of development, but also the decommissioning / end-of-life and beyond asset lifecycle stages. The whole lifecycle methodology allows for a more robust 'worst case scenario' to be applied, which is proportionate to the nature and scale of the proposed development.

14.2.10 Several guidance publications have been produced containing suggested methods for establishing a GHG emissions baseline and limited advice on techniques for applying significance thresholds. The European Investment Bank (EIB) *'EIB Project Carbon Footprint Methodologies. Methodologies for the Assessment of Project GHG Emissions and Emission Variations'* (2023)[4] guidance will be used to establish the baseline scenario. This goes into greater detail in terms of a baseline methodology and allows for easier comparison of impacts where there is no prior development in an area.

14.2.11 Part B of the climate change assessment will apply the IEMA *'Environmental Impact*

[3] Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance, IEMA 2022 (iema.net).

[4] EIB Project Carbon Footprint Methodologies. Methodologies for the Assessment of Project GHG Emissions and Emission Variations, Version 11.3, EIB 2023.

Assessment Guide to: Climate Change Resilience and Adaptation' (2020)[5] guidance as this is the most recent available and is applicable to the UK. In addition, the following guidance documents have also been used to inform both parts of the climate change impact assessment:

- European Commission, Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment (2013)[6];
- Royal Institution of Charted Surveyors (RICS), Whole life carbon assessment for the built environment (1st Edition 2017[7], 2nd Edition 2023[8]);
- British Standards Institution (BSI) PAS 2080:2016 'Carbon Management in Infrastructure[9]; and
  - British Standard (BS) EN 15978-1 Sustainability of construction works - Methodology for the assessment of performance of buildings (2011)[10].

14.3 Assessment Methodology

Extent of Study Area

14.3.1 The proposed development will impact on global GHG concentrations across all project lifecycle stages, which will have a long-term, permanent adverse effect on the climate through contributing to the human-induced global warming effect. Within a climate change context, therefore, the key sensitive receptor to the impacts of the proposed development will be global climate, which has a high sensitivity to further emissions. The proposed development will also be affected by future changes to the climate. This global receptor differs to the other local scale receptors listed within an EIA context as it is not within a predefined boundary and, therefore, a different approach to the extent of the study area is required for the assessment of impacts.

14.3.2 It is understood that certain regions, populations and species are more sensitive than others to climate change, but it would not be reasonable to provide an assessment of

[5] Environmental Impact Assessment: Guide to: Climate Change Resilience and Adaptation Institute of Environmental Management and Assessment, IEMA 2020 (iema.net).
[6] Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment, European Commission, 2013. ISBN 978-92-79-28969-9.
[7] Whole life carbon assessment for the built environment, Royal Institution of Chartered Surveyors (RICS) Professional Statement, UK 1st Edition, 2017. RICS, London.
[8] Whole life carbon assessment for the built environment, RICS Professional Standard, Global. 2nd Edition, September 2023. Effective from 1 July 2024. RICS, London.
[9] PAS 2080:2016 Carbon management in infrastructure, 2016, London: BSI.
[10] BS EN 15978:2011 Sustainability of construction works. Assessment of environmental performance of buildings. Calculation method, 2011. ISBN: 978 0 580 77403 4.

the proposed development's potential impact on all of these receptors as any single development would have an indiscernible impact on global climate change, overall. A system boundary and a temporal boundary is applied to the assessment in order to determine the proposed development's impact on climate change in relation to the release of GHG emissions associated with the project across the entire lifecycle. The impact of climate change on the proposed development is assessed based on global climate projections and regional climate projections for a 25 km grid surrounding the application site.

Characterisation of Impacts

14.3.3 The assessment is intended to ensure that the proposed development does not emit unacceptable levels of emissions, not only in an effort to reduce future climate change impacts but also to contribute towards local, national, and global emission reduction targets. The resilience of the proposed development to future changes in climate is also assessed using probabilistic climate projections for the region. The categorisation of both of these assessments in relation to key determining criteria are explained, below.

- **Positive or Negative** - The impact can only be negative due to the guaranteed release of GHG emissions from development; the purpose of the assessment is to consider the efforts of the project to minimise the negative impact.
- **Extent** - The release of GHGs may occur locally, but the associated impact (i.e. contribution to global warming and climate change) is a global issue.
- **Magnitude** - Any single scheme has an infinitesimal impact on global climate change overall, but the assessment is still important to assess the proposed development's contribution to local and national targets. The assessment also considers magnitude in the context of emission reduction compared to baseline scenarios. For the purposes of determining the magnitude of effects of climatic variables on the proposed development, a combination of the probability and consequence of likely events are used.
- **Probability** - This takes into account the chance of the climatic effect occurring over the relevant time period (e.g. lifespan) of the proposed development and the likely impact of this if the risk is not mitigated.
- **Consequence** - This reflects either the geographical extent of the climatic effect or the number of receptors affected (i.e. scale), the complexity of the effect, the

degree of harm to those affected and the duration, frequency and reversibility of effect.

- **Duration and Timing** - The duration of the impacts extends from the construction, through the operational and to the decommissioning phases of a given development. Research has shown that the operational phase typically accounts for around 90-95% of emissions across the lifetime of a development. The duration and timing of a future climatic event will affect resilience.
- **Frequency** - Emissions are likely to occur continuously across the lifetime of the site as a result of fossil fuel combustion, electricity use, transportation and natural processes. When assessing the resilience of the proposed development to future climate, however, the frequency of projected events is used to determine the likelihood and consequence of impacts.
- **Reversibility** - Once emitted into the atmosphere, GHGs are circulated and interact with different processes and reactions to create different molecules with varying lifespans and effects. This is essentially irreversible, but it is possible to take actions that can limit the emissions released and it is also possible to sequester certain gases and remove them from the atmosphere (e.g. via the use of green and blue infrastructure).
- **Likelihood** - Any form of activity or process will result in the release of GHGs to some degree. This includes activity associated with positive climate change action, such as the development of renewable energy or other low carbon technology. The likelihood of future climate risks is determined by the level of probability. This assessment aims to consider how the inevitable impact of emissions is minimised and reduced, as well as how the resilience to future climate change is increased, in the design and planning of the proposed development.

14.3.4 Mitigation has taken a prominent position within the EIA process in relation to impacts on climate. GHG emissions mitigation is considered from the outset and throughout the project's lifetime. However, the biggest driver for change is the recent revision to Part L of the Building Regulations in England, which requires developers to demonstrate substantial improvements in carbon emissions in order to achieve planning permissions and sign-off and handover of buildings from construction to the operational phase. Without this sign off the developments cannot be lawfully occupied.

PART A: ASSESSMENT OF IMPACTS ON CLIMATE (GREENHOUSE GAS EMISSIONS)

Scope of the Assessment

System Boundary

14.3.5 The scope of the climate change impact assessment is considered to be those activities associated with the proposed development that either directly or indirectly release GHG emissions that contribute to climate change effects (irrespective of source) across all relevant project lifecycle stages (i.e. whole lifecycle carbon emissions).

14.3.6 BS EN 15978 and the RICS PS set out four stages in the life of a typical project, described as 'lifecycle modules'. These lifecycle modules have been simplified in Figure 15.1, below, but include:

- Module A1 - A5 (Product sourcing and construction stage);
- Module B1 - B7 (Use stage);
- Module C1 - C4 (End of life stage); and
- Module D (Benefits and loads beyond the system boundary).

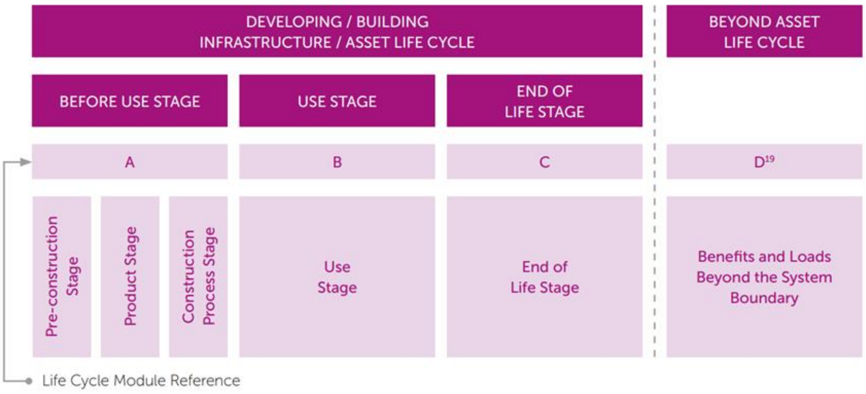

Figure 14.1: Simplified Diagram of Modular Approach of Lifecycle Stages and Modules for EIA GHG Emissions Assessment [Source: IEMA, 2022[3]]

14.3.7 The system boundary applied for this assessment is Cradle-to-Grave and it will cover the entirety of modules A1 (raw material extraction and supply) through to C4 (end of life stage). Module D is optional and involves a greater level of uncertainty, especially at this early stage of planning. The assessment is proportional to the nature and scale of the proposed development.

Temporal Boundary

14.3.8 A reference study period of 60 years has been chosen as the basis of the GHG emissions assessment (based on the expected service life of the construction asset) and forms the temporal boundary for the assessment. This reference study period is recommended in the RICS Professional Standard (2nd Edition, 2023)[8] for whole life carbon assessments of domestic and non-domestic projects.

Whole Lifecycle Carbon Emissions

14.3.9 A sum total of all building-related emissions over a building's entire lifecycle, which includes operational emissions from day-to-day energy use, is provided in order to assess the impacts associated with the proposed development over the reference study period. Emission savings achieved from any incorporated low carbon technologies during operation (e.g. renewable energy / heat generation) are taken into consideration. The assessment includes embodied carbon emissions, which consists of the following:

- Material sourcing
- Fabrication of components
- Transportation of materials to/from Site
- Construction
- Maintenance, repair and replacement
- Demolition, dismantling, and disposal.

14.3.10 The objective of the assessment is to ensure the minimum overall lifetime carbon emissions and the maximum lifetime resource efficiency, and to demonstrate how the proposed development will mitigate the impact it will have on climate change through the release of GHG emissions in the longer-term. The distinction between operational and user GHG emissions is important to establish within the assessment. In terms of non-residential properties, operational emissions are associated with the regulated energy demand, which is controlled by the Building Regulations.

14.3.11 The user GHG emissions are associated with the unregulated energy demand and annual water consumption. At this time, it is not possible to fully understand how energy and emissions use will change within buildings during the 60-year reference study period. Therefore, it has been assumed that energy use will remain the same year-on-year throughout the assessment period. Unregulated energy use could vary substantially when the proposed development is operational, but it is not possible to accurately predict this energy use and a reasonable allowance has been made to account for this within the assessment.

Effects Not Considered within the Scope

14.3.12 The lifetime emissions will not be adjusted to take into account the Government projections for national grid decarbonisation by 2050, as there are limitations and uncertainty to these longer-term energy mix projections. Lifecycle analysis is based on existing grid conditions to present a 'worst-case scenario' for future impacts associated with energy consumption across the project's entire lifetime.

14.3.13 Not included in the assessment are those emissions associated with the transport movements of occupants, goods and services, workers, supply chain and visitors to site once the proposed development becomes operational. These are largely tied to actions outside of the Applicant's control. It is worth noting that the proposed development will manufacture batteries for electric vehicles (EV), and that these vehicles will emit less GHG emissions into the atmosphere than petrol and diesel vehicles. The Energy Strategy submitted with the planning application for AESC Plant 3 has calculated that the average CO_2 emissions saved would be equivalent to 130,345 tCO_2e per year (allowing for charging with grid electric). If those EVs were charged by decarbonised electricity, savings could rise to as much as 183,785 tCO_2e per year.

14.3.14 Different greenhouse gases have different levels of impact on the climate. The assessment considers carbon dioxide equivalent (CO_2e) emissions. This is a universal metric measure used to compare the emissions from various greenhouse gases on the basis of their global-warming potential (GWP) by converting amounts of other gases to the equivalent amount of CO_2 with the same GWP. In practice this is limited to consideration of CO_2, methane (CH_4) and nitrous oxide (N_2O) only. It is understood that there are other emissions that contribute to climate change, such as those found in refrigerants (e.g., chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs)). These emissions are considered to be minimal in volume by comparison to the operational CO_2e emissions and have not been considered in the whole lifecycle carbon analysis.

Setting a Baseline

14.3.15 For the purpose of the climate change impact assessment, in contrast to other impact assessments within this ES, the baseline is not assumed to be 'no development'. Rather, it is considered to be an equivalent 'typical' development. The justification behind this is explained in the methodology, below. A Technical Note published by European Bank for Reconstruction and Development (EBRD) in 2019 states that this type of baseline is appropriate since *"it is recognised that 'something' must be done"* and allows for a comparison of relative effect[11].

14.3.16 In accordance with the EIB (2023) methodology[4], this assessment assumes that the need for development is there and will, therefore, be constructed somewhere. In doing so, recognition must be paid to the fact that emissions will still be caused by the introduction of any new development and that these will contribute to global warming. The IEMA (2022) guidance indicates that all emissions contribute to climate change and that the global climate is highly sensitive to further atmospheric emissions. The guidance, however, provides significance criteria to assess the level of adverse impact a project will have. These consider if the project is adhering to existing and emerging policy and if it is contributing to the UK's net zero trajectory.

14.3.17 A baseline is a reference point against which the impact of a new project can be compared against, sometimes referred to as 'business as usual' (BaU), where assumptions are made on current or future GHG emissions. Baselines can take the form of:

A. GHG emissions within the boundary of the GHG quantification but without the proposed project; or

B. GHG emissions arising from an alternative project design and/or BaU for a project of this type.

14.3.18 This assessment considers both forms of baseline represented by points A and B to provide a meaningful comparison of impacts associated with the project. As stated in the IEMA (2022) guidance, the ultimate goal of establishing a baseline is being able to assess and report the net GHG impact of the proposed development. Baseline conditions for the site are described in Section 14.4 (Baseline Conditions).

14.3.19 In relation to baseline A, there are limitations in estimating the GHG emissions associated with the current use as reliable data is unavailable. The IEMA guidance (2022) sets out that:

"It may not always be possible to report on current baseline emissions, particularly with projects situated in areas with no physical development or activity. In this instance there would be zero GHG emissions to report at a site level". And, "…alternative baselines can be used to supplement the analysis and address uncertainty…a realistic worst-case baseline should still be used for assigning

[11] European Bank for Reconstruction and Development (EBRD) (2019). 'Technical note: Methodology for the economic assessment of EBRD projects with high greenhouse gas emissions.' EBRD, London.

significance".

14.3.20 Baseline B forms this alternative and as is used for assigning significance as it provides a logical reference point in relation to legislative and policy-based climate commitments.

14.3.21 The EIB (2023) provides further guidance on undertaking sectoral/BaU baseline assessments, including:

"By definition, emissions prior to developing on a greenfield site are zero. Hence, applying a simple 'before and after' approach gives rise to a zero baseline. By contrast, the baseline scenario … (i.e. without a project scenario) places no weight on whether a development is greenfield, brownfield or a partial replacement — the key issue is how the projected demand could otherwise have been met, which is not addressed in the 'before and after' scenario.

If the project is designed to replace a life-expired asset, a 'before and after' approach would use previous emissions as the baseline. However, this approach would lack credibility in many cases.

"The project baseline scenario (or 'without project' scenario) is defined as the expected alternative means to meet the output supplied by the proposed project...

…The baseline scenario must therefore propose the likely alternative to the proposed project which (i) in technical terms can meet required output; and (ii) is credible in terms of economic and regulatory requirements. The choice of baseline should normally be approached in the same way as the expected alternative scenario is determined for the project economic analysis."

14.3.22 The EIB guidance (2023) further states that first, a baseline scenario should be identified that is able to meet the demands of the proposed development in technical terms (e.g. the baseline must be able to technically meet the outputs of the proposed project). Secondly, that the scenario is credible by meeting these simplified tests:

- Socio-economic test: The baseline scenario should be financially viable with similar financial rates of return to that of the proposed project.
- Legal requirement test: The baseline emissions alternative scenario could not fail to comply with binding legal requirements.
- Life-expired test: The baseline alternative could not assume continuing use of existing assets beyond their economic life.

14.3.23 The EIB (2023) guidance describes how the proposed development will be compared to a standardised development, which will form the baseline BaU scenario for the assessment. This assumes that the development is required and will be provided elsewhere if not here. The standardised development on an alternate site would produce the same deliverables and meet the legislated and policy requirements. In-line with industry best practice dictated by the IEMA guidance (2022), the future baseline will capture all emissions within the applied system boundary (i.e., cradle-to-grave).

14.3.24 The approach to setting a baseline for the assessment of GHG emissions, although different to the other technical disciples, is compliant with the requirements of the EIA legislation in the UK.

Estimating GHG Emissions

14.3.25 The impact assessment assumes that measures included in the Energy Strategy will be incorporated into the proposed development and uses high-level assumptions using industry insights to present a worst-case scenario. The BaU baseline scenario will report on operational GHG emissions and how these may change over time (e.g. based on occupancy changes, regulatory requirements or the adoption of renewable technologies).

14.3.26 The assessment for this application is based on a combination of detailed information as supplied by the project design team, as well as UK default values for current industry standards and indicative material specifications. The general equation for emission estimation is:

$$GHG\ emissions\ =\ Activity\ Data\ x\ Emission\ Factor$$

14.3.27 Any activities where expected emissions are less than 1% of the total emissions can be excluded, but only where all exclusions total up to a maximum of 5% of total overall emissions associated with the proposed development across all project lifecycle modules (the whole lifecycle carbon emissions).

14.3.28 Emissions are expressed in terms of tonnes of carbon dioxide equivalent (tCO_2e). This is a universal metric measure used to compare the emissions from various GHGs on the basis of their GWP by converting amounts of other gases to the equivalent amount of CO_2 with the same GWP.

Before Use Stage (Lifecycle Modules A1-A5)

14.3.29 In the absence of detailed project-specific information relating to the methods of construction that will used, emissions associated with this phase of the proposed development have been estimated using a RICS benchmark calculation. This is based on typical emissions per unit of indicative project cost (i.e. tCO_2e per £1 million invested) (RICS 2017). The project value is commercially sensitive and cannot be disclosed in the ES Chapter.

In-Use Stage (Lifecycle Modules B1-B7)

14.3.30 The impact assessment assumes that measures included in the Energy Strategy (Appendix 3.4) will be fully incorporated into the proposed development. High-level assumptions using industry insights are used to present a 'worst-case' scenario for operational emissions in relation to regulated energy.

End of Life Stage (Lifecycle Modules C1-C4)

14.3.31 In the absence of project-specific information relating to decommissioning of the proposed development, the emissions associated with the deconstruction and demolition process for the site at the end-of-life project stage (lifecycle modules C1-C4) are based on the average per Gross External Area (GEA) (RICS 2017).

Relative Emissions

14.3.32 The proposed development is assessed for its relative emissions (Re) or net emissions, which is expressed as the difference between absolute emissions generated by the proposed development (Ab) and the baseline emissions from the BaU scenario (Be):

$$Relative\ Intensity\ Ratio\ (Re) = Absolute\ Intensity\ Ratio\ (Ab) - Baseline\ Intensity\ Ratio\ (Be)$$

14.3.33 The relative emissions are then used a reference point in combination with industry expertise on carbon reduction targets to evaluate the project against the significance criteria defined below.

Significance criteria

14.3.34 Effects that are deemed to be 'Significant' for the purposes of this assessment are different to those associated with other technical ES chapters. All sources of GHG emissions will contribute to global climate change. The atmospheric concentration of GHG emissions is defined by IEMA (2022) as being of high sensitivity to further emissions. Therefore, all emissions are considered to have an adverse and permanent impact on climate change in both the short, medium, and long-term.

14.3.35 The significance of the impacts associated with the proposed development has been assessed in-line with the criteria set out within the IEMA guidance (2022), as summarised in Table 14.1. Where GHG emissions cannot be avoided, the goal of the EIA process is to reduce the project's residual emissions at all lifecycle stages within the applied system boundary.

Table 14.1: Significance Criteria for Assessment of Impacts from GHG Emissions

Criteria	Impact	Significance
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.	Major Adverse	Significant
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.	Moderate Adverse	Significant
The project's GHG impacts would be fully consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type. A project with minor adverse effects is fully in-line with measures necessary to achieve the UK's trajectory towards net zero.	Minor Adverse	Not Significant

Table 14.1: Significance Criteria for Assessment of Impacts from GHG Emissions		
Criteria	Impact	Significance
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.	Negligible	Not Significant
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.	Beneficial	Significant

14.3.36 With consideration to the IEMA (2022) guidance, minor adverse and negligible effects are considered to be 'Not Significant' (see Table 14.1). Impacts are only considered to be minor adverse if the project's GHG impacts are fully consistent with existing and emerging policy requirements and good practice. Impacts are only considered to be negligible if the development goes well beyond existing policy and design standards. It needs to be viewed as well 'ahead of the curve' for the net zero trajectory and have minimal residual emissions. Projects that actively reverse (rather than only reduce) the risk of severe climate change can be judged as having a beneficial effect.

Consultation Undertaken to Date

14.3.37 A detailed EIA was carried out in July 2021, with a focus on the construction and operational phase on the AESC Plant 2. This has since been modified for the development of the AESC Plant 3 development as a proposed expansion, which is covered in this EIA / ES.

14.3.38 No additional consultation activities with SCC were deemed necessary in support of the preparation of this ES chapter for the proposed construction of AESC Plant 3, and assembly and warehousing building.

14.3.39 . This assessment has been updated to follow the revised industry guidance published in February 2022. There may still exist some similarities in the approach used in the 2021 ES, but this assessment is considered to be more robust and utilises current terminology associated with whole lifecycle carbon emissions for the proposed development.

Assumptions and Limitations

14.3.40 This chapter has been prepared to support the planning application as detailed in ES Chapters 1 to 3. Detailed design information for the proposed development was not available for the full site at the time of undertaking this study, and the assessment is based on the available information. The assessment of impacts associated with GHG emissions has been based on information provided by other consultants working on the project and WA is not responsible for any potential inaccuracies arising from the use of the third-party data.

14.3.41 It is noted that the proposed development does not have a predetermined end of life or demolition plan. For the purpose of the assessment, a defined lifetime period of 60 years has been selected to align with the reference study periods recommended by RICS (2017) and the principles of EN 15978;7.3. It is likely that, in practice, the proposed development will be operational beyond this 60-year timeframe, but aligning to this guidance provides a standardised timeframe to allow a comparable estimate of whole lifecycle emissions for different types of projects that can be used to set benchmarks for future development as the UK transitions to net zero.

14.3.42 A reasonable assumption has been made that the proposed buildings and energy strategy will comply with all relevant legislation for new developments. This assessment is based on the assumption that the units will comply with the current 2021 interim uplift to Building Regulations as a minimum (a 27% emissions reduction on regulated energy demand against a 2013 Part L baseline). It is important to note that the required emission reduction target rises to 75-80% for all building types constructed post 2025 (with a 12-month transition period) if construction of each individual unit that forms the proposed development commences prior to the date of full implementation of the Future Building Standard (anticipated in 2026).

14.4 Baseline Conditions

Current Baseline

14.4.1 The current baseline represents existing GHG emissions from the assessment prior to construction and operation of the project under consideration. This represents Baseline A as described in section 14.3 Assessment Methodology.

14.4.2 Prior to development, the overall area within the application redline boundary of the proposed site is 42.39 hectares (ha) and forms part of the wider International Advanced Manufacturing Park (IAMP). The site comprises an area of agricultural land (primarily arable) just North of the A1290 access road and adjacent to the AESC Plant 2 (situated to the west).

14.4.3 The first phase of IAMP ONE (three industrial units) and the associated infrastructure works were completed in 2020, enabling global connectivity and power availability of up to 55 MVA[12]. AESC Plant 2 was under construction at the time of undertaken this assessment. The site has existing demands for regulated or unregulated energy and, therefore, some emissions associated with these sources. In this instance, there is not a zero emissions baseline to report at site level. This is on the basis that there are currently emissions emitted from the existing land uses within the redline boundary for the application site, prior to the proposed development.

Future (Sectoral) Baseline

14.4.4 As set out in section 14.3 Assessment Methodology, for the purposes of the assessment in this ES chapter, the absolute emissions (Ab) are compared to 'a sectoral future baseline' (Be) that has been developed to provide a credible comparison of relative effects, as recommended by the EIB (2023) guidance. This is a different approach to other ES chapters that describe a 'no development scenario' as the future baseline. The baseline BaU emissions scenario (Be) represents Baseline B as described in section 14.3 Assessment Methodology.

14.4.5 The proposed development will generate emissions over the construction phase, as well as throughout the development's lifetime while the buildings are occupied by site users. There will be emissions associated with the proposed development at every stage of the project lifecycle. To enable a comparison of relative effects at the site, a BaU scenario has been created for the sectoral baseline, which is primarily based on the current 2021 interim uplift to Part L Building Regulations. This is also based on the indicative floor areas for the proposed units as set out in the Proposed Site Plan (Appendix 3.1) and assumes energy demand is met entirely through natural gas.

[12] IAMP website: https://iampnortheast.co.uk/ [Accessed September 2023].

14.4.6 The total whole lifecycle emissions for the BaU baseline scenario over the 60-year reference study period, covering project lifecycle modules A1 - A5 (product and construction), B1 - B7 (in use) and C1 - C4 (end of life) are presented in Table 14.2, below. This represents a typical development of a similar type built elsewhere to regulatory standards and forms the future baseline against which the proposed development is assessed.

Table 14.2: Baseline Scenario – Whole Lifecycle Carbon (WLC) based on Cradle-to-Grave	
Project Stage & Lifecycle Modules	*Whole Lifecycle Carbon Emissions (tCO_2e)*
Construction [A1-A5]	139,299
Operational – All Gas [B1-B6]	6,064,033
End of Life [C1-C4]	15,535
TOTAL	**6,218,866**

14.5 Embedded Mitigation

14.5.1 The development of mitigation measures is an integral part of EIA. The most effective form of mitigation measures are measures those that are designed-in to the scheme (i.e. embedded or inherent measures), leading to the avoidance of identified impacts or a reduction in impact magnitude. Measures to mitigate impacts associated with construction are normally based on accepted industry standards (standard mitigation measures), resulting in a high degree of certainty over their delivery.

14.5.2 Embedded mitigation has been considered in the assessment as the Applicant wishes to be policy compliant with their approach. It will be necessary for the proposed development to incorporate various renewable and low carbon technologies to achieve the minimum target of 27% emissions reductions required by the Future Buildings Standard (2021 uplift on Part L 2013 requirements). Full details of the embedded mitigation can be found in the accompanying Energy Strategy for the proposed development (Appendix 3.4). The assessment assumes that this includes the deployment of roof-mounted Solar Photovoltaic (PV) arrays at the site, which will be used to offset the projected energy demand. Air Source Heat Pumps (ASHP) are also being considered and are expected to provide a considerable saving in CO_2e emissions to support the general domestic water heating to the offices and process loads.

14.6 Assessment of Effects

Whole Lifecycle Carbon Emissions

14.6.1 All GHG emissions contribute to global warming and are considered significant, with a permanent adverse and long-term effect on climate change. The assessment of potential effects assumes that embedded and standard mitigation measures are implemented for all aspects of the proposed development to reduce lifecycle emissions.

14.6.2 The total whole lifecycle emissions associated with the proposed development over the 60-year refence study period, covering project lifecycle modules A1 – A5 (product and construction), B1 – B7 (in use) and C1 – C4 (end of life), have been estimated for Scenario A (with gas boilers) and Scenario B (all-electric heating) based on the floor areas indicated in the Proposed Site Plan (Appendix 3.1). The results of the assessment are summarised in Table 14.3, below.

14.6.3 Modelling indicates that there will be a 0.78% reduction in emissions for Scenario A, a 68 % reduction in emissions for Scenario B and an overall -34% reduction compared to the BAU emissions baseline (relative emissions).

Table 14.3: Absolute Scenarios – Whole Lifecycle Carbon (WLC) based on Cradle-to-Grave	
Scenario A – With Gas Boilers	
Project Stage & Lifecycle Modules	*Whole Lifecycle Carbon Emissions (tCO_2e)*
Construction [A1-A5]	139,299
Operational [B1-B6]	3,921,249
End of Life [C1-C4]	15,535
TOTAL	**4,076,082**
Scenario B – All-Electric Heating	
Project Stage & Lifecycle Modules	***Whole Lifecycle Carbon Emissions (tCO_2e)***
Construction [A1-A5]	139,299
Operational – All Gas [B1-B6]	1,142,578
End of Life [C1-C4]	15,535
TOTAL	**1,297,412**

14.6.4 The potential impact of the whole lifecycle carbon emissions is interpreted below for each project stage.

Construction Phase

14.6.5 The construction phase spans the project lifecycle modules A1 through to A5. This includes the embodied carbon contained within the building materials from extraction of the raw material [A1] through to manufacturing of the end building products [A2-A3], as well as transportation of materials to project site [A4] and the construction and installation process [A5].

14.6.6 The proposed development will require demolition of existing farm buildings, levelling and grading of the existing site, construction of the new manufacturing buildings, construction of ancillary buildings and infrastructure, and landscaping. The demolition of the buildings at North Moor is being brought forward via a separate planning application and it is anticipated that the demolition work will have been completed before construction starts on AESC Plant 3.

14.6.7 The first phase of construction work will comprise the removal of topsoil from the areas proposed for built development (including roads and parking areas) and construction of the access road(s) into the individual development plots. Topsoil removed from within the development areas will be retained for use on site in landscaped areas. As detailed in ES Chapter 9 (Resource Management), all waste arisings are expected to be managed onsite during all phases of the proposed development through the use of appropriate mitigation measures and through onward transfer to appropriate waste facilities for hazardous and non-hazardous waste.

14.6.8 The proposed development as a whole, if constructed to current industry standards, has been estimated to generate around 139,299 tCO_2e per £1 million of projected project costs to build. This equates to about 3% of the total whole life carbon associated with each element of the proposed development. The graph, below, shows how the embodied carbon within the materials used for construction of the proposed development accounts for the largest proportion of whole lifecycle emissions.

Figure 14.2: Embodied Carbon by Lifecycle Stage as modelled for IAMP AESC Plant 3.

14.6.9 With the implementation of embedded mitigation measures during the construction phase, the proposed development is deemed to have a **Moderate Adverse** (**Significant)** effect in-line with IEMA (2022) definitions of significance. The proposed development would adopt standard industry practice for construction, which does not currently consider the UK net zero trajectory for emissions reduction across all sectors.

Operational Phase

14.6.10 The operational phase spans the project lifecycle modules B1 [Use phase], B4-B5 [material replacement and refurbishment], B6 [energy consumption], and B7 [water use]. The assessment of impacts for the operational phase assumes that the proposed development will comply with the appropriate Building Regulations in place at the time of construction. The WLC emissions have been estimated based on the detailed designs for the Proposed development, with the following two operational energy scenarios proposed:

- Scenario A is using gas boilers to meet space heating demands; and
- Scenario B is with all-electric heating.

14.6.11 The operational emissions for the two scenarios with the embedded mitigation (as assumed) are estimated to account for over 80% of the total WLC emissions associated with the Proposed development.

14.6.12 There is still a reliance on the combustion of fossil fuel to meet the majority of the required energy demand for Scenario A and, therefore, the level of effect from the operational phase with the embedded mitigation proposed is deemed to be Moderate Adverse in the long-term. This option is in-line with minimum legislation and regulatory requirements but is not as compatible with the UK's net zero trajectory.

14.6.13 Scenario B represents the shift to all electric to meet the energy demands for the proposed development, which will also benefit from the decarbonisation of the national grid. The level of effect from the operational phase with the embedded mitigation proposed is deemed to be Minor Adverse in the long-term. Scenario B will be the preferred option as far as is reasonably practicable so that the proposed development can demonstrate a contribution to the UK's net zero ambition.

14.6.14 The significance of these operational emissions is determined by the Proposed development's relative emissions or net emissions.

Demolition and Decommissioning

14.6.15 Lifecycle modules C1 (deconstruction / demolition) through the C4 (waste disposal) cover the end-of-life project stages within this cradle to grave assessment of impacts. End of Life scenarios for the proposed development have not been considered in the designs and the proposed development does not have a design for decommissioning strategy as this is not mandatory under current legislation and not a planning prerequisite.

14.6.16 The average deconstruction and demolition process at the end of the proposed development's 60-year lifetime (as assessed using UK default values provided by RICS) accounts for approximately 15,535 tCO_2e. This equates to less than 1% the total lifecycle emissions associated with the proposed development. Owing to the uncertainty associated with these emission scenarios and in accordance with the IEMA (2022) guidance for exclusions below 1% of the overall total emissions up to a total of 5%, these end-of-life emissions are excluded from the assessment of impacts.

Relative Emissions

14.6.17 Relative emissions over the assumed 60-year lifetime have been estimated at between -31,853 to -26,284 tCO_2e. This is around 34% below the BaU sectoral future baseline for whole lifecycle carbon emissions. In terms of energy efficiency, the emission reduction is achieved against regulated energy, only, using the current 2021 interim uplift to Part L for non-residential buildings as the baseline for this assessment.

14.6.18 The result of this assessment is purely in relation to the Applicant demonstrating intentions to comply with current Building Regulations, meet emissions targets within policy, and pursue further action and commitment to sustainable development.

Significance of impacts

14.6.19 In-line with the significance criteria defined by the IEMA (2022) guidance, the residual effects with the embedded mitigation are deemed to be as follows:

- Scenario A would likely have a **Moderate Adverse** (**Significant**) effect in the long-term. The impacts on climate from GHG emissions associated with the proposed development would not fully contribute to decarbonisation targets for projects of this type and falls short of fully contributing to the UK's net zero trajectory.
- Scenario B would have a **Minor Adverse** (**Not Significant**) effect in the long-term. The project's GHG impacts would be fully consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type. A project with minor adverse effects is fully in-line with measures necessary to achieve the UK's trajectory towards net zero.

14.7 Mitigation Measures

Construction Phase

14.7.1 No additional mitigation measures have been committed to at this stage of planning.

14.7.2 In addition to the inherent mitigation, there are additional measures that could be implemented or pursued in the design and construction of the proposed development to further reduce impacts on climate change during the construction phase. These include, but are not limited to the following:

- Use of electrical plant and energy efficient equipment for construction;
- Use of sustainable site offices which are energy efficient and powered by temporary renewable energy generation systems; and
- Reuse and recycling of materials onsite (e.g. topsoil).

14.7.3 Reducing water consumption onsite is a key aspect of reducing the overall environmental impact of the proposed development and has been considered in the building designs. Reduction during the construction phase can be achieved in a number of ways, such as, but not limited to the following:

- Installing water efficient site welfare (water-free urinals etc.);
- Utilising recycling systems onsite, such as rainwater harvesting;
- Prefabrication of design elements off site to reduce direct water demand; and
- Use of alternatives such as non-hazardous dust coagulants to reduce dust suppression requirements.

14.7.4 At this stage, the Principal Contractor has not been appointed and the proposed development is unable to commit to the implementation of these additional measures.

Operational Phase

14.7.5 No additional mitigation measures for the operational phase are proposed at this stage. Overall, the proposed development has been modelled to meet current local and national policy requirements for energy efficiency targets and known climate change impacts.

14.7.6 Embodied carbon has been shown to account for over half of all lifecycle emissions and opportunities to reduce these impacts are greatest at the early concept design stages of a project. End-of-life scenarios can be accounted for within the early concept designs for a proposed development (where reasonably practicable) with prior planning for construction materials to be repurposed, reused or recycled once the building components are no longer fit for purpose. In this way, the impacts arising from the whole project lifecycle from construction, deconstruction and demolition processes, and the embodied carbon contained within construction materials, can be significantly reduced.

14.8 Residual Effects

Construction Phase

14.8.1 The construction of the proposed development will result in the short-term release of GHG emissions into the atmosphere, which has a long-term and permanent adverse effect contributing to global warming and climate change. The proposed development has not committed to additional mitigation at this stage and, therefore, the residual effects during construction remain as **Moderate Adverse** (**Significant**).

Operational Phase

14.8.2 The proposed development will result in the long-term release of GHG emissions once operational, which has a long-term and permanent effect contributing to global warming and climate change. Designs for the proposed development have not committed to additional mitigation at this stage. With the implementation of measures to reduce the carbon impact of the project through material management, and in-line with the significance criteria defined by the IEMA (2022) guidance, the overall residual effects will remain as assessed in section 14.6.19; **Moderate Adverse (Significant)** for Scenario A and **Minor Adverse (Not Significant)** for Scenario B.

14.9 Assessment of Cumulative Effects

14.9.1 The atmospheric concentration of GHG emissions and resulting effect on climate change is affected by all sources and sinks globally, anthropogenic and otherwise. All global cumulative GHG emission sources are relevant to the effect on climate change, with atmospheric GHG concentrations defined by IEMA guidance (2022) as being of *'high sensitivity to further emissions'*.

14.9.2 It is considered that there is potential for cumulative impacts during the construction and operational phases. Differing to other ES chapters, a review of the schemes identified for cumulative effects in relation to climate change has not been undertaken (for the reasons explained below).

Inter-cumulative effects

14.9.3 In terms of climate change, which is a global issue, comprehensive consideration of inter-cumulative effects (i.e. effects of this proposed development in combination with other committed developments) would need to account for every other development and activity that generates carbon emissions or releases other GHG effects. As this encompasses (to varying degrees) most of the activity on the globe, it is not practical to consider inter-cumulative effects with locally identified developments, beyond recognising that it is necessary to reduce carbon emissions across the board and each and every development has a duty to minimise its own emissions as far as technically viable.

14.9.4 It is unreasonable for the purposes of a planning application to quantify all sources of emissions from other third-party developments for the following reasons:

- The emissions from other developments fall outside of the system boundary applied for assessing whole lifecycle emissions and do not form part of the assessment under the methodology outlined.
- Large technical data requirements from other developments are not accessible.
- It would require a huge interlinking scope of assessment that would exceed that expected of a planning application for any one development.
- It is not feasible to undertake a high-level chemical assessment to analyse likely synergistic impacts between different emissions from varying developments.
- Complicated, unpredictable chemical reactions driven by atmospheric, climatic and behavioural factors are beyond the Applicant's control.

Intra-cumulative effects

14.9.5 Intra-cumulative effects (i.e. climate change effects in combination with other environmental effects on a common receptor) are also unrealistic to appraise. Climate change effects manifest as effects considered within other environmental disciplines (e.g. air quality and flood risk), but do not really have a quantifiable direct effect on local receptors. The effects act on a global receptor but the individual contribution from a single development of this scale is almost indistinguishable. It is the additive effects from all the other development going on around the world that poses the potential catastrophic threat.

Mitigation of cumulative impacts

14.9.6 It is assumed that all other nearby developments will have similar aims to reduce their scope 1 (direct) and scope 2 (indirect) GHG emissions, and that the impact of these emissions will have been assessed during the planning of those individual developments. The proposed development cannot be expected to mitigate against cumulative effects from other project emissions for which the Applicant has no direct control or indirect influence.

PART B: ASSESSMENT OF CLIMATE RESILIENCE

14.10 Vulnerability to Climate Change

14.10.1 The 2017 Town & Country Planning (EIA) Regulations not only require an assessment of the potential impacts of a development on climate change, but also an assessment of a development's vulnerability to potential impacts of climate change. This will ensure that the risk of the development to climate change effects are identified and mitigated against through adaptation.

14.10.2 Assessing the impacts of climate change on a scheme varies from the assessment of impacts arising from the scheme in other EIA topics, since it focusses on the global impact of an external factor (climate change) on the scheme, rather than the local impact of the scheme on receptors in a confined geographical location. The resilience of the proposed development to climate change is assessed based on the susceptibility and vulnerability of a range on different receptors. The effects is considered to be significant based on a matrix of likelihood and consequence.

14.11 Assessment Methodology

14.11.1 The IEMA guidance 'Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation' (2020) explains how our climate is changing but also how there remains uncertainties in the magnitude, frequency and spatial occurrence, either as changes to average conditions or extreme conditions, which generally makes it difficult to assess the impacts of climate change in relation to a specific project. Scientific assumptions must, therefore, be made in order to assess the resilience of developments to any future changes in climate.

14.11.2 Climate change projections for the UK (UKCP18) are based on global climate simulation models to explore regional responses to climate change. UKCP18 considers the effects arising from a series of emissions scenarios and Representative Concentration Pathways (RCP) that project how future climatic conditions in the UK are likely to change at a regional level, taking account of naturally occurring climate variations. Probabilistic projections provide a range of possible climate change outcomes and their relative likelihoods (ranging across 10th to 90th percentiles).

Climate change projections

Climate scenarios and timelines considered

14.11.3 The UKCP18 dataset provides future climate change projections for land and marine regions, as well as observed climate data for the UK. Analysing time series plume data from UKCP18 provides an indication of climate projections for the regional 25 km grid that encompasses the site. The proposed development was assessed against the four RCPs to show how the climate could change up to the year 2100 within each socio-economic emission scenario, compared to a 1982-2000 baseline.

Future climate baseline

14.11.4 A summary of a range of projected changes to climate variables will be provided that can be used to build-up a holistic view of future climate and assess potential impacts. UKCP18 climate projections for the 2030s through to 2080s time slices have been selected as the Future Climate Baseline to correspond with the proposed timescales for the construction and operational phases of the detailed and outline elements of the Proposed development.

14.11.5 According to UKCP18, relative probabilities for specific outcomes are typically much higher, near the 50% cumulative probability level (median) of the distribution than for outcomes, lying either below the 10% cumulative probability level or above the 90% cumulative probability level. The assessment uses the central estimate (50^{th} percentile) for the high emissions and low socio-economic scenario (RCP 8.5). This is the conservative approach recommended as best practice by IEMA guidance (2020) to establish the likely worst-case changes to climatic conditions.

Sensitivity

Climate vulnerability and sensitivity of receptors

14.11.6 Potential receptors within elements of the project relevant to the location, nature and scale of the development have been identified and receptor groups include:

- Infrastructure receptors (including equipment and building operations).
- Human health receptors (e.g. construction workers, site users, and building occupants).
- Environmental receptors (e.g. habitats and species).
- Climatic systems (e.g. water cycle).

14.11.7 The IEMA guidance (2020) describes the sensitivity of the receptor / receiving environment as “the degree of response of a receiver to a change and a function of its capacity to accommodate and recover from a change if it is affected”. In-line with the IEMA guidance, the following factors have been considered to ascribe the sensitivity of receptors in relation to potential climate change effects:

- Value or importance of receptor.

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

14.11.8 The scale of susceptibility and vulnerability of the receptor is determined using the criteria in Table 14.4 (susceptibility) and Table 14.5 (vulnerability), below.

Table 14.4: Susceptibility Criteria	
Susceptibility	
Low	Receptor has the ability to withstand or not be altered much by the projected changes to the existing/prevailing climatic factors.
Medium	Receptor has some limited ability to withstand or not be altered by the projected changes to the existing/prevailing climatic conditions.
High	Receptor has no ability to withstand or not be substantially altered by the projected changes to the existing/prevailing climatic factors.

Table 14.5: Vulnerability Criteria	
Vulnerability	
Low	Climatic factors have little influence on the receptors.
Medium	Receptor is dependent on some climatic factors but able to tolerate a range of conditions.
High	Receptor is directly dependent on existing/prevailing climatic factors and reliant on these specific existing climate conditions continuing in future or only able to tolerate a very limited variation in climate conditions.

Significance criteria

14.11.9 In-line with the IEMA guidance (2020), a combination of probability and consequence is used to reach a reasoned conclusion on the magnitude of the effect of climate change on the Proposed development. According the IEMA guidance, magnitude is based upon a combination of:

- *"Probability, which takes into account the chance of the effect occurring over the lifespan of the development if the risk is not mitigated.*
- *Consequence, which reflects the geographical extent of the effect or the number of receptors affected (e.g. scale), the complexity of the effect, degree of harm to those affected and the duration, frequency and reversibility of effect."*

14.11.10 Definitions of likelihood and magnitude will vary between schemes and are tailored to the specific project. Project lifetime is considered to include construction and operational stages and is taken to be 80 years for this assessment of climate risk. A longer reference study period is used to assess climate risk as many developments remain in-situ long after the original development has fulfilled its designed objectives.

14.11.11 A likelihood category is assigned from Table 14.6 based on the probability of the regional climate effect identified using the future climate baseline. From this the consequence of impact is determined using the criteria in Table 14.7, taking into account the assessment of susceptibility and vulnerability of the receptor(s).

Table 14.6: Likelihood Criteria	
Likelihood Category	Description (Probability and Frequency of Occurrence)
Very High	The event occurs multiple times during the lifetime of the project (e.g. approximately once a year).
High	The event occurs several times during the lifetime of the project (e.g. approximately once every five years).
Medium	The event occurs limited times during the lifetime of the project (e.g. approximately once every 15 years).
Low	The event occurs during the lifetime of the project (e.g. once in 80 years).
Very Low	The event may occur once during the lifetime of the project.

Table 14.7: Consequence of Impact Criteria	
Consequence of Impact	Description of Impact
Extreme Adverse	National-level (or greater) disruption lasting more than 1 week.
Major Adverse	National-level disruption lasting more than 1 day, but less than

	1 week. OR Regional-level disruption lasting more than 1 week.
Moderate Adverse	Regional-level disruption lasting more than 1 day, but less than 1 week.
Minor Adverse	Regional-level disruption lasting less than 1 day.
Negligible	Isolated disruption to the immediate locality lasting less than 1 day.

14.11.12 The IEMA guidance (2020) notes that it is likely that, if the probability and / or consequence of the effect is high, the magnitude of the effect would also be high. The magnitude of effects of climate change impacts on the proposed development is determined using the Significance Matrix for Assessing Climate Resilience (Table 14.8), and then an associated level of significance is applied for the proposed development as indicated in Table 14.8, below. Effects that are Moderate or Major Adverse are considered to be 'Significant'.

Table 14.8: Significance Matrix for Assessing Climate Resilience

Magnitude of Effects and Level of Significance		Measure of Likelihood				
		Very Low	**Low**	**Medium**	**High**	**Very High**
Measure of Consequence	**Negligible**	Negligible (Not Significant)	Negligible (Not Significant)	Negligible (Not Significant)	Minor Adverse (Not Significant)	Minor Adverse (Not Significant)
	Minor	Negligible (Not Significant)	Minor Adverse (Not Significant)	Minor Adverse (Not Significant)	Moderate Adverse (Significant)	Moderate Adverse (Significant)
	Moderate	Minor Adverse (Not Significant)	Minor Adverse (Not Significant)	Moderate Adverse (Significant)	Moderate Adverse (Significant)	Moderate Adverse (Significant)
	Major	Minor Adverse (Not Significant)	Moderate Adverse (Significant)	Moderate Adverse (Significant)	Substantial Adverse (Significant)	Substantial Adverse (Significant)
	Extreme	Minor-Moderate Adverse (Not Significant)	Moderate Adverse (Significant)	Moderate-Substantial Adverse (Significant)	Substantial Adverse (Significant)	Substantial Adverse (Significant)

Limitations

14.11.13 The IEMA guidance (2020) explains how our climate is changing, but there also remains uncertainties in the magnitude, frequency and spatial occurrence, either as changes to average conditions or extreme conditions. This makes it difficult to assess the impacts of climate change in relation to a specific project. Scientific assumptions must, therefore, be made in order to assess the resilience of developments to any future changes in climate. The Applicant can implement measures to reduce the impacts and increase climate resilience according to global and regional climate projections with relevance to the scale of the Proposed development. However, the uncertainties associated with probabilistic climate projections are outside of the Applicant's control and cannot be fully mitigated against.

14.12 Baseline Conditions

Existing Conditions

14.12.1 England is classified under Köppen-Geiger as having a 'Cfb' climate, more commonly known as a temperate oceanic climate. These are typically mid latitude climates with warm summers and mild winters. The average temperature in all months will be below 22°C and there is not an identifiable dry / wet season (i.e. precipitation rates are similar year-round). The City of Sunderland, where the site is located, is located approximately 34 m above sea level. The average annual rainfall in the area is around 718 mm and the average annual temperature is 9.5 °C[13].

Future Baseline

Global climate change projections

14.12.2 Global probabilistic projections provide a wider sampling of uncertainty and are useful for considering the wider context of future changes in climate. Table 14.9 highlights the main projected global climate change issues.

Table 14.9: Projected global impacts of climate change	
Climate change Issue	Projected Global Impacts
Solar Radiation	Long term projected changes in surface solar radiation, as a result of global warming, would suggest a decrease in available solar power due to a decrease in downwelling shortwave radiation, likely linked to the

[13] https://en.climate-data.org/europe/united-kingdom/england/sunderland-77/.

Table 14.9: Projected global impacts of climate change	
Climate change Issue	Projected Global Impacts
	increase of water vapour. This is considered to be anthropogenic strengthening of “natural” decadal variability in irradiance, known as global dimming and brightening, which is influenced by synoptic weather patterns, cloud variations and atmospheric aerosols.
Heat Waves	The IPCC predict that temperature extremes will increase more rapidly than global mean surface temperature, with the number of hot days projected to increase in most land regions. In the 1.5°C warming scenario heat waves in mid latitudes could warm by up to 3°C.
Extreme Rainfall and Flooding	IPCC and Met Office both suggest a general uncertainty in the projection of changes in heavy precipitation for the UK due to position in the transition zone between north and south Europe’s contrasting projected changes. It is generally agreed the northern parts of the UK will experience overall increases of up to 10%, whilst southern areas may experience decreases of up to 5%. Overall, the UK is expected to see a general increase in precipitation trends up to the year 2100.
Rising Sea Levels	The most recent modelling indicates global sea level rise of 0.26-0.77m by 2100, under a 1.5°C warming scenario. Risk is amplified on small islands and in low lying coastal areas and deltas.
Storms and Winds	Atmospheric circulations have large variability across interannual through to decadal time scales, which makes forming projections with any reasonable confidence very difficult. There is more robust evidence in the Northern Hemisphere that since the 1970s there has been a general poleward shift of storm tracks and jet streams and near-surface terrestrial wind speeds have been declining by approximately 0.1-0.14 ms^{-1} per decade across land. Despite anemometers being used for decades to measure near surface wind speed, the data has rarely been used to analyse trends and lacks

Table 14.9: Projected global impacts of climate change	
Climate change Issue	Projected Global Impacts
	important instrumentation meta data. In general, confidence is low in wind speed projections due to large uncertainties across global data sets.
Cold Spells and Snow	It has been observed the spring snow cover has been continuing to decrease in extent in the Northern Hemisphere and that cold temperature extremes are projected to decrease along with the number of frost days.

Regional climate change projections

14.12.3 Climate change will have both direct (operational and performance-based) and indirect (securing of supplies and rising energy costs) impacts on operations at the Site. Regional and Local projections represent small scale climate changes through a narrower sampling of uncertainty and provide the detail needed to inform local decision-making regarding adaptation. The graphs in **Error! Reference source not found.** to **Error! Reference source not found.** show how climate variables in the region could change up to the year 2100, compared to a 1982-2000 baseline, across all four RCPs.

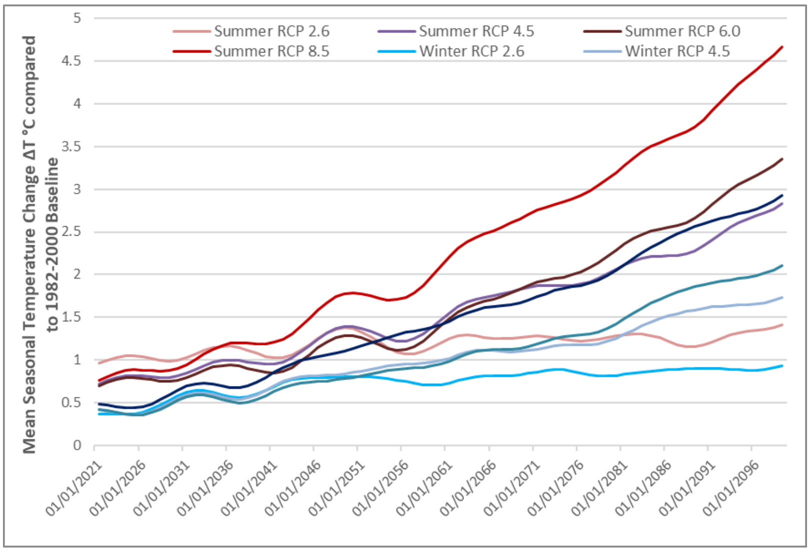

Figure 14.3: Projected changes in seasonal Mean Air Temperature across four RCP scenarios, from 2021-2049 compared to the 1981-2000 baseline, using the probabilistic projections (50th percentile) for a 25 Km Grid around Sunderland, England.

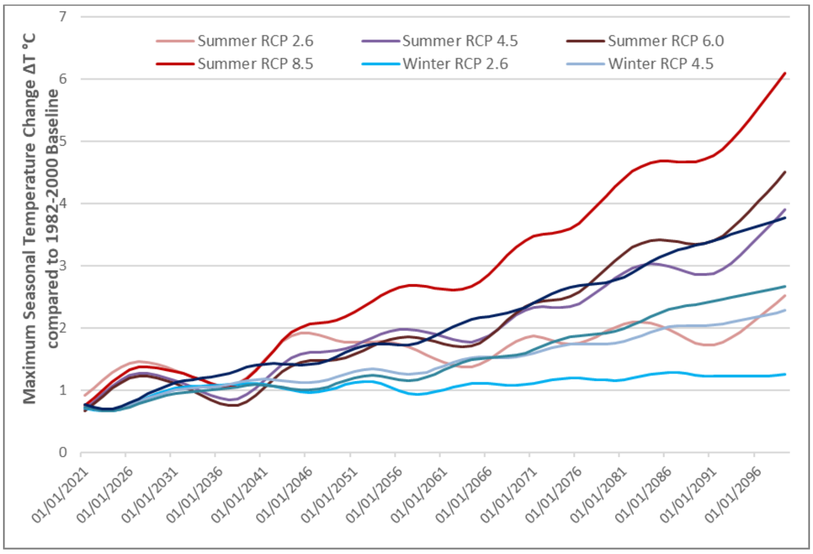

Figure 14.4: Projected changes in seasonal Maximum Air Temperature across four RCP scenarios, from 2021-2049 compared to the 1981-2000 baseline, using the probabilistic projections (50th percentile) for a 25Km Grid around Sunderland, England.

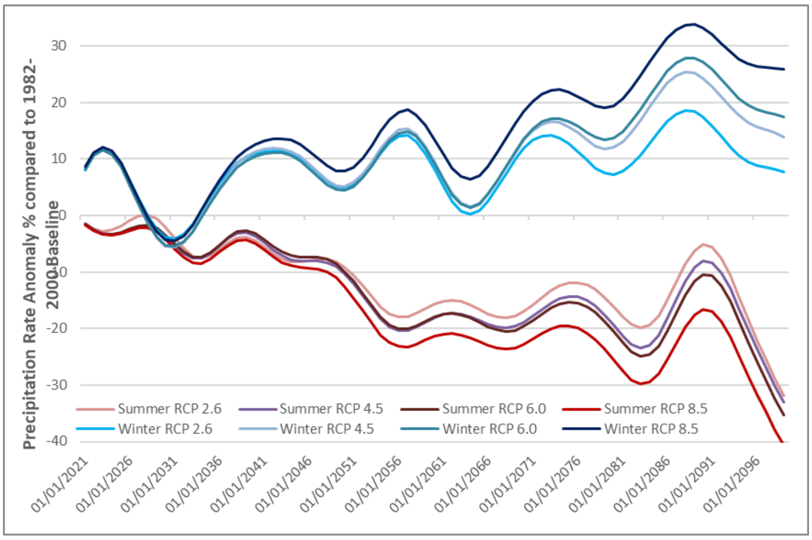

Figure 14.5: Seasonal average Precipitation rate anomaly (%) for 2021-2049 compared to the 1981-2000 baseline for all RCP scenarios using probabilistic projections (50th percentile) for a 25Km Grid around Sunderland, England.

14.12.4 The graphs in **Error! Reference source not found.** and **Error! Reference source not found.** show that, across all four RCP scenarios, the mean and maximum temperature at the site is expected to increase both in the winter and the summer over the lifetime of the proposed development. The graph in **Error! Reference source not found.** shows that the precipitation levels at the site are expected to increase in the winter, potentially leading to increased flooding. Levels are expected to decrease in the summer, which could lead to an increased risk of drought. As well as this, local projections indicate changes in the intensity of summer rainfall events, which could cause unexpected flash floods. This trend is reflected across all four RCP scenarios.

14.12.5 These results for regional climate projections reinforce the overall UKCP18 projections for a 'greater chance of warmer wetter winters and hotter drier summers' across the UK in future. This highlights the need for the proposed development to be able to deal with the likely potential for both increased flooding and increased droughts.

Future climate baseline

Climate Scenarios and Timelines Considered

14.12.6 A summary of climate projections for climate variables under RCP 8.5 for the 2030s, 2050s, 2070s and 2090s time periods is provided in **Error! Reference source not found.**. This timeline corresponds with the proposed timescales for the proposed development's construction and operational phases and using RCP8.5 indicates the conservative approach for future climate change.

Table 14.10: Quantitative Summary of the Future Baseline for Key Climatic Variables in Sunderland

Season	Variable	Time Period*	Projected Change at				
			Lower Probability		Median	Higher Probability	
			5th percentile	10th percentile	50th percentile	90th percentile	95th percentile
Winter	Mean Temperature (ºC)	2030s	-1.01	-0.65	0.60	1.87	2.23
		2050s	-0.58	-0.21	1.13	2.50	2.89
		2070s	-0.39	0.07	1.71	3.40	3.89
		2090s	0.05	0.60	2.53	4.55	5.15
	Mean Precipitation (%)	2030s	-38.6	-29.9	4.5	54.6	71.7
		2050s	-33.6	-24.4	12.9	63.3	79.4
		2070s	-37.1	-26.1	15.5	64.0	78.9
		2090s	-29.5	-17.7	27.5	84.7	106.5
Summer	Mean Temperature (ºC)	2030s	-0.72	-0.34	0.99	2.33	2.71
		2050s	-0.33	0.11	1.62	3.22	3.68
		2070s	0.22	0.74	2.66	4.69	5.29
		2090s	0.87	1.51	3.87	6.42	7.18
	Mean Precipitation (%)	2030s	-58.8	-45.8	-4.6	48.7	67.4
		2050s	-61.6	-52.2	-14.1	32.4	49.6
		2070s	-66.4	-57.9	-21.6	30.8	46.0
		2090s	-77.8	-66.8	-26.2	16.9	29.8

**UKCP18 provides 20-year time slices, hence averages taken for: 2030s (2020-2039), 2050s (2040-2059), 2070s (2060-2079), 2090s (2080-2099) under RCP 8.5.*

14.12.7 **Error! Reference source not found.**, above, shows that the temperature at the site during the construction phase is unlikely to change dramatically but there may be daily extremes that are not accounted for in these seasonal projections. There is an overall upwards trend in temperature during the lifetime of the proposed development that would lead to increased risks associated with climate change impacts.

14.13 Potential Effects

Climate change vulnerability

14.13.1 The Design for Future Climate Report (2010) highlights three broad risk categories to buildings from future climate change in the UK, which are:

i. **risk to comfort and energy performance:** warmer winters will reduce heating requirements, but the increased use of cooling systems in the summer will present a challenge to energy consumption and carbon emissions;

ii. **risk to construction:** resistance to extreme conditions, detailing and the behaviour of materials; and

iii. **risk to water management:** management of water during both flooding and drought events, and changes in soil composition.

14.13.2 Combined, these categories can be considered climate change threats that could result in increased energy demands, economic losses and loss of life. The Technical Report for the third Climate Change Risk Assessment (CCRA3) identifies sixty-one climate risks cutting across multiple sectors in the UK. These include a wide range of potential costly impacts of climate change affecting households, businesses, public services, and health and productivity. Impacts range from a deterioration in soil health and agricultural productivity to impacts on water availability and energy security.

14.13.3 A recent report by the Climate Change Committee (CCC) published in 2019 found that UK homes and other buildings (both new builds and retrofits) are still not fit for the future. In particular, emission reductions from UK housing have stalled and efforts to adapt the housing stock for higher temperatures, flooding and water scarcity are falling far behind the increase in risk from the rapidly changing climate..

14.13.4 As well as seeking improvements in the construction techniques, new developments will also need to improve various aspects of the operational performance to provide more resilience against climate change. At localised levels, the effects can manifest in different ways and the most appropriate strategies should be selected on a site-specific basis. Adaptation involves developing a resilience and a preparedness to deal with the likely consequences of climate change and this should also be considered for the proposed development.

14.13.5 The CCC advise that, to be resilient to future climate impacts, all buildings should use low-carbon sources of heating such as heat pumps and heat networks, with no new buildings connected to the natural gas network by 2025. All buildings (new, upgrades or repairs) should go beyond current Building Regulations to include increasing the uptake of:

- Passive cooling measures (shading and ventilation).
- Improved air quality.
- Improved water efficiency.
- Improved energy efficiency through improvements to building fabric.

14.13.6 Table 14.11 highlights the impact on the proposed development that could arise from climatic effects, reproduced from data in reports by the National House Building Council (NHBC), European Commission (EC) and the UK Climate Change Risk Assessment Reports (CCRA). The level of reduction in global emissions will alter the likelihood of these effects as the climatic conditions will vary; this is shown within the range of temperatures and precipitation levels seen across the RCPs in **Error! Reference source not found.**. The climatic projections shown in the above figures are seasonal averages and there is potential for even higher temperatures within that season.

14.13.7 The Independent Assessment of UK Climate Risk (2021) identifies flooding and high temperature as posing the greatest risks to the built environment, and these are summarised in Table 14.11, below. Other potential effects of climate change on the built environment are summarised in the assessment of susceptibility and vulnerability of the proposed development to the future climate baseline (see Table 14.12). In the interest of completeness, and to account for potential irregular, adverse extreme weather, this section also covers reducing risk to snow and ice. However, projections suggest that, overall, snow and ice will become a decreasing risk with climate change.

Table 14.11: Potential Impacts on receptors at the Proposed development

Climatic Factor	General Impact	Receptors	Component/Sub Structure Impact
Soil drying	Increase risk of soil drying will affect water tables and could affect	Building structure	Increased risk of basement heave or subsidence, water ingress, consequential damage to finishes and stored items. Ground shrinkage can lead to failure of electrical, gas and water pipes, foundations and sub-structures.

Table 14.11: Potential Impacts on receptors at the Proposed development			
Climatic Factor	**General Impact**	**Receptors**	**Component/Sub Structure Impact**
	foundations in clay soils.		
Temperature	Maximum and minimum changes in temperature will affect heating and cooling. Daily maximum and minimum temperature will affect thermal air movement.	Building structure	Overheating of mechanical and electrical equipment effecting lifespan, reliability and potential health and safety issues. Plastic materials will have a reduced lifespan. Structure/cladding/roofing membranes, sealants, pavements and roads have increased risk of cracking. Reduced capacity of overheated power lines. Building overheating (due to increased fabric efficiency and incorrect implementation). Solar PV modules work slightly less efficiently at high temperatures and some studies have shown that high temperatures can age at a faster rate.
		Habitats and Species	Changes in habitat / species functionality. Dry environments increase risk of fire causing destruction. Increased displacement, maladaptation, disease and/or mortality.
		Occupants	Increased discomfort or overheating in summer.
Relative humidity	Increase will affect condensation and associated damage or mould growth.	Building structure	Timber framed construction, Internal walls, finishes and stored items will be affected by condensation and associated damage or mould growth by increase in relative humidity.
		Occupants	Increased risk of asthmatic illnesses. Risk of mould growth may affect occupant's health over a longer period.
Precipitation (including snow and ice)	Increase and decrease will affect water tables; cleaning costs will be increased in winter, with associated redecoration requirements; durability and risk of water ingress will be affected by combination of precipitation increase and gales.	Building structure	Increased damage to capping system and higher risk of failure, increased chances of flooding. Structure / cladding / roofing membranes and sealants have increased risk of cracking due to different moisture movements. Damage to foundations and basements. Delays in construction and increased costs. Increased risk of subsistence.
		Occupants	Increase may result in increased winter cleaning costs with associated redecoration requirements. Increased risk of flooding.
		Habitats and Species	Increased disease / mortality. Water scarcity / flooding. Pest exacerbation.
Gales, storms, extreme weather	Increase will affect need for weather tightness, risk of water ingress, effectiveness of air conditioning, energy use, risk of roof failures.	Building structure	Increase will affect need for weather tightness as risk of water ingress. Risk of roof failures and damage to the roof.
		Habitats and Species	Changes in the distribution of habitats, which has the potential to be beneficial (i.e. expansion of valuable habitat type) or adverse (i.e. loss or degradation of valuable habitat type). Changes in distribution of protected and notable species, which has the potential to be beneficial (i.e. expansion of species range) or adverse (i.e. reduction in species range, loss or fragmentation of species populations). Increases in the spread of invasive non-native species. Increase in species susceptibility to diseases.
Solar radiation	Window specification and glare control requirement.	Building structure	Increase may affect need for solar glare control.
		Occupants	Exposure to UVB and UVA from solar radiation can cause adverse health effects, including increased incidence of skin cancers, cataracts, and immune suppression.

Table 14.11: Potential Impacts on receptors at the Proposed development			
Climatic Factor	**General Impact**	**Receptors**	**Component/Sub Structure Impact**
Cloud cover	Increase/decrease in seasonal lighting needs.	Building structure	Changes in lighting systems and glare control requirement.
		Habitat and Species	Clouds influence many environmental factors such as rain, sunlight, surface temperature and leaf wetness. All of these affect the ability for plants and animals to survive if change is quicker than they can adapt.

14.14 Embedded Mitigation

Construction Phase

14.14.1 It is assumed that the proposed development will comply with the standards that a contractor is expected to commit to during the construction phase, such as Common Minimum Standards (CMS), Construction (Design and Management) Regulations (CDM) and / or the Considerate Constructors Scheme (CCS). It is anticipated that, prior to commencement of any construction activities, a Construction Environmental Management Plan (CEMP) will be agreed with the Local Planning Authority (LPA). The CEMP will seek to manage and (where practical) minimise the impact of the construction phase of the proposed development upon the site and surrounding area in the short-term.

Operational Phase

14.14.2 It has been assumed that the embedded mitigation measures considered for this proposed development include:

- Incorporation of freeboard to design flood levels.
- Finished floor levels set 600 mm above design flood levels.
- Ground raising/embankment.
- Flood storage compensation area.
- Development catchments to mimic baseline catchments.
- Attenuation of run-off to greenfield run-off rate using sustainable drainage.
- Provision of pollution hazard reduction by sustainable drainage.
- Sediment settlement prior to drainage discharge
- Pollution incident response plans.
- Sediment run-off containment.

14.14.3 All buildings within the site boundary will be designed to meet the minimum regulatory requirements of Building Regulations Part L (energy efficiency) and Part F (ventilation) in place at the expected time of construction. It has been assumed that the current 2021 interim uplift standards, which require at least a 27% emission reduction over 2013 Part L for non-residential buildings, will be embedded within the technical designs as a minimum. These reductions will be achieved through a combination of improved building fabric and implementation of renewable energy and heat technologies, although the exact mix has not been determined at this stage.

14.14.4 The building designs will also all need to apply the mitigation measures outlined in Building Regulations Part O (overheating), which aims to reduce solar gain in new buildings, Part S (electric vehicle infrastructure), which aims to ensure a smooth transition with appropriate provision of EV infrastructure within new development, and Part G (water efficiency), which addresses hot water safety and efficiency of water consumption in buildings. These are assumed to be embedded mitigation measures within the proposed designs as compliance is required by UK legislation.

Sensitivity of receptors

14.14.5 For the purpose of this assessment, the detailed and outline parts are assessed as one to reflect the site-wide resilience to climate change impacts. The sensitivity of receptors during both construction and operation have been determined conjunctively through an assessment of the susceptibility and vulnerability of the site to future climate changes, with the results given in Table 14.12, below. The level of likelihood for the climate change issue is also identified in Table 14.12 according to the future climate baseline outlined in **Error! Reference source not found.**.

Table 14.12: Assessment of susceptibility and vulnerability of the proposed development to future climate baseline

Climate Change Issue	Receptors Impacted	Susceptibility	Vulnerability	Likelihood
Soil Drying	Building Structures	Low	Low	Medium
	Species and Habitats	Medium	Medium	Medium
Increased Temperature	Site Workers and Occupants	Medium	Medium	High
	Structures	Medium	Low	High
	Species and Habitats	Medium	Medium	High
Relative Humidity	Site Workers and Occupants	Medium	Medium	Medium
Precipitation Changes and Water Availability	Site Workers and Occupants	Medium	Medium	High
	Structures	Medium	Medium	High
	Species and Habitats	Medium	Medium	High
Snow and Ice	Site Workers and Occupants	Low	Low	Low
	Structure	Low	Low	Low
Gales, Storms, Extreme Weather	Structure	Medium	Medium	High
	Species and Habitats	Medium	Medium	High

Table 14.12: Assessment of susceptibility and vulnerability of the proposed development to future climate baseline				
Climate Change Issue	**Receptors Impacted**	**Susceptibility**	**Vulnerability**	**Likelihood**
Solar Radiation	Site Workers and Occupants	Medium	Medium	Medium
	Structure	Low	Low	Low
Cloud Cover	Site Workers and Occupants	Low	Low	Low

Magnitude of Impacts

14.14.6 A qualitative assessment has been undertaken based on the data from UKCP18 to assess the magnitude of the effects of climate change (Table 14.13). In-line with the 2020 IEMA guidance, a combination of probability and consequence is used to reach a reasoned conclusion on the magnitude of the effect of climate change on the proposed development. The IEMA guidance indicates that the greater the probability of an effect, the more likely it is to occur, and the higher significance effect it will have on the proposed development if these projected changes in climate are not considered at the outset of the project.

Table 14.13: Assessment of Magnitude of Impacts on proposed development from Future Climate Baseline			
Climate Change Issue	**Likelihood**	**Consequence**	**Magnitude of Impacts**
Soil Drying	Medium	Minor Adverse	Minor Adverse
Increased Temperature	High	Minor Adverse	Minor Adverse
Relative Humidity	Medium	Minor Adverse	Minor Adverse
Precipitation Changes and Water Availability	High	Minor Adverse	Minor Adverse
Snow and Ice	Low	Minor Adverse	Minor Adverse
Gales, Storms, Extreme Weather	High	Minor Adverse	Minor Adverse
Solar Radiation	Medium	Minor Adverse	Minor Adverse
Cloud Cover	Low	Minor Adverse	Minor Adverse

14.14.7 The impact of changes to the future climate baseline for the proposed development (summarised in Table 14.13) has been assessed to be within the medium to high likelihood and have minor adverse consequences if not mitigated against. Taking into account the control mechanisms and mitigation measures in place through Building Regulations, which the proposed development would be expected to comply with as a minimum standard, the overall magnitude of impact is considered to be relatively low for the assumed 60-year lifetime of the project with a **Minor Adverse**.

14.15 Significance Assessment

14.15.1 The impact of future climate change on the proposed development with embedded mitigation is considered to be Not Significant, as identified in Table 14.14, below.

Table 14.14: Significance Assessment for Climate Resilience		
Climate Change Issue	**Magnitude of Effect**	**Significance**
Soil Drying	Minor Adverse	Not Significant
Increased Temperature	Minor Adverse	Not Significant

Relative Humidity	Minor Adverse	Not Significant
Precipitation Changes and Water Availability	Minor Adverse	Not Significant
Snow and Ice	Minor Adverse	Not Significant
Gales, Storms, Extreme Weather	Minor Adverse	Not Significant
Solar Radiation	Minor Adverse	Not Significant
Cloud Cover	Minor Adverse	Not Significant

14.15.2 The overall impact of future climate change on the proposed development, with embedded mitigation in place during both the construction and operational phases, will lead to an impact that is deemed to be **Minor Adverse** (**Not Significant**). This assessment is based on the reasonable assumption that the proposed development will meet the minimum standards required by Building Regulations. The proposed development should implement mitigation measures to further reduce GHG emissions and enhance the resilience to future changes in climate.

14.16 Mitigation Measures

14.16.1 No additional mitigation measures are proposed with regards to climate resilience.

14.17 Residual Effects

14.17.1 At this stage, the proposed development is not committed to additional mitigation measures but may consider these in the future as outline designs for the site progress. As such, the residual effects are deemed **Minor Adverse** (**Not Significant**).

14.18 Summary and Conclusion

14.18.1 This chapter has been developed in two parts. Firstly, an impact assessment considering the likely effects arising from undertaking the proposed development, has been carried out and, where appropriate, mitigation has been suggested to reduce effects through limiting the release of GHG emissions over the project's assumed lifetime. Secondly, a qualitative review of the potential impact of the changing climate on the proposed development has been completed that has used published climate models to predict likely climate effects.

Assessment of impacts on climate (from GHG emissions)

14.18.2 In line with IEMA (2022) guidance, all GHG emissions associated with the proposed development are considered to be significant as a starting point, with a long-term / permanent adverse impact on climate change through contributing to human-enhanced global warming.

14.18.3 The proposed development's absolute WLC emissions with embedded mitigation were modelled to be around 34% below the sectoral BaU baseline for this application based on the assumption that the proposed development will deploy solar PV on the roof-top and install heat pumps for space heating. This signifies that the proposed development will comply with the current 2021 interim uplift to Part L Building Regulations for regulated energy efficiency but is not taking additional measures that will improve the overall impact above a development of the same size, with comparable facilities, constructed to minimum Building Regulations.

14.18.4 Scenario A has a residual reliance on the combustion of fossil fuel to meet the majority of the required operational energy demand. Whereas Scenario B represents the shift to all electric to meet the energy demands for the proposed development that will also benefit from the decarbonisation of the national grid. Scenario B will be the preferred option as far as is reasonably practicable so that the proposed development can demonstrate a contribution to the UK's net zero ambition.

14.18.5 As Building Regulations do not yet fully comply with the trajectory to net zero, a project that is designed to meet them, but which does not exceed them, would have a moderate impact overall. The proposed development will comply with current 2021 Building Regulations and meet the minimum emissions targets as set within national and local policy for buildings constructed before the end of 2026. In-line with IEMA (2022) guidance, the proposed development falls short of fully contributing to the UK's trajectory towards net zero, and the residual operational impact for the uses proposed is **Moderate Adverse** (**Significant**). The emission savings achieved over the 60-year project lifetime will be further reduced when taking into account the decarbonisation of the national grid, which negates any additional savings over a longer timeframe.

14.18.6 This impact assessment considers the buildings and infrastructure for the proposed development and not it's intended purpose. The proposed development will manufacture batteries for electric vehicles (EV) and this will aid the UK's transition to a greener economy by ensuring appropriate technology is readily available.

Assessment of climate resilience

14.18.7 It will not be possible to eliminate every risk associated with climate change, but through intelligent design, preparation and responsible construction and operation, these risks will be minimised. The assessment has focussed on reducing these risks in key areas such as overheating, flooding, and extreme weather, which has taken into consideration not only the health and safety of the users of the proposed development (i.e. construction workers and building occupants), but also the resilience of the proposed development itself to future climate impacts. With the implementation of the embedded mitigation measures the residual impacts are deemed to be **Minor Adverse** and (**Not Significant**).