

Chapter 12: Climate Change and Greenhouse Gas Assessment

CLIMATE CHANGE AND GREENHOUSE GAS ASSESSMENT	
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SUPPORTING APPENDIX	ES Volume 3, Appendix: Climate Change and Greenhouse Gas Assessment: Annex 1: Glossary; Annex 2: Policy and Guidance Background; and Annex 3: Professional Experience.
KEY CONSIDERATIONS	The Proposed Development will lead to the direct and indirect release of greenhouse gases (GHGs), both during the demolition and construction phase, and throughout the lifetime of the Proposed Development. GHGs are gases which have the potential to increase atmospheric temperatures and which contribute to climate change. This assessment estimates the GHG emissions associated with the Proposed Development taking a lifecycle approach and presents the numerous mitigation measures and specific design measures provided by the scheme to minimise its GHG footprint. The metric for assessing the climate change impacts of GHG emissions in this assessment is Global Warming Potential (GWP). This is expressed in units of CO₂ equivalent (CO₂e) over 100 years. This allows for the emissions of the six key GHGs: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF₆) to be expressed in terms of their equivalent GWP in mass of CO₂e.
CONSULTATION	An EIA Scoping Report was prepared and submitted to Gravesham Borough Council (GBC) on the 11 th August 2022 requesting a Scoping Opinion from GBC. A copy of the EIA Scoping Report is provided in ES Volume 3, Appendix: EIA Methodology – Annex 1 . A Scoping Opinion was received on 16 th September 2022, as provided in ES Volume 3, Appendix: EIA Methodology – Annex 2 . The Scoping Opinion did not raise any notable comments in relation to the climate change and GHG assessment.

PART A CLIMATE CHANGE RESILIENCE AND ADAPTATION

- 12.1
- The approach to assessing the potential climate change impacts has been undertaken in accordance with the IEMA guidance ‘Climate Change Resilience and Adaption’ (2020)¹, which presents a framework for the consideration of climate change resilience and adaption in the EIA process. It recognises a need for a proportionate approach to the assessment, due to the uncertainties associated with predicting how the environment will respond to climate change.
- 12.2
- The guidance advises on *inter alia*, defining the future climate scenario, the integration of climate change adaption into the design, and the process for EIA. The guidance also provides advice on the execution of the impact assessment across the technical topics, including the identification of the climate related parameters which are likely to influence the project in question, and the anticipated changes to those parameters under a future climate scenario.
- 12.3
- Consistent with the guidance, a future climate scenario has been developed through the use of the future climate projections published by the Met Office (through the UK Climate Projections (UKCP18) website). The results include projections for variables including annual mean temperatures, and annual changes in summer and winter precipitation – refer to **ES Volume 3, Appendix: EIA Methodology – Annex 3**.
- 12.4
- To describe the predicted future climate, a medium emissions scenario (RCP8.5) for 2080 has been utilised as the future baseline. RCP8.5 has been used as it represents the most reasonable emissions scenario with regards to climate policy, land use, and technological development. The year 2080 is the timeframe considered most relevant to the Proposed Development. The projected change to the range of climatic conditions has adopted the 50% probability level, which is a central estimate adopted given the level of uncertainty associated with predicting the modelled scenarios.
- 12.5
- The future climate change scenario has been considered within each of the technical topics covered in this ES, and the level of assessment and methodology is proportional to the available evidence base. The aim of the assessment has been to consider whether the residual effect on receptors (under the current condition, without climate change) are likely to be different under an alternative future climate regime; in particular, to identify whether the potential impacts and residual effects of the Proposed Development will be worse or improve under the future baseline, and therefore if these changes alter the significance of effects identified for the Proposed Development under the current condition (without climate change). A key aspect of the assessment (for each of the technical topics considered) has been to identify the likely effect of those receptors considered more vulnerable to changes in climate, having taken into account the resilience and adaptive measures (being either design or management) which are proposed for the Proposed Development in order to mitigate the risk presented by climate change. Therefore, the first part of this section presents the adaptation and resilience measures

proposed as part of the Proposed Development. Based upon this, the second part then presents the likely effects of climate change on the effects concluded in each technical assessment.

- 12.6
- Due to the level of uncertainty in both the future climate projections and how the future climate conditions may affect sensitive receptors, the assessment is qualitative, based on objective professional judgement, unless where there is published, accepted quantifiable methods available (i.e., in relation to the assessment of flood risk).

Climate Change Adaptation and Resilience

- 12.7
- Through the specification of the following measures, the Proposed Development (as set out in **ES Volume 1, Chapter 4: The Proposed Development**) will adapt to and be resilient to climate change:
- Enhanced fabric u-values;
 - Thermal bridges reduced as far as practicable and enhanced air tightness;
 - Passive design measures to reduce unwanted solar gains to reduce/omit the need for cooling;
 - Natural ventilation where possible; mechanical ventilation with enhanced efficiency and heat recovery elsewhere;
 - High efficiency lighting (internal and external) throughout;
 - Fully electric technology for heating and central hot water systems;
 - Use of Central District Heating Systems (where feasible);
 - Use of PV’s and Heat Pumps to maximise sustainable forms of heating and electricity generation;
 - Integrating a Net Zero development Strategy that targets 2030 Net Zero Construction methods and practices;
 - Measures to minimise water demands in periods of drought, such as the implementation of rainwater harvesting;
 - Measures to minimise the risks of increased flood risk and surface water run-off affecting the site or others, through Sustainable Drainage Systems (SuDS); and
 - Selection of native and resilient planting for incorporation into the landscaping strategy to reduce potential future maintenance / replacement.

Socio-Economics

- 12.8
- Several environmental factors are considered to experience potential variations in the future due to climate change:
- The mean average air temperature is projected to increase;
 - Annual average precipitation is due to increase; and
 - Wind speed and total cloud cover are due to slightly decrease.
- 12.9
- These changes to future climatic conditions are not considered to have a significant effect upon the sensitive receptors within the socio-economic assessment with respect to the Proposed Development, as presented in **ES Volume 1, Chapter 6: Socio-Economics and Health**.
- 12.10
- Therefore, potential effects related to climate change are not relevant to the assessment of socio-economic effects.
- 12.11
- Further detail on the effect of the Proposed Development on climate change, and the effect of climate change on the Proposed Development, in accordance with the Institute of Environmental Management and Assessment (IEMA) guidance ‘Climate Change Resilience and Adaption’ (2020)², is detailed in **ES Volume 3, Appendix: EIA Methodology – Annex 3**.

¹ IEMA (2020). Climate Change Resilience and Adaption (website: <https://www.iema.net>)

² Institute of Environmental Management and Assessment, (2020); Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation.

Traffic and Transport

- 12.12** The likely effects of the Proposed Development are defined under the current climate conditions, which may alter under a future climate scenario. The EIA Regulations require that the change in impact magnitude and a receptor's vulnerability (i.e. susceptibility of resilience to change) are considered in respect of a future climate condition.
- 12.13** The likely projected future conditions for each of temperature, precipitation, wind speed and cloud cover have been considered. It is considered that the magnitude of impact and resultant nature and scale of the effects of the Proposed Development during the operational phase will not be changed under future climate conditions.
- 12.14** Overall, the likely effects of the Proposed Development are unlikely to change as a result of climate change.

Air Quality

- 12.15** Air quality is predicted to improve in the future, owing to lower emissions from road vehicles and heating and cooling plant as progressively lower emission technologies become available. The assessment, therefore, focuses on the near-term (year of opening), but the outlook for the longer term is one of improvement, both in terms of local and regional air quality, but also in terms of emissions associated with the Proposed Development itself.
- 12.16** Climate change is a long-term effect, and significant changes in climate are not expected by 2026 (the first year of occupation of the Proposed Development). Climate change will, therefore, not affect air quality model predictions set out in **ES Volume 1, Chapter 8: Air Quality**. In the longer term (2050 – 2080) changes in climate might affect the need for heating and cooling; however, the UK has recently legislated a 2050 net zero³ target following recommendations and analysis completed by the Committee on Climate Change (CCC)⁴. It is anticipated that 100% of power generation will be low carbon by 2050, with any residual emissions removed through technical and/or natural means. Consequently, it is anticipated that all operational emissions associated with energy provision (heating and cooling) will be net zero by 2050.

Noise and Vibration

- 12.17** Climate change has the potential to result in an increase in heat during the hottest months of the year and reduce temperatures during the coldest months of the year. There is therefore potential for an increased demand on heating and cooling systems, both within the Proposed Development itself and for sensitive receptors external to the site.
- 12.18** Increased temperatures during the warmer times of the year (i.e. summer) will potentially result in future residents of the potential residential component of the Proposed Development having to rely on either natural ventilation solutions (i.e. attenuated operable louvres or openable windows), or comfort cooling for longer periods of time. The use of natural ventilation solutions may expose the occupants to greater internal noise levels. It will be necessary for the detailed design of the residential buildings to consider the implications of noise and overheating in the design and outline measures that do not exclusively rely on the opening of windows.
- 12.19** Ventilation and cooling requirements during the summer, and demand for heating during the cooler months, may require additional or upgraded equipment such as mechanical cooling, which if not appropriately mitigated, would result in greater noise impacts on the surrounding residential receptors. In this scenario, any building services plant will need to be designed to the same measures that have been outlined in the assessments and therefore the impacts and effects described within the assessments above will remain the same.

Daylight, Sunlight, Overshadowing, Solar Glare and Light Intrusion

- 12.20** Following the guidance published by BRE, daylight assessments are carried out under an assumed overcast sky.
- 12.21** The methodologies used to quantify the levels of daylight are the VSC or NSL. Of these, none are explicit measurements of light but rather the VSC is expressed as percentages of the total amount of light received at an unobstructed location. The NSL by contrast is a percentage of the room that can see the sky.
- 12.22** Being percentages, the daylight assessments above do not depend on the absolute amount of daylight outside and, since they also assume an overcast sky, they are independent of the cloud coverage or the annual number of sunlight hours.

- 12.23** By following the current BRE Guidelines methodology, therefore, the numeric daylight results are not affected by changes in climate.

- 12.24** Climate change projections (**ES Volume 3, Appendix: EIA Methodology – Annex 3**) suggests that the average cloud coverage be slightly reduced, although no information is provided on how this would affect global and diffuse illuminance and irradiance levels. Whilst the relationship between cloud cover and daylight illuminance is not defined as part of the projections it is probably reasonable to assume as cloud coverage is reduced, the overall amount of usable daylight increases. However, this would not impact the conclusions within **ES Volume 1, Chapter 10: Daylight, Sunlight, Overshadowing, Solar Glare and Light Intrusion**, which are based on numeric daylight assessments.

- 12.25** Therefore, the current BRE Guidelines criteria and the results of the associated daylight assessments are not influenced by, nor would they be altered by climate change.

Wind Microclimate

- 12.26** The 'Climate Projects Report' published by UKCP18 presents the probable changes in wind speeds for the 2070-2099 period (timeframe considered most relevant for urban regeneration projects) in both the summer and winter seasons (see Climate Change Technical Note presented within **ES Volume 3, Appendix: EIA Methodology – Annex 3**).
- 12.27** As set out in **ES Volume 3, Appendix: EIA Methodology – Annex 3**, the current trends in climate change are not likely to have any significant effects on the predicted wind microclimate conditions in and around the Proposed Development, as detailed in **ES Volume 1, Chapter 11: Wind Microclimate**. It is therefore not necessary to provide a quantitative analysis of the increase in storm frequency and its implication on the effect on the wind microclimate for the Proposed Development.

Archaeology

- 12.28** The likely effect in relation to climate change on buried heritage assets is rising water levels as a result of increased rainfall. Any such change after the Proposed Development is completed could be beneficial for the preservation for any localised alluvial deposits containing palaeoenvironmental remains remaining in situ (due to the sensitivity of palaeoenvironmental remains to changes in hydrology).
- 12.29** Further detail on the impact of the Proposed Development on climate change, and the impact of climate change on the Proposed Development, in accordance with the IEMA guidance 'Climate Change Resilience and Adaption' (2020)⁵, is detailed in **ES Volume 3, Appendix: EIA Methodology – Annex 3**.

Water Resources Flood Risk, Drainage and Ground Conditions

- 12.30** When assessing the effect of climate change on ground conditions, the key variable is the future effect and change in rainfall levels. For example, an increase in rainfall levels is likely to create an increase in pollution pathways for contaminants to reach controlled waters, thus leading to adverse effects on sensitive receptors.
- 12.31** The receptors that have been identified within this assessment need to be considered in terms of their vulnerability (i.e. susceptibility or resilience to change) to the changes in the future climate. **Table 12.1** gives a summary of the receptors, including their sensitivity classification and their vulnerability under these future climate conditions.
- 12.32** The vulnerability of a receptor is defined by the following classifications:
- **High Vulnerability** – the receptors directly dependent on existing and/or prevailing climatic factors and reliant on these specific existing climate conditions continuing in the future; or only able to tolerate a very limited variation in climate conditions;
 - **Moderate Vulnerability** – the receptor is dependent on some climatic factors, but able to tolerate a range of conditions; and
 - **Low Vulnerability** – climatic factors have little influence in receptors.

³ <https://www.theguardian.com/environment/2020/sep/21/uk-plans-to-bring-forward-ban-on-fossil-fuel-vehicles-to-2030>

⁴ Net zero has been defined by the CCC to allow for greenhouse gas (GHG) removals to offset any residual GHG emissions in 2050 so that the overall balance of emissions is zero.

⁵ Institute of Environmental Management and Assessment, (2020); *Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation*.

Table 12.1 Summary of Receptor Sensitivity and Vulnerability for Assessment

Receptor	Sensitivity	Vulnerability
Soils	Medium	Moderate
Superficial Deposits	High	Moderate
Bedrock Geology	Medium	Moderate
Surface Water	High	High
Groundwater	High	High
Human Health (construction workers and adjacent site users)	High	Moderate
Human Health (future site users and services maintenance staff)	High	Moderate
Infrastructure and Building Material	High	Moderate
Proposed Planting	High	High

- 12.33** The current and future baseline conditions and the impacts on controlled waters have already considered the predicted impact of climate change. For example, the WFD ecological status for the groundwater catchments have a future objective of 'good' by 2027 and takes into account the future effect of climate change on water quality.
- 12.34** The proposed mitigation measures outlined in **ES Volume 1, Chapter 15: Water Resources, Flood Risk, Drainage and Ground Conditions** include the future effects of climate change and, therefore, once these measures are implemented, the Proposed Development will be considered safe in terms of future climate effects and it would not have a deleterious effect of local soil or groundwater quality.
- 12.35** Overall, with the proposed mitigation measures, there will be no change in the significance of the assessment and the resulting residual effects would remain.

Flood Risk

- 12.36** The impacts of climate change on flood risk and water management have been considered and the upper end of the total potential change anticipated for 2070-2115 has been used, equating to a 40% increase in peak rainfall intensity. Applying a 40% additional allowance will enable surface water from storm events up to and including the 1 in 100-year event plus climate change to be safely stored on-site without detriment to existing flood risk. As a result, the proposed surface water drainage strategy will serve to improve the resilience of the existing site to the anticipated changes in rainfall patterns.
- 12.37** The Thames Estuary 2100 Plan (TE2100) sets out the required flood defence crest level to maintain a sufficient standard of protection whilst accounting for the impacts of climate change. For this site, the EA requested that tidal defences must be raised to a crest level of 8.00m AOD by 2070. Due to the requirement for the Proposed Development to apply a 100-year design life, the EA stated that the raising of the tidal defences to 8.00m AOD must be included as part of the Proposed Development. The River Thames tidal flood wall is located outside of the red line boundary and therefore these defences are not located within the Applicants control and therefore any future upgrades to the defences are not included within the Proposed Development outline application. However, futureproofing of the site and the flood defences has been duly considered in the development design, with the inclusion of a 19m set back (standard being 16m) that is free from any built development in the northern extent of the site up to the northern boundary. The Applicant has also committed within this application to provide new flood defences within the 19m set back to meet the Thames Estuary 2100 (TE2100) standards that is required. Given the outline nature of the proposal, details with regards to the design, existing condition of the current defences and structure will be provided at reserved matters stage.

Ecology and Biodiversity

- 12.38** No effects of climate change on ecology and biodiversity at the Proposed Development are anticipated and therefore, no mitigation is required. Long-term management shall be undertaken to ensure the habitats are subject to regular review to ensure retained and new habitats are successful, as set out in **ES Volume 1, Chapter 14: Ecology and Biodiversity**.
- 12.39** The provision of soft landscaping including the retention of existing trees, the extensive planting of further native trees, amenity planting and hedging that will all help improve local air quality and improve water drainage, all which contributes to improving climate regulation and long-term resilience. Therefore, no changes to the effects

presented in within **ES Volume 1, Chapter 14: Ecology and Biodiversity** are expected as a result of climate change.

Heritage, Townscape and Visual

- 12.40** The likely effects of the Proposed Development are defined under the current climate conditions, which may alter under a future climate scenario. The EIA Regulations require that the change in impact magnitude and a receptor's 'vulnerability' (i.e. susceptibility or resilience to change) are considered in respect of a future climate condition.
- 12.41** The vulnerability of the receptors according to the definitions provided in the guidance, and it has been judged that all of the heritage, townscape and visual receptors have low vulnerability.
- 12.42** The likely projected future conditions for each of temperature, precipitation, wind speed and cloud cover have been considered. It is considered that the magnitude of impact and resultant nature and scale of the effects of the Proposed Development during the operational phase will not be changed under the future climate conditions.
- 12.43** Overall, the likely effects of the Proposed Development presented in the Townscape and Visual Impact Assessment and the built heritage assessment (**ES Volume 2**) are unlikely to change as a result of climate change.

PART A LIKELY SIGNIFICANT EFFECTS

- 12.44** In conclusion, under the future climate scenario, the residual effects of the Proposed Development would remain consistent with the effects identified as described throughout this ES and summarised in **ES Volume 1, Chapter 17: Likely Significant Effects and Conclusions** under the current climate conditions. No additional or different likely significant climate change effects (in terms of the effect of climate change on the Proposed Development) have been identified.

PART B GREENHOUSE GAS EMISSIONS ASSESSMENT

ASSESSMENT METHODOLOGY

- 12.45** This section of this ES chapter provides a Greenhouse Gas (GHG) assessment for the Proposed Development. The Proposed Development involves the demolition of existing buildings and construction of a mixed-use scheme, comprising residential units, a hotel, a new football stadium, various commercial uses, community space, sui generis uses and public realm. A full description of the Proposed Development can be found in **ES Volume 1, Chapter 4: The Proposed Development**.
- 12.46** GHGs are gases which have the potential to increase atmospheric temperatures and which contribute to climate change. The Proposed Development will lead to the direct and indirect release of GHGs, both during the demolition and construction phase, and throughout its lifetime. This assessment estimates the GHG emissions associated with the Proposed Development taking a lifecycle approach and presents the numerous mitigation measures and specific design measures provided by the scheme to minimise its GHG footprint.

Scope of the Assessment

- 12.47** The EIA Directive 2014 sets out the rationale for incorporating climate change into the EIA process. It states: "Climate change will continue to cause damage to the environment and compromise economic development. In this regard, it is appropriate to assess the impact of projects on climate (for example greenhouse gas emissions) and their vulnerability to climate change."
- 12.48** The requirements of the EIA Directive 2014 have been adopted within UK EIA Regulations 2017 and require that the assessment provides: "A description of the likely significant effects of the development on the environment resulting from, inter alia... (f) the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change".

Defining the Baseline

- 12.49** The Proposed Development will require the phased demolition of existing buildings. Any embedded carbon in the demolition materials is not additional to this project; the reuse of materials recycled during demolition results in a reduced requirement for new construction materials, and consequently a reduction in embedded carbon generated during construction. The baseline is therefore assumed to be zero, as the embedded carbon emissions associated with construction already reflect the net change.

12.50 The baseline for the operational assessment relates to the energy emissions generated by the current use of the site. As the information on the maintenance activities of existing buildings, energy consumption, and current trips for the site are both unknown, the baseline emissions are assumed to be zero. This provided a conservative assessment.

Evolution of the Baseline

12.51 If the Proposed Development was not to come forward, it is expected that the site would remain in its current state.

Impact Assessment Methodology

12.52 The assessment has taken a whole life approach to develop a GHG footprint for the Proposed Development. The footprint sources considered include GHG emissions:

- embedded in the material used in the construction of the Proposed Development;
- from traffic movements during demolition and construction of the Proposed Development;
- from energy consumed by the operation of the Proposed Development;
- from the operational Repair, Maintenance and Refurbishment of the Proposed Development; and
- from transport associated with the operation of the Proposed Development.

12.53 In addition to the emissions sources listed above, there are some minor GHG emissions sources that have been scoped out of the assessment. These emissions combined will make up a very small component of the overall GHG footprint and are challenging to estimate at this stage of the project as they can depend on how the users of the Proposed Development operate, as well as their own corporate GHG targets.

12.54 The emissions sources scoped out of the assessment are waste disposal, construction site activities (e.g. construction plant, site offices, transport, welfare facilities etc.), water consumption, demolition of existing structures. With regards to the demolition material, it is assumed that where possible and feasible, materials such as asphalt and concrete and appropriate steel members will be reused or repurposed within the Proposed Development. For conservatism the majority of materials used in the construction of the built environment are considered 'new'. Measures to reduce GHGs from these sources have been considered where possible in the 'Mitigation' section of this ES chapter.

12.55 **Table 12.2** sets out the GHG assessment scenarios examined by the assessment, key sources of data and methodologies used.

12.56 The metric for assessing the climate change impacts of GHG emissions in this assessment is Global Warming Potential (GWP). This is expressed in units of CO₂ equivalent (CO₂e) over 100 years. This allows for the emissions of the six key GHGs: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF₆) to be expressed in terms of their equivalent global warming potential in mass of CO₂e.

12.57 Emissions associated with the demolition and construction phase of the Proposed Development are calculated for the whole construction phase and annualised emissions based on the anticipated construction period, which is approximately eight years based on information in **ES Volume 1, Chapter 5: Demolition and Construction**. The construction phase GHG emissions have therefore been annualised assuming an 8-year construction phase to be conservative.

12.58 The energy and transport GHG emissions associated with the Proposed Development have been calculated for the first fully operational year (2031), taking account of national projections with regards to energy production, vehicle fleet etc. Emissions associated with repair, maintenance and refurbishment have been based on the latest available factors, with no consideration of future improvements.

12.59 The assessment determines the baseline GHG emissions and the GHG emissions from the Proposed Development in the first fully operational year (2031) and assumes an estimated operational lifetime of 60 years, which is a typical assumption in accordance with British Standard EN 15978:2011⁶.

12.60 The assessment estimates the Proposed Development's GHG emissions in the opening year as this provides a worst-case assessment due to decarbonisation of the energy supply in the future, and increase in sustainable transport in preference to private car use.

Table 12.2 GHG Assessment Scenarios

Development Phase	Baseline	Proposed Development	Methods and Data Sources	Reference
DEMOLITION AND CONSTRUCTION				
Embedded Carbon	The baseline is assumed to be zero.	Emissions associated with the extraction and processing of the materials required to construct the Proposed Development ('cradle to gate').	GHG calculation using ICE embodied energy and carbon coefficients for the different construction materials within the Proposed Development, per mass of construction material.	ES Volume 1, Chapter 5: Demolition and Construction
Transport	The baseline is assumed to be zero.	Emissions associated with traffic generated by the demolition and construction of the Proposed Development.	Application of 2022 GHG factors to km travelled by vehicle type listed in ES Volume 1, Chapter 5: Demolition and Construction.	ES Volume 1, Chapter 5: Demolition and Construction
OPERATION				
Repair, Maintenance and Refurbishment	The baseline is assumed to be zero.	Emissions associated with the operational repair, maintenance and refurbishment of the Proposed Development.	Application of RICS factor to calculated GHG emissions embedded in construction materials.	ES Volume 1, Chapter 5: Demolition and Construction
Transport	The baseline is assumed to be zero.	Emissions associated with traffic generated by the operation of the Proposed Development in the first fully operational year (2031).	Application of calculated 2031 GHG factors to km travelled by mode from Transport Assessment	Transport Consultant
Energy	The baseline is assumed to be zero.	Emissions associated with the operation of the Proposed Development in the first year fully operational (2031)	Application of CIBSE ⁷ and NEED ⁸ energy factors to Gross Floor Areas (GFAs) of different use classes within the Proposed Development	GFAs, CIBSE & NEED energy factors

Demolition and Construction

12.61 GHGs associated with the demolition and construction of the Proposed Development relate to those embedded in the materials from which the Proposed Development is constructed, and with traffic movements generated during the demolition and construction activities.

Embedded Carbon

12.62 It has been assumed for the purpose of the baseline, that none of the materials from the existing buildings to be demolished are recycled or reused on site for the embedded carbon calculations in order to obtain a worst-case scenario.

12.63 Embedded GHG emissions have been calculated based on the Inventory of Carbon and Energy (ICE) embodied energy and carbon coefficients⁹, as set out in **Table 12.3**. These factors are available for a range of construction materials, including aggregate, cement, concrete and metals, and are provided as kilograms of GHGs per kg of material. **Table 12.8** presents the estimated quantities of delivered construction material, which have been used in the assessment.

12.64 The ICE factors have been determined for the appropriate material type, and are then multiplied by the predicted mass of each construction material, using estimates regarding the thickness of some materials, such as cladding, finished and walls (to convert to a surface area to a volume), and also estimates of material density.

⁶ British Standard BSEN 15978:2011. Sustainability of construction works. Assessment of environmental performance of buildings. Calculation method.

⁷ CIBSE (2012) Guide F: Energy efficiency in buildings ISBN 978-1-906846-22-0

⁸ Department for Business, Energy & Industrial Strategy (2020) National Energy Efficiency Data-Framework (NEED). Available: <https://www.gov.uk/government/collections/national-energy-efficiency-data-need-framework>

⁹ Circular Ecology (2019) Inventory of Carbon & Energy (ICE), Version 3.0.

Table 12.3 ICE Embodied Carbon Coefficients

Material	ICE Embodied Carbon Coefficient (kgCO ₂ e/kg)	ICE Category
Concrete	0.103	Concrete – General
Rebar	1.99	Steel, Rebar
Steel	1.27	Steel, Engineering Steel
Façade Cladding and Glazing	1.437	Glass, General
Roof Finishes	0.191	Bitumen – Straight-run bitumen
Blockwork Walls	0.213	Bricks – General (Common Block)
Internal Walls and Ceilings	0.39	Plaster – Plasterboard
Wall Finishes	2.91	Paint – General
Floor Finishes	9.8 ^a	Carpet – General Carpet
Hard and Soft Landscaping	0.024	Soil – General (Rammed Soil)

^a Provided in m²

Construction Traffic

- 12.65** The estimated number of construction trips to and from the site during the enabling works and construction period have been provided within **ES Volume 1, Chapter 5: Demolition and Construction**. These have been provided for the following vehicle types: light goods vehicles (LGV), heavy goods vehicles (HGV) <7.5T and HGVs >7.5T.
- 12.66** The precise origin/destination of the trips is not known and therefore assumptions have been made on the origin/destination of these vehicles, which travel distances based on RICS Whole Life Carbon Assessment guidance¹⁰, which sets out default travel distances for construction delivery vehicles and defines local trips as 50km and national trips as 300km. The trip distance assumptions are provided in **Table 12.4**.

Table 12.4 Estimated Average Trip Distance Assumptions

Vehicle Type	Average Distance (km)	Assumption
LGV	50	100% local trips
Rigid HGV	175	50% local trips, 50% national trips
Articulated HGV	175	50% local trips, 50% national trips

- 12.67** Although these distances are estimates, and vehicle trips to and from the site during construction works will vary greatly in origin and destination, the distances are intended to be overestimates (as averages) and are therefore conservative.
- 12.68** GHG emission factors for construction transport have been obtained from the Department of Business, Energy and Industrial Strategy (BEIS) publication on GHG Conversion Factors for Company Reporting¹¹ which sets out GHG emissions factors for a range of modes of transport valid for 2022. The GHG emissions factor are applied to the calculated total construction travel distance to estimate the GHG emissions from construction transport. The use of 2022 factors for construction transport is conservative as emissions from road transport are likely to decarbonise in future years as vehicles become more fuel efficient.
- 12.69** A summary of the 2022 GHG emission factors for selected modes of construction transport used in this GHG assessment are provided in **Table 12.5**. The assumption has been made that each HGV arrives at the site fully laden and leaves empty. In reality, some vehicles may arrive empty and leave laden (for example to remove waste), but as in each case a HGV journey is one-way laden and one-way unladen, the assumption that all HGVs arrive laden has been made for simplicity.

Table 12.5 Construction Transport GHG Factors (2022)

Activity	Type	Unit	2022 BEIS Factor (kgCO ₂ e)
LGV	Average Diesel LDV	Km	0.17082

Activity	Type	Unit	2022 BEIS Factor (kgCO ₂ e)
Rigid HGV	Rigid Diesel HGV ^a	Km	0.82369
Articulated HGV	Articulated Diesel HGV ^a	km	0.86750

^a Assuming a 50:50 split between fully laden and unladen.

Completed Development

- 12.70** GHGs associated with the operation of the Proposed Development relate to emissions from repair, maintenance and refurbishment, transport, and energy use.

Energy Consumption

- 12.71** In terms of the baseline setting for energy use, the IEMA guidance acknowledges that baseline energy use for existing buildings can be very difficult to calculate. The IEMA guidance recommends that baseline energy use is considered to be zero, or an alternative baseline is considered, whereby the GHG emissions from an alternative development of building design are considered. In this case, the baseline energy consumption has been assumed to be zero as information regarding the energy consumption of the existing land use was not available. This will provide a conservative assessment as the current emissions from energy consumption have not been considered. Energy consumption for the Proposed Development has been estimated based on the GFAs of different land uses within the scheme. Where necessary, such as for retail land uses, the GFA has been converted to a 'sales floor area' based on CIBSE guidance. Each land use type has an associated yearly energy consumption (kWh/m²), which has then been combined with the floor area to provide an annual energy consumption (kWh/year). The total energy demand has been assumed to be provided with full electric sources. The annual energy consumption has then been multiplied by a BEIS energy factor to calculate the tonnes of CO₂ equivalent generated by the fully operational scheme.

Transport

- 12.72** GHG emissions from operational transport, including service and delivery vehicle trips and staff commuting have been calculated using multi-modal transport data provided by the project transport consultants, Vectos.
- 12.73** Data has been provided for the number of local and non-local trips to and from the Proposed Development each day by mode of travel (e.g. car, bus and national rail). These have been combined with estimates of average travel distance and GHG emissions factors for transport available from BEIS¹⁰ to calculate the resultant GHG emissions, as presented in **Table 12.6**.

Table 12.6 Operational Transport GHG Factors

Mode	Type	Unit	Calculated 2031 factor (kgCO ₂ e)
National Rail	National Rail	Passenger.km	0.01450
Bus	Non-London Local Bus	Passenger.km	0.11774
Car driver	Average car	km	0.12348

- 12.74** The average length of each trip has been taken from the National Transport Survey (NTS) database¹² for each mode in the South East region.
- 12.75** The BEIS emissions factors are available for 2022 and have been adjusted for the first fully operational year (2031) and future years for the assessment of lifetime emissions, using information on engine and fuel efficiency improvements sourced from the DfT's WebTAG data book¹³.
- 12.76** To account for decarbonisation of transport through the transition to net zero 2050, expected decarbonisation profiles have been obtained for cars, HGVs and buses from the DfT's transport decarbonisation plan¹⁴. Decarbonisation is applied from 2030 onwards to 2049 in line with the plan and then the residual emissions factors are fixed from 2050 to 2088. The decarbonisation profile for cars has also been applied to motorcycles and taxis.

¹⁰ RICS (2017) Whole Life Carbon Assessment for the Built Environment (1st Edition).

¹¹ BEIS (2022) Greenhouse gas reporting: conversion factors 2022: <https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022>

¹² Department for Transport (2022) National Transport Survey: Table NTS9910, Available: <https://www.gov.uk/government/statistical-data-sets/nts03-modal-comparisons>

¹³ Department for Transport (2021) TAG data book May 2022v1.18: <https://www.gov.uk/government/publications/tag-data-book>

¹⁴ DfT (2021) Decarbonising Transport: A Better, Greener Britain.

Repair, Maintenance and Refurbishment

- 12.77** Over the lifetime of the Proposed Development there will be GHG emissions associated with the repair, maintenance and refurbishment of the building¹⁵. These emissions are effectively 'unregulated' as there is no policy or standard for establishing compliance nor is there published data on good practice against which developments can be benchmarked. Nonetheless, emissions from repair, maintenance and refurbishment have been considered in the GHG assessment based on data from RICS.
- 12.78** RICS estimate that for residential buildings, embedded GHG emissions during use (i.e. repair, maintenance and refurbishment) are around 35% of the embedded GHG emissions to practical completion; for commercial buildings, around 91% of embedded GHG emissions. The Proposed Development is approximately 75% residential and 25% non-residential, by floor area; therefore, the lifetime GHG emissions from repair refurbishment and maintenance have therefore been estimated to be 49% of the embedded emissions of the Proposed Development to practical completion. This is conservative as it will not account for the significant likely decarbonisation of the manufacturing sector by 2050 in line with the UK Government's commitments to net zero.

Net Zero Policy Implications

- 12.79** The UK has recently legislated a 2050 net zero target following recommendations and analysis completed by the Committee on Climate Change (CCC)¹⁶. The CCC's Net Zero report¹⁷ has established a "Further Ambition" scenario which considers feasible and cost-effective policy and technology interventions to ensure the UK can meet its new net zero target.
- 12.80** For power generation under this scenario, the CCC consider that 100% of power generation by 2050 will be low carbon and for ground transport it forecasts that all ground transportation (apart from small number of HGVs) will be electrically powered. The CCC therefore forecast that power and ground transportation sectors are largely decarbonised by 2050 with any residual emissions removed through technical and or natural means.
- 12.81** The implications of the UK adopting the net zero target are that it is reasonable to assume that government policies will be brought forward to ensure the net zero target is achieved. The recent government announcement bringing forward the ban on sale of new vehicles that are not electrically powered to 2030 is an example of policy that is being developed.
- 12.82** It is therefore anticipated that all operational and transportation emissions associated with the Proposed Development are likely to be zero at the latest by 2050.

Assumptions and Limitations

- 12.83** The following assumptions and limitations are relevant to the GHG assessment:
- the Proposed Development is complete and operating at full capacity in 2031;
 - the construction phase of the Proposed Development involves the buildings and infrastructure, and transport movements described in **ES Volume 1, Chapter 5: Demolition and Construction**;
 - it has been assumed that the measures set out within the Sustainability Strategy to minimise emissions from energy consumption and embodied carbon will be implemented; and
 - the lifetime GHG emissions make a number of assumptions, led by Government data and strategies about decarbonisation of key emissions sources such as energy and transport.

Methodology for Defining Effects

Receptors and Receptor Sensitivity

- 12.84** The assessment of GHGs does not include identification of local sensitive receptors, as GHG emissions do not directly affect specific locations, but lead to indirect effects by contributing to climate change. Identification of sensitive areas for climate change has been undertaken by the IPCC, however specific impacts on these areas are not included within this assessment. The sensitive receptor with respect to GHG emissions is therefore the atmosphere, where GHGs contribute to increasing atmospheric temperatures and resultant climate change effects.

Magnitude of Impact

- 12.85** There are no impact descriptors for GHG emissions.

Defining the Effect and Categorising Likely Significant Effects

- 12.86** For GHG emissions there are no recognised criteria and thresholds that relate to the quantum of GHG emissions released.
- 12.87** In terms of defining significance, guidance from IEMA¹⁸ has been adopted, which has identified three underlying principles to inform the assessment of significance, as follows:
- GHG emissions from all projects will contribute to climate change; the largest interrelated cumulative environmental effect;
 - the consequences of a changing climate have the potential to lead to significant environmental effects on all topics in the EIA Directive – e.g., population, fauna, soil, etc.; and
 - GHG emissions have a combined environmental effect that is approaching a scientifically defined environmental limit, as such any GHG emissions or reductions from a project might be considered to be significant.
- 12.88** Based on these principles, IEMA conclude that:
- When evaluating significance, all new GHG emissions contribute to a negative environmental impact, however, some projects will replace existing development or baseline activity that has a higher GHG profile. The significance of a project's emissions should therefore be based on its net impact over its lifetime, which may be positive, negative or negligible;
 - Where GHG emissions cannot be avoided, the goal of the EIA process should be to reduce the project's residual emissions at all stages; and
 - Where GHG emissions remain significant, but cannot be further reduced, approaches to compensate the project's remaining emissions should be considered.
- 12.89** In advising on the significance of any net change in GHG emission resulting from a development IEMA identify that in order to limit the adverse effects from climate change global temperature change needs to be limited to well below 2°C, aiming for 1.5°C. The implication of this objective is that global emissions need to fall to net zero by 2050.
- 12.90** The UK's response to limiting climate change is enshrined in law through the Climate Change Act⁵ which requires the UK economy to be net zero by 2050 following a trajectory set through five yearly carbon budgets. The 2050 target (and interim budgets set to date) are, according to the CCC, compatible with the required magnitude and rate of GHG emissions reductions required in the UK to meet the goals of the Paris Agreement, thereby limiting severe adverse effects.
- 12.91** It follows therefore that the significance of any net change of GHG resulting from a development is not so much whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions consistent with a trajectory towards net zero by 2050.
- 12.92** To establish the significance of the GHG emissions from a development therefore requires judgements on:
- Their consistency with policy requirements, since these have been specified to ensure the economy decarbonises in line with the UK's net zero target; and
 - The degree to which the development has sought to mitigate its emissions.
- 12.93** Examining each of these dimensions allows the assessment to make professional judgement on the likely significance of effects based on a set of significance criteria established in the IEMA guidance, summarised in **Table 12.7**.

¹⁵ Refurbishment refers to ongoing refurbishment of elements of the building as required during its estimated 60 year lifetime and does not include a complete whole-building refurbishment, as this would occur at the end of the building's practical life and would be subject to a future lifecycle GHG assessment.

¹⁶ Net zero has been defined by the CCC to allow for GHG removals to offset any residual GHG emissions in 2050 so that the overall balance of emissions is zero.

¹⁷ Committee on Climate Change (2019) Net Zero. The UK's contribution to stopping global warming, Available:

<https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/>

¹⁸ IEMA (2017), 'Assessing Greenhouse Gas Emissions and Evaluating their Significance.'

Table 12.7 GHG Significance Criteria

Significance Rating	Description	Criteria to Determine Significance of Net GHG Emissions
Major Adverse	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.	The project's net 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.
Moderate Adverse	A project with moderate adverse effects falls short of fully contributing to the UK's trajectory towards net zero.	The project's net 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.
Minor Adverse	A project with minor adverse effects is fully in line with measures necessary to achieve the UK's trajectory towards net zero.	The project's net GHG impacts are: - fully consistent with applicable existing and emerging policy requirements; and - in line good practice design standards for projects of this type.
Negligible	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.	The project's net GHG impacts are: - reduced through measures that go well beyond existing and emerging policy; and - better than good practice design standards for projects of this type, such that radical decarbonisation or net zero is achieved well before 2050.
Beneficial	A project with beneficial effects substantially exceeds net zero requirements with a positive climate impact.	The project's net GHG impacts are: - below zero; and - it causes a reduction in atmospheric GHG concentrations, whether directly or indirectly, compared to the without-project baseline.

12.94 IEMA also advise that:

- Major adverse, moderate adverse and beneficial effects should be considered significant in the context of EIA;
- In the case of large-scale developments, irrespective of the level of mitigation, if net GHG emissions exceed 5% of UK or devolved administrations carbon budget, that this is a level of change that is considered significant;
- Meeting the minimum standards set through existing policy or regulation cannot necessarily be taken as evidence of avoiding a significant adverse effect, and it is recommended therefore that the assessment also considers emerging policy/standards and the guidance of expert bodies such as the CCC on necessary policy developments, particularly for multi-phased projects with long timescales; and
- To aid decision making it is important to inform the decision maker about the relative severity of environmental effects such that they can be weighed in a planning balance. Therefore, it is essential to provide context for the magnitude of GHG emissions reported in the EIA in way that aids evaluation of these effects by the decision maker. IEMA advise that context can be provided through comparison of the whole life GHG emissions resulting from the development with national, local and sectoral totals, as well as carbon budgets.

12.95 Therefore, the assessment of significance is established over two steps as follows:

Step 1: Establish Context of GHG Emissions

12.96 Context for decision making is provided by comparing the net change in the whole life GHG emissions resulting from the development with local and regional GHG emissions totals, and carbon budgets

Step 2: Determine Significance of Effects

12.97 Significance of effects is established through applying the criteria detailed in **Table 12.7** based on professional judgement that considers:

- The consistency of the development with national, regional and local policies designed to limit GHG emissions and meet the UK's net zero target; and
- The robustness, timeliness and efficacy of mitigation measures proposed to avoid, reduce and compensate GHG emissions.

12.98 In terms of mitigation, IEMA recommends that mitigation should in the first instance seek to avoid GHG emissions. Where GHG emissions cannot be avoided, the development should aim to reduce the residual significance of a project's emissions at all stages. Where additional GHG emissions remain but cannot be further reduced at source, approaches should be considered that compensate the project's remaining emissions, for example through offsetting.

Geographic Extent of Effects

12.99 The geographic extent of effects arising from the Proposed Development will extend beyond the development boundary, and could well extend across the entire country, and therefore the extent is considered to be 'global'.

Effect Duration

12.100 GHG emissions will be generated for the lifetime of the project (or at least up to 2050) by which time it might be expected that net GHG emissions will be zero. They are, therefore considered to be permanent.

Direct and Indirect

12.101 The Proposed Development's GHG emissions will not have any direct environmental effects, but contribute to climate change, which is an indirect environmental effect.

BASELINE CONDITIONS

Demolition and Construction

12.102 The Proposed Development will require the phased demolition of existing on-site buildings. Any embedded carbon in the demolition materials is not additional to this project; the reuse of materials recycled during demolition results in a reduced requirement for new construction materials, and consequently a reduction in embedded carbon generated during construction. The baseline is therefore assumed to be zero, as the embedded carbon emissions associated with construction already reflect the net change.

Completed Development

12.103 GHG emissions associated with repairs, maintenance and refurbishment of the baseline are assumed to be zero due to lack of information on maintenance activities for the existing building. This provides a conservative assessment.

12.104 There are no data available on the existing transport and energy use of the site and therefore for the purposes of this assessment, and in line with the IEMA guidance recommendations, a reasonable worst-case assumption is used whereby the baseline transport and energy emissions are assumed to be zero.

12.105 The total assumed baseline GHG emissions are zero tonnes/annum CO₂e.

POTENTIAL EFFECTS

Demolition and Construction

Embedded Carbon

12.106 To calculate the embedded carbon from construction, the mass of each building material has been multiplied by the corresponding ICE carbon coefficient obtained from the inventory. The calculation of the embedded carbon in the Proposed Development, completed in **Table 12.8** is therefore:

Sum of Each Mass of Material (kg) x Relevant Embodied Carbon Coefficient (kgCO₂e/kg) / 1,000 = Embedded GHG (tonnes CO₂e)

Table 12.8 Calculation of GHG from Construction Material

Material	Volume (m ³)	ICE Carbon Coefficient (kgCO ₂ e/kg)	Embedded GHGs from Construction (tonnes CO ₂ e) ^a
Concrete	216,000	0.103	53,583

Material	Volume (m³)	ICE Carbon Coefficient (kgCO ₂ e/kg)	Embedded GHGs from Construction (tonnes CO ₂ e) ^a
Rebar	25,600 ^b	1.99	51
Steel	3,600 ^b	1.27	5
Façade Cladding and Glazing	3,000 ^{c,d}	1.437	10,777
Roof Finishes	1,280 ^e	0.191	548
Blockwork Walls	33,630 ^f	0.213	13,610
Internal Walls and Ceilings	5,795 ^g	0.39	1,808
Wall Finishes	342 ^h	2.91	995
Floor Finishes	62,000 ⁱ	9.8	608
Hard and Soft Landscaping	225,000 ^j	0.024	10,800
Total	-	-	92,784

^a All figures are rounded to the nearest tonne.
^b Value provided in kg, rather than m².
^c Assuming that 100% of the total provided quantity is façade glazing.
^d Assuming 12mm thickness.
^e Assuming 20mm thickness.
^f Assuming standard UK 102.5mm brick thickness.
^g Assuming 9.5mm thickness.
^h Assuming 0.5mm thickness.
ⁱ Value provided per m², rather than m³.
^j Assuming 1mm thickness.

12.107 The total embedded CO₂e emissions for the Proposed Development from construction to practical completion, and repair, maintenance and refurbishment during operation are 92,784 tonnes. Based on a 8-year construction period, this equates to 11,598 tonnes/annum.

12.108 Since the Proposed Development is to be constructed on land that is already developed and does not lead to a significant loss in habitat, no land use change GHG emissions are assumed to occur.

Construction Traffic

12.109 The calculation of construction transport related GHG emissions for the Proposed Development are presented in **Table 12.9**. The assessment multiplies the calculated 2022 GHG emission factors for each mode of travel (see **Table 12.5**) by the average annual distance travelled. Total vehicle numbers have been provided by the project transport consultant, Vectos.

Table 12.9 Calculation of GHG from Construction

Mode	Trips During Construction	Distance Travelled During Construction (km) ^a	CO ₂ e (tonnes) ^b
LGV	1,066	53,300	9
Rigid HGV ^c	656	114,800	95
Articulated HGV ^c	4,531	792,925	688
Total	-	-	792

^a Total distances travelled are calculated by multiplying the number of trips by the average distances travelled by each vehicle type, as described in paragraph 12.66.
^b CO₂e emissions are calculated by multiplying distance travelled by CO₂e factors by mode from **Table 12.5**.
^c Assuming rigid and articulated HGVs are 100% laden inbound and 0% laden outbound.

12.110 The total CO₂e emissions from construction traffic for the Proposed Development are 792 tonnes. Based on the 8-year construction period, this equates to 99 tonnes/annum (although all of these emissions will occur in the construction phase prior to building occupation).

Completed Development

Transport

12.111 The assessment of transport related GHG emissions for the Proposed Development in the first fully operational year (2031) are presented in **Table 12.10**. The transport data used in the assessment has been provided by the project transport consultant. The assessment of transport-related GHG emissions multiplies GHG emission factors published by BEIS¹¹, adjusted to the year 2031 for each mode of travel (see **Table 12.6**), by the distance travelled (taken from the NTS database for the South East of England).

Table 12.10 Assessment of GHG Emissions from Operational Transport

Mode	Distance per trip (km)	Trips per Annum (two-way)	Distance Travelled per Annum (km)	CO ₂ e per Annum (tonnes) ^a
Car driver	13.1	2,101,097	27,524,371	3,399
Bus	7.8	525,274	4,097,137	482
Rail	47.2	350,183	16,528,638	240
Total	-	7,003,658	76,199,800	4,121

^a CO₂e emissions are calculated by multiplying distance travelled by CO₂e factors by mode from **Table 12.6**.

12.112 The total transport GHG emissions are calculated as 4,121 tonnes of CO₂e per annum.

Energy

12.113 The assessment of the energy related GHG emissions for the Proposed Development in the first fully operational year (2031) are presented in **Table 12.11**. The GFAs were provided by the project architects (UNStudio). The yearly energy consumption for each land use type is calculated using CIBSE⁷ and NEED⁸ energy factors.

Table 12.11 Assessment of GHG Emissions from Operational Energy Consumption

Land use	Floor area (m²) or number of dwellings	Energy Consumption (kWh/m²)	Energy Consumption (kWh/year)
Retail	15,750	324	5,103,000
Food and Beverage	9,500	1,980	18,810,000
Local Services	1,100	305	335,500
Indoor Sport, Recreation and Fitness	1,200	643	771,600
Medical or Health Services	1,500	270	405,000
Creche or Nursery	1,200	196	235,200
Offices	18,000	404	7,272,000
Local Community Use	4,000	220	880,000
Stadium and Associated Facilities	15,000	750	11,250,000
Hotel	20,000	610	12,200,000
Residential dwellings <50m² (studio units)	157	10,200	1,601,400
Residential dwellings 51-100m² (1/2/3 bed units)	3,343	14,800	49,476,400
Total	-	-	108,340,100

- 12.114** The total energy consumption presented in **Table 12.11** (108,340,100 kWh/year) is, however, based on historic building standards. The Future Homes Standard¹⁹ (for the residential elements) and The Future Buildings Standard²⁰ (for the non-residential elements) ensures that new developments will emit 75% less carbon than those delivered under current regulations. Therefore, the total energy consumption under the new regulations will be significantly lower than the figure presented above.
- 12.115** Taking account of the new building regulations, the Proposed Development is estimated to have an operation energy consumption of 27,085,025 kWh/year. Assuming all energy comes from electric sources, this will result in an annual CO₂ emission of 5,653 tonnes.

Repair, Maintenance and Refurbishment

- 12.116** As described in paragraph 12.78, GHG emissions relating to the repair, maintenance and refurbishment of the Proposed Development over its lifetime have been estimated based on the embedded construction carbon emissions, and are estimated to equal 49% of the values presented in **Table 12.8**. GHG emissions are estimated to total 45,464 tonnes, or 758 tonnes per annum.

Total GHG Emission Footprint

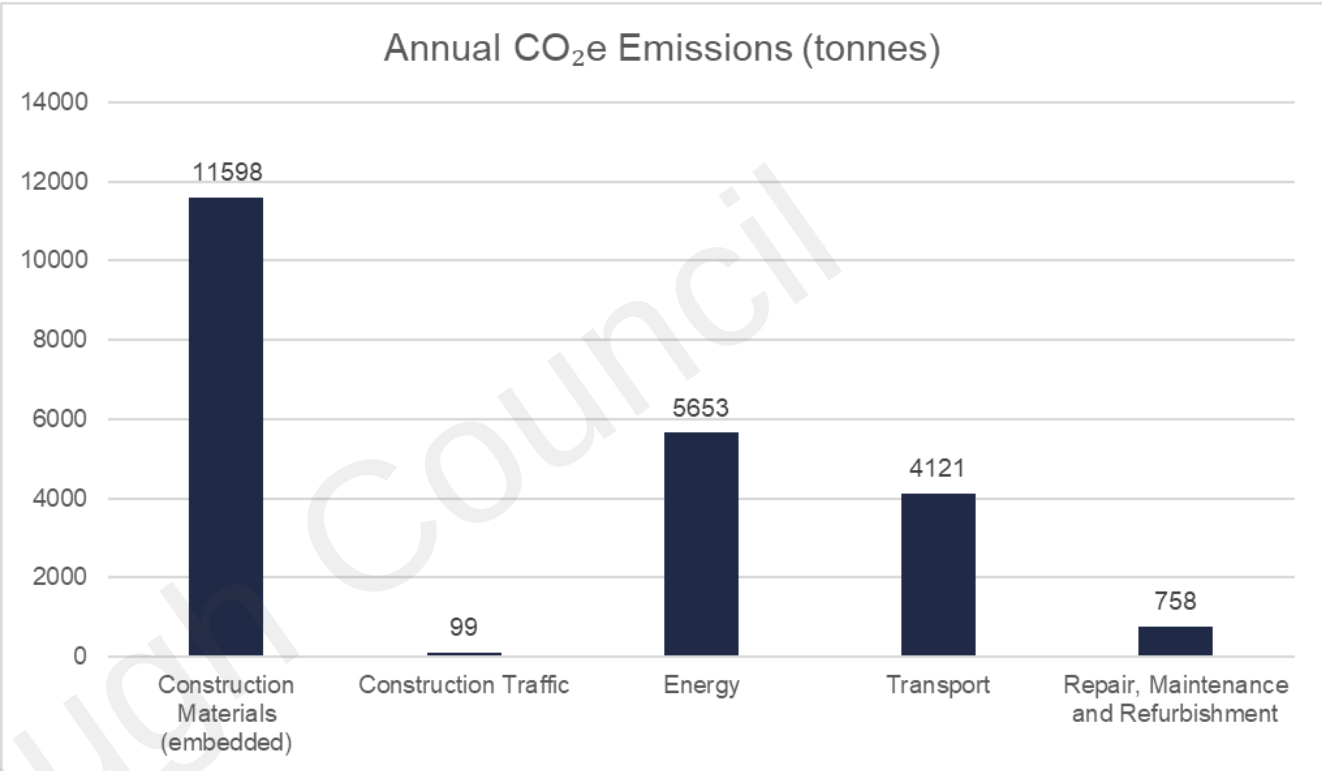
- 12.117** **Table 12.12** and **Figure 12.1** summarise the GHG emissions for the Proposed Development in the opening year for each footprint element. The GHG emissions from embedded materials used in construction and emissions from construction transportation are annualised assuming a 60-year life. Annualising the embedded and construction transportation GHG emissions allows them to be compared on a like-for-like basis to the operational GHG emissions which are reported on a per annum basis.
- 12.118** As shown in **Table 12.12** the Proposed Development will result in a new increase in GHG emissions in the opening year of 22,229 tonnes. This is the first step of the assessment of significance as described previously.

Table 12.12 GHG Footprint for Proposed Development in 2031 ^a

Development Phase	Footprint Element	Tonnes of CO ₂ e/annum		
		Baseline	Opening Year	Net Emissions
Construction	Embedded	0	11,598	11,598
	Transport	0	99	99
Operation	Repair, Maintenance and Refurbishment	0	758	758
	Energy	0	5,653	5,653
	Transport	0	4,121	4,121
Total		0	22,229	22,229

^a All figures are rounded to the nearest tonne

Figure 12.1 Proposed Development Opening Year GHG Footprint



MITIGATION, MONITORING AND RESIDUAL EFFECTS

Demolition and Construction Mitigation

- 12.119** Reducing GHG emissions during construction would include consideration of minimising the use of materials as well as the procurement of sustainable materials, with consideration of the embedded carbon footprint of the material, from the extraction of the raw materials to the production of the final construction products, and the transport of products between the factory and Proposed Development.
- 12.120** A Site Waste Management Plan (SWMP) will be developed to demonstrate how the waste will be minimised and managed. Construction waste will be minimised by the re-use of existing materials, however, where this is not possible the waste will be sorted to maximise recycling and to divert as much from landfill as possible.
- 12.121** An Operational Waste Management Strategy has been prepared (see **ES Volume 3, Appendix: Outline Operational Waste and Recycling Strategy**).
- 12.122** Walking, cycling and other sustainable forms of transport would be promoted, and pedestrian site access would be segregated from the road by physical barriers to ensure safety upon arrival and departure, with separate pedestrian gates and footways provided. Cycle parking facilities will be provided. A staff Travel Plan will be prepared by the contractor to encourage the use of sustainable modes of transport considering the good level of public transport accessibility in the immediate area to the site. In terms of construction transport, a Construction Logistics Plan (CLP) will be prepared prior to the commencement of construction of the Proposed Development. The CLP will set out the measures to reduce the environmental impact from the construction stage and to optimise the efficient delivery and collection of goods and materials to the site.

Completed Development Mitigation

Transport

- 12.123** A Framework Travel Plan²¹ has been developed for the Proposed Development and accompanies the planning application. The Framework Travel Plan sets out the measures to minimise car use and facilitate the sustainable

¹⁹ Ministry of Housing, Communities & Local Government (2021) The Future Homes Standard: changes to Part L and Part F of the Building Regulations for new dwellings. Available: <https://www.gov.uk/government/consultations/the-future-homes-standard-changes-to-part-l-and-part-f-of-the-building-regulations-for-new-dwellings>

²⁰ Department for Levelling Up, Housing and Communities & Ministry of Housing, Communities & Local Government (2021) The Future Buildings Standard. Available: <https://www.gov.uk/government/consultations/the-future-buildings-standard>
²¹ See **ES Volume 3, Appendix: Traffic and Transport – Annex 1**

movement of staff, visitors and goods to and from the Development. A Travel Plan Coordinator would be appointed to take responsibility for the development and management of the Travel Plan.

12.124 The following measures are proposed to influence sustainable travel behaviour from the site:

- Encourage the use of sustainable delivery services for online shopping in addition to working from home;
- Provide on-site amenities that are within walking and cycling distance from all points within the site;
- A 'Welcome Pack' to be distributed to each dwelling which will promote public health campaigns such as Change 4 Life and walking challenges;
- Ensuring all pedestrian routes are well maintained and well-lit;
- Information on pedestrian routes in and around the site with relevant maps;
- Provide secure cycle storage;
- Provide incentives to promote the uptake of cycling such as cycle shop discounts, cycle training services etc.;
- Promote Kent County Council's new cycle loan scheme which provides free access to refurbished cycles;
- Promote existing cycle training initiatives such as cycle training courses for small groups;
- Provide up-to-date timetables and journey planning tools; and
- Sustainable Travel Vouchers will be provided to residents of the site, these vouchers can be used by first time residents to cover the cost of Fastrack Bus Tickets in order to increase the number of people using public transport services.

Energy Consumption

12.125 Key mitigation measures adopted by the Proposed Development to minimise GHG emissions from energy use over the building's operational phase include the following:

- Fully electric technology for heating and central hot water systems;
- Use of Central District Heating Systems (where feasible);
- Use of PV's and Heat Pumps to maximise sustainable forms of heating and electricity generation;
- Openable windows to maximise natural ventilation;
- Low energy lighting throughout with occupant detection and photocell dimming, where possible;
- Use of sustainable sources of materials, sourced from sustainable forestry; and
- Integrating a Net Zero development Strategy that targets 2030 Net Zero Construction methods, and practices.

Residual Effects

12.126 The final stage of assessment of significance is to consider the residual GHG emissions in the context of the proposed mitigation and relevant policy targets.

12.127 The data in **Table 12.12** sets out that there will be residual net annual GHG emissions of 11,697 tonnes per annum during construction and 10,532 tonnes from operation in the opening year. The mitigation measures described above will be implemented to avoid, reduce and compensate the GHG emissions during construction and throughout the lifetime of the Proposed Development, however, a net increase in GHG emissions against the baseline GHG emissions will remain in the opening year of 2031

12.128 For operational transport and energy emissions, annual emissions are anticipated reduce to net zero by 2050 in line with the UK Government's commitments to climate change.

12.129 The UK has adopted a net zero target to be achieved no later than 2050 with UK government legally mandated to take steps across the economy to meet this target. This will include measures to decarbonise UK power supply as well as ground transportation the effects of which will be to reduce the longer term operational GHG emissions associated with the Proposed Development to zero by 2050.

12.130 Although the Proposed Development has residual GHG emissions in the opening year, it is considered that these have been minimised through an appropriate degree of mitigation consistent with best practice and IEMA

guidance and ensure the Proposed Development is compliant with the UK's target for net zero carbon emissions by 2050. The Proposed Development has been demonstrated to meet all relevant policies related to greenhouse gas emissions and climate change, and seeks to achieve improvements on the Net Zero targets by aiming to target 2030 . Based on the significance criteria set out in **Table 12.7**, it is therefore judged that the Proposed Development will have a **Negligible** impact on GHG emissions, and thus the effect is Not Significant.

PART B LIKELY SIGNIFICANT EFFECTS

12.131 The GHG assessment has identified that the Proposed Development will lead to GHG emissions, however these are described as Negligible and therefore 'in accordance with IEMA best practice guidance on the assessment of GHGs for EIA.

12.132 This conclusion is based on the GHG emissions generated by the Proposed Development being small in the context of GHG budgets, the Proposed Development being compliant with all relevant policies relating to GHG and climate change, and the fact that the Proposed Development will not conflict with or prevent the UK meeting its net zero GHG emissions target of 2050.

12.133 Mitigation is provided to avoid and reduce the GHG emissions, which follows the key principles of GHG mitigation in the IEMA guidance and is consistent with the requirements of relevant policy.