

# STRIDE TREGLOWN



## Environmental Statement: Chapter 11 – Climate Change

Ellel Holiday Village, Lancaster

*Ellel*

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# 11. Climate Change

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## 11.1. Introduction

- 11.1.1 This chapter of the ES, carried out by 7 Consulting, provides an assessment of the likely climate change effects arising from the construction and operational phases of the proposed development.
- 11.1.2 A detailed description of the site and the proposed development is provided in chapter 3: *The Site and Project Description*. This chapter aims to summarise the findings of the Climate Change Assessment.
- 11.1.3 To align with the requirements of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (referred to hereafter as the EIA Regulations 2017) this chapter covers a Greenhouse Gas (GHG) emissions assessment that considers the effects on climate from a GHG emissions arising from the proposed development, including how the project will affect the ability of the government to meet its carbon reduction plan targets.

## 11.2. Legislation, Policy and Guidance

### International

EIA Directive 2014/52/EU

- 11.2.1 As of May 2017, an Environmental Impact Assessment (where relevant) must include assessment of the impact of a proposed development on climate change (for example, the nature and magnitude of GHG emissions).

The Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard, WRI & WBCSD

- 11.2.2 The GHG Protocol provides standards and guidance for companies and other types of organisations in preparing a GHG inventory.

The European Commission (EC) guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment 2013

- 11.2.3 The Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment aims to help Member States improve the way in which climate change and biodiversity are integrated in Environmental Impact Assessments (EIAs) carried out across the EU.

2010/335/EU Commission Decision of 10 June 2010

- 11.2.4 The calculation of land carbon stocks is based on 2010/335/EU COMMISSION DECISION of 10 June 2010 on guidelines for the calculation of land carbon stocks for the purpose of Annex V to Directive 2009/28/EC, Official Journal of the European Union, L 151/17.

### National

Climate Change Act 2008

- 11.2.5 The Climate Change Act 2008 (Ref. 12 06) sets a legally binding target for the UK to reduce its GHG emissions from 1990 levels by at least 80% by 2050. The target is supported by a series of five year 'carbon budgets' with progress being monitored by the Committee on Climate Change, an independent advisor to the UK Government.

The Town and Country Planning (Environmental Impact Assessment Regulations 2017)

11.2.6 The EIA Regulations 2017 (Ref. 12 1) state in Regulation 4:

*“(2) The EIA must identify, describe and assess in an appropriate manner, in light of each individual case, the direct and indirect significant effects of the proposed development on the following factors—consideration should be given to the likely significant effects...*

*....(c) land, soil, water, air and climate;”*

11.2.7 In addition, Schedule 4 of the EIA Regulations 2017, Information for Inclusion in Environmental Statements, identifies that the following information is to be provided in an Environmental Statement:

*“4. A description of the factors specified in regulation 4(2) likely to be significantly affected by the development: ... climate (for example greenhouse gas emissions, impacts relevant to adaptation)...”; and*

*“5. 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;....”*

National Planning Policy Framework (NPPF) (2019)

11.2.8 States that the purpose of planning is to contribute to the achievement of sustainable development and that positive improvements should be sought in the quality of the built, natural and historic environment, as well as in people’s quality of life. Several of the NPPF policies relate to climate change mitigation and resilience including:

- Section 6: Building a strong, competitive economy this policy states that the Government is committed to securing economic growth in order to create jobs and prosperity, building on the country’s inherent strengths, and to meeting the twin challenges of global competition and a low carbon future.
- Section 12: Achieving well-designed spaces this policy notes the importance of the design of the built environment. Weight should be given to outstanding or innovative designs which promote high levels of sustainability. Good design is a key aspect of sustainable development.
- Section 14: Meeting the challenge of climate change, flooding and coastal change this policy states that planning plays a key role in helping shape places to secure radical reductions in GHG emissions, minimising vulnerability and providing resilience to the impacts of climate change and supporting the delivery of renewable and low carbon energy and associated infrastructure. This is central to the economic, social and environmental dimensions of sustainable development.

Planning Practice Guidance (PPG)

11.2.9 The NPPF is supported by National Planning Practice Guidance (NPPG) including the Climate Change PPG (Ref. 12 8), which advises how to identify suitable mitigation and adaptation measures in the planning process, to address the impacts of climate change.

## Carbon Plan 2011

- 11.2.10 The Government's national carbon reduction strategy (provided in the Carbon Plan 2011) provides a plan for the UK to meet its carbon reduction targets. While the Government is legally bound to meet the commitments set out in this plan, any increase in GHG emissions as a result of the proposed development will not necessarily result in the planning application being refused, unless the increase causes a materially significant effect.

Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance 2017

- 11.2.11 The Institute of Environmental Management and Assessment (IEMA) report 'Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance' provides guidance on addressing GHG emissions assessment and mitigation in EIA.

IEMA document Principles on Climate Change Mitigation and EIA 2010

- 11.2.12 The Institute of Environmental Management and Assessment (IEMA) document Principles on Climate Change Mitigation and EIA sets out the overarching principles relating to the consideration of climate change mitigation in EIA.

GHG Emission Factors

- 11.2.13 The Department of Environment, Food and Rural Affairs (Defra) and the Department of Business, Energy and Industrial Strategy (DBEIS) annually publish the UK Government GHG Conversion Factors for Company Reporting. These are used in the quantification of GHG emissions to convert the activity data into emissions.

The Inventory of Carbon & Energy (ICE) Database

- 11.2.14 The inventory is the world's leading source of embodied energy and carbon data. This database has been used to source appropriate carbon factors to estimate the embodied carbon of materials used for construction of the proposed development. ICE uses some CIBSE data for materials properties, e.g. densities.

UK Climate Projections

- 11.2.15 The UK Climate Projections (UKCP09) is the leading source of climate information for the UK and its regions. This climate resilience review uses the observed climate data and climate change projections from the UKCP09 to consider future potential impacts on the proposed development. The expected 2018 update of UK Climate Projections (UKCP18) has not been available in time to be used for this ES.

BS EN 15804 Sustainability of Construction Works. Environmental Product Declarations 2012

- 11.2.16 BS EN 15804 gives guidance around core product category rules relating to Environmental Product Declarations (EPDs) for construction products and services. It provides a structure to ensure that all Environmental Product Declarations (EPDs) of construction products, construction services and construction processes are derived, verified and presented in a harmonised way.

- 11.2.17 BS EN 16978 focuses on the calculation method to assess the environmental performance of a building, based on life cycle assessment (LCA) for both new and existing buildings. It provides a description of the object of assessment, system boundaries applicable at the building level, procedures used for inventory analysis, a list of indicators and procedures for calculation, reporting and data requirements.

#### Local

##### Lancaster District Local Plan (Parts One and Two)

- 11.2.18 At a meeting of Full Council in January 2019, Lancaster City Council declared a climate emergency and committed itself to;
- Set up a Climate Change Cabinet Liaison Group, involving councillors, residents, young citizens and experts from our two universities
  - Convene a citizens' assembly to help identify how our activities can be made net-zero carbon by 2030
  - Proactively include young citizens in this process
  - Introduce climate change impact assessments, including carbon emission appraisals, in reports to Cabinet and Council
  - Support Lancashire's Air Quality Champions network and request a city councillor to attend meetings
  - Commission a report from its pension funds and investments on levels of investment in the fossil fuel industry
  - Call upon local MPs to ensure government provides the powers, resources and funding to make this possible
- 11.2.19 **Policy DM30** of the Lancaster Local Plan Part Two requires high standards of design and construction through measures to reduce energy consumption, opportunities for energy supply on-site or decentralised, opportunities to contribute to local and community-led energy initiatives, and the re-use of existing resources, amongst other things.
- 11.2.20 Whilst the new local plan does seek to address climate change, it was far too far advanced in the local plan process to incorporate some of the actions and directions of the climate emergency declaration. Lancaster City Council is conducting an immediate Local Plan review to ensure that the aspects of this important agenda are adequately considered and include the necessary mitigation and adaptation measures necessary to address the climate emergency. The first consultation ended on 20th November 2020.

##### Assessment Methodology

- 11.2.21 This section of the chapter presents the following:
- Identification of the basis of the assessment presented in this chapter;
  - Feedback from consultation received with respect to GHG;

- The methodology behind the assessment of climate change effects (GHG), including the criteria for the determination of sensitivity of receptor and magnitude of change from the existing ‘baseline’ condition;
- An explanation as to how the identification and assessment of potential climate change effects has been reached; and
- The significance criteria and terminology for the assessment of residual effects from GHG emissions.

### 11.3. Basis of Assessment

- 11.3.1 An EIA Scoping request prepared by Stride Treglown was formally submitted to Lancaster City Council in January 2020. Details of this process can be found in Chapter 1: Introduction of this document. The Scoping Report identified the issues which would be addressed in the EIA and documented within the Environmental Statement (ES), outlining what should be ‘scoped in’ and ‘scoped out’ of the Environmental Statement.
- 11.3.2 This chapter draws on information presented in other chapters, mainly Chapters 8: Highways and Transportation and 9: Air Quality. These form the basis of the assessment of likely significant effects on climate presented in this chapter.

### 11.4. Consultation

- 11.4.1 A Scoping Letter was prepared and submitted to Lancaster City Council in January 2020. Under Regulation 2 (1) (part c) of the EIA Regulations, the Local Planning Authority circulated this EIA Scoping Letter to the relevant consultation bodies for their comment.
- 11.4.2 No methodology is provided regarding the assessment of effects of impacts due to the proposed development’s effect on the local area’s climate resilience. As a result, the Local Planning Authority was unable to provide any comment on the suitability of the approach..
- 11.4.3 An EIA Scoping Opinion was subsequently issued by Lancaster City Council on 6<sup>th</sup> April 2020.
- 11.4.4 With regards to climate change, the EIA Scoping Opinion states; *“Climate Change Adaption – this is an important component of the Environmental Statement as to how the development will be more climate resilient and make use of more low carbon resources”*.
- 11.4.5 This ‘Climate Change Adaption’ chapter is therefore included within the ES and sets out the impacts of the proposed development on sustainability and climate change.

### 11.5. Proposed Level and Scope of Assessment

#### Greenhouse gas (GHG) impact assessment

- 11.5.1 Potential impacts for the GHG assessment applicable to the proposed development are presented in **Table 11-1**.

**Table 11-1: Potential sources of GHG Emissions Relevant to the Proposed Development**

Lifecycle stage	Activity	Primary Emission Sources
Pre-construction	Land clearance	Loss of carbon sink
Product		Embodied GHG emissions in materials used for construction
Construction	On-site construction activity	GHG emissions from fuel consumption from mobile and stationary plant  GHG emissions from treatment of waste including water treatment
	Transport of construction materials	Fuel consumption from off-site transport
	Transport of construction workers	Fuel consumption from worker commuting
Maintenance		GHG emissions associated with maintenance works
Operation		GHG emissions from all significant energy/fuel using equipment, plus process emissions

### Study Area

- 11.5.2 The study area for the GHG assessment is the emissions arising within the red line boundary from the proposed development over the project lifecycle, from pre construction through to operation and maintenance, over the expected life of the development. This includes its effect on the identified receptor, which is the global climate itself. The UK's carbon inventory and associated five year National Carbon Budgets have been used as a proxy.
- 11.5.3 Notwithstanding the above, where activities within the red line boundary have an effect on GHG emissions outside this boundary, this needs to be taken into account as part of the GHG assessment. Examples include offsite transport of construction materials to the Site.

### Impact Assessment Methodology

- 11.5.4 The same methodology has been applied for determining construction and operational effects on GHG emissions resulting from the proposed development.

- 11.5.5 The baseline for the GHG emissions assessment is a business as usual scenario whereby the proposed development does not go ahead. Emissions from land clearance were not quantified in this assessment as the emissions from loss of carbon stock would be minimal due to the low carbon vegetation currently present on site and the planned landscaping included in the design.
- 11.5.6 The global climate has been identified as the receptor for the purposes of the GHG emissions impact assessment. However, to enable significance evaluation of the estimated GHG emissions arising from the proposed development, the UK GHG inventory and the corresponding 5 year UK carbon budgets were used as a proxy for the global climate.
- 11.5.7 There is no published standard definition for receptor sensitivity to GHG emissions set out in the IEMA guidance or elsewhere. The sensitivity of the receptor, the UK carbon budget (as a proxy for the global climate), has been defined as high. The rationale for this approach is as follows:
- Any additional GHG impacts could compromise the UK's ability to reduce its GHG emissions and therefore meet its future carbon budgets; and
  - Due to the extreme importance of limiting global warming to below 2°C this century, as broadly asserted by the International Paris Agreement and the climate science community.
- 11.5.8 The GHG assessment includes the calculation of GHG emissions from across the lifecycle of the project, i.e. from construction activities and materials and operation/use of the proposed development. It has been used to identify GHG 'hot spots' i.e. sources and activities likely to contribute the largest amount of GHG emissions. Correspondingly, this has enabled the identification of priority areas for mitigation. This approach is consistent with the principles set out in IEMA guidance.
- 11.5.9 In line with the GHG Protocol the GHG assessment presented in this chapter is reported as tonnes of carbon dioxide equivalent and considers the seven Kyoto Protocol gases, which are broadly referred to in this ES Chapter under an encompassing definition of 'GHG Emissions'.
- Carbon dioxide (CO<sub>2</sub>);
  - Methane (CH<sub>4</sub>);
  - Nitrous oxide (N<sub>2</sub>O);
  - Sulphur hexafluoride (SF<sub>6</sub>);
  - Hydrofluorocarbons (HFCs);
  - Perfluorocarbons (PFCs); and,
  - Nitrogen trifluoride (NF<sub>3</sub>).
- 11.5.10 Where activity data has allowed, expected GHG emissions arising from construction activities and embodied carbon in materials of the proposed development have been quantified using a calculation based methodology, as per the following equation as stated in the DEFRA 2018 emissions factors guidance and aligned with the GHG Protocol.

Activity data x GHG emissions factor = GHG emissions value

11.5.11 The emission factors used are selected from data published by the Department for Environment, Food and Rural Affairs (Defra) the Department of Business, Energy & Industrial Strategy's (DBEIS) UK Government GHG Conversion Factors for Company Reporting (Ref. 12 12) and the Inventory of Carbon and Energy (ICE) developed by Bath University.

11.5.12 Key activity data used to calculate emissions include:

- Embodied emissions within construction products;
- Transport of construction materials;
- Number of construction workers predicted and an assumed daily travel commute distance;
- Fuel used by the plant and machinery predicted for construction activities; and
- Energy consumption during operation.

## 11.6. Significance Criteria

11.6.1 Due to the absence of any defined industry guidance for assessing the magnitude of GHG impacts for EIA, standard GHG accounting and reporting principles have been followed to assess impact magnitude. In GHG accounting, it is common practice to consider exclusion of emission sources that are <1% of a given emissions inventory, on the basis of a 'de minimis' contribution. Both the Department of Energy and Climate Change (DECC) (Ref. 12 20) and Carbon Trust allow emission sources of a <1% contribution to be excluded from emission inventories and for these inventories to still be considered complete for verification purposes.

11.6.2 This would therefore suggest emissions of <1% of the UK inventory and a relevant annualised carbon budget could be considered to have a minimal contribution to the wider national GHG emissions. This approach has been used to assess the magnitude of the GHG emissions from the proposed development and the associated criteria are outlined in Table 11 2.

**Table 11-2: Description of Magnitude Criteria for GHG Emissions Assessment**

Magnitude of Change	Criteria Description
High	Estimated GHG emissions equate to more than 1% of total emissions across the 5 year UK Carbon Budget period in which they arise.
Low	Estimated GHG emissions equate to less than 1% of total emissions across the 5 year UK Carbon Budget period in which they arise.

11.6.3 The UK carbon budgets are in place to restrict the amount of GHG emissions the UK can legally emit in a defined five year period (Ref. 12 22). In assessing the significance of future GHG emissions, it is important to consider how they could affect the UK's ability to meet its carbon budgets. The significance criteria therefore reference the appropriate budget period in which the emissions arise. The UK is currently in the 3rd carbon budget period, which runs from 2018 to 2022.

- 11.6.4 The overall construction programme for the proposed development (2021-2027) falls within the 3rd and 4th carbon budgets.
- 11.6.5 The operational phase of the proposed development (fully operational and occupied by 2028) has been compared to the appropriate and available carbon budgets within the design life of the development. To date the UK has agreed up to the 5th carbon budget period which runs from 2028 to 2032.
- 11.6.6 Table 11-3 shows the current and future UK carbon budgets up to 2032, highlighting a reduction in the amount of greenhouse gas the UK can legally emit going into the future. Any source of emissions contributing to the UK's carbon inventory will have a more significant impact on the UK carbon budgets in the future.

**Table 11-3: Relevant Carbon Budgets for the GHG Emissions Assessment**

Carbon Budget	Total Budget (MtCO <sub>2</sub> e)
3 <sup>rd</sup> (2018-2022)	2,544
4 <sup>th</sup> (2023-2027)	1,950
5 <sup>th</sup> (2028-2032)	1,725

- 11.6.7 The significance of effects arising from GHG emissions has been determined using the matrix in Table 11-4. This differs from the criteria presented in Chapter 2: EIA Process by omitting the 'Very Low', 'Low' and 'Medium' categories for sensitivity and omitting the 'Very Low' and 'Medium' categories for magnitude.
- 11.6.8 This is because the sensitivity of the receptor (global climate) to increases in GHG emissions is always high, and the magnitude of the impact is determined by a threshold of less than or more than 1% of the relevant UK 5 year carbon budgets. This is in line with the IEMA guidance which states that the application of the standard EIA significance criteria is not considered to be appropriate for climate change mitigation assessments.
- 11.6.9 A GHG impact of equal to or greater than 1% of the relevant 5 year UK carbon budget would be considered significant and be rated 'Major' in accordance with Table 11.4.

**Table 11-4: Significance of Effects matrix for the GHG Emissions Assessment**

		Sensitivity	
		High	
<b>Magnitude</b>	Low	Minor	
	High	Major	

### 11.7. Assumptions and Limitations

- 11.7.1 Some aspects of the design have not been finalised at this stage. As a result, some data is not available to provide a quantified assessment of the GHG emissions from the construction and operation of the proposed development. The GHG assessment presented here is therefore a mix of quantitative and qualitative, according to data availability.
- 11.7.2 Emissions from land clearance were not quantified in this assessment as the emissions from loss of carbon stock would be minimal as the existing site consists of approximately 70 ha of low carbon vegetation and the landscaping in the design allows for replacement of carbon stock. Any net changes in carbon stock are expected to be small in comparison to the overall construction emissions.
- 11.7.3 There is expected to be a potential net increase in carbon stock as a result of landscaping, but this has not been quantified as the design is not finalised at this stage.
- 11.7.4 The construction period has been estimated to be 12-14 months. For the GHG assessment, this has been extended to 60 weeks.
- 11.7.5 HGV movements have been estimated as 20 per day for the busiest construction period (6 weeks duration) and 4 per week for the remainder of the construction period.
- 11.7.6 Building designs are not yet finalised therefore embodied GHG emissions from the materials used in the buildings have been estimated using RICS Benchmark data.
- 11.7.7 It has not been possible to quantify GHG emissions from worker commuting as estimates of worker numbers are not yet available.
- 11.7.8 A detailed construction plant schedule is not available at this stage. Only a qualitative assessment of emissions from on site construction activities can be provided.
- 11.7.9 An operational life of 60 years has been assumed for the proposed development, as this is typical of modern buildings.
- 11.7.10 The assessment of operational GHG emissions extends to energy use of on site facilities such as heating and lighting of internal areas and catering energy.

## 11.8. Baseline Environmental Conditions

### Greenhouse Gas (GHG) Assessment

- 11.8.1 The baseline for the GHG assessment is a 'business as usual' scenario where the proposed development is not progressed. The baseline comprises of existing carbon stock and sources of GHG emissions within the boundary of the existing site(s).
- 11.8.2 The GHG assessment considers all GHG emissions arising over the lifecycle of the scheme. This includes direct GHG emissions arising from activities within the proposed development and indirect emissions from activities outside the proposed development (e.g. transportation of materials to site, embedded carbon within construction materials).
- 11.8.3 Based on the existing use of the site(s), GHG emission sources and benefits would come from the following sources:
- Energy consumption;
  - Process emissions;
  - Carbon stock;
  - Waste generation;
  - Waste treatment (including water and drainage/run off); and
  - Employee commuting..

## 11.9. Assessment of Significant Effects

- 11.9.1 The assessment of the proposed development has been carried out based on a mix of qualitative and quantitative consideration of available information.
- 11.9.2 The total GHG emissions from the construction of the proposed development are estimated to be in the order of 596 tCO<sub>2</sub>e. The primary GHG emission sources and the breakdown of the estimated GHG emissions are presented in **Table 11-5**.

**Table 11- 5: Summary of total GHG emissions from the construction phase of the proposed development**

Lifecycle stage	Proposed Development Construction Emissions (tCO <sub>2</sub> e)	Associated GHG Impact
Land clearance	4	The existing site consist of approximately **ha of low carbon vegetation. The loss of carbon stock would therefore be low.

Lifecycle stage	Proposed Development Construction Emissions (tCO2e)	Associated GHG Impact
Product (Embodied Carbon)	556	The parking area will be ***sqm, consisting of an aggregate base, binder course and surface course. The embodied GHG emissions from these has been quantified. The on-site buildings will increase the embodied GHG emissions. In the absence of a detailed design, this has been assumed to be twice that of the parking area emissions.
Transport of construction materials to the proposed development site	13.3	Transport of materials and waste will be by HGV, with associated GHG emissions.
Worker commuting	10	Due to the location, worker commuting is expected to be by private car which has higher GHG emissions than public transport. However, commuting distances are expected to be relatively short, which will continue to keep the resultant emissions low.
On-site construction activity	6	During construction, there will be GHG emissions resulting from vehicle use, such as on-site plant and delivery of materials.
Transport of construction waste	7	There will be emissions from the transport and disposal of construction waste. Waste transport has been included in the emissions from HGVs above.
New carbon stock	Not known	It is expected that there would be a net increase in carbon stock as a result of the landscaping, but this has not been quantified as the design has not been finalised at this stage.
Total	596	

11.9.3 Once the proposed development is complete and occupied, total net GHG emissions over a 60 year life span are estimated to be in the order of 26,738. The primary GHG emissions sources and a breakdown of the estimated GHG emissions are shown in **Table 11-6** below.

**Table 11- 6: Summary of complete and occupied phase annual GHG emissions from the Proposed Development**

Lifecycle stage	Proposed development operation emissions (tCO <sub>2</sub> e)	Associated GHG impact
Energy consumption including process emissions (assumed 60 years)	24,522	During operation there will be GHG emissions from energy consumption of on-site facilities – heating and lighting of all internal areas and catering energy use within the market place.
Transport and disposal of operational waste	2182	There will be emissions arising from catering waste.
Maintenance	34	GHG emissions arising from maintenance activities will come from both energy and materials use. The operational life of the proposed development has been assumed as 60 years for the GHG assessment.
Baseline emissions	0	
Net annual total	26,738	

**Summary of overall effects of proposed development**

11.9.4 **Table 11-7** provides the context of the GHG emissions from the proposed development by comparison with the relevant UK Carbon Budgets. The relevant carbon budgets for this assessment are the 3rd (2018 2022), 4th (2023 2027) and 5th (2028 2032). The UK carbon budgets have only been developed up to 2032.

**Table 11- 7: Contribution of the Proposed Development to the UK national carbon budgets**

Carbon Budget (MtCO <sub>2</sub> )	Proportioned construction phase GHG emissions in budget periods (tCO <sub>2</sub> e)	Proportioned complete & occupied phase GHG emissions in budget periods (tCO <sub>2</sub> e)	Combined proportioned GHG emissions from the proposed development in budget periods (tCO <sub>2</sub> e)	% of Carbon budget
3rd: 2018 2022 (2544)	596	445	1,041	0.000044
4th: 2023 2027 (1950)		2,225	2,225	0.0001
5th: 2028 2032 (1725)		2,225	2,225	0.0001

11.9.5 Within each of the UK carbon budgets, the GHG emissions of the proposed development do not account for more than 1% of any of the individual five year carbon budgets, therefore the magnitude of the GHG emissions impact is considered to be low.

11.9.6 The sensitivity of the receptor (the global climate) is considered to be **minor adverse** and as such, the significance of the GHG emissions impact of the proposed development is considered to be **not significant**.

### Climate Change Resilience

#### Construction Impacts

11.9.7 During the construction process, receptors may be vulnerable to a range of climate risks. These are addressed by the mitigation measures in Section 11.12. Potential impacts during the construction phase could include:

- Inaccessible construction site due to severe weather events (flooding, snow and ice, storms) restricting working hours and delaying construction;
- Health and safety risks to the workforce during severe weather events;
- Unsuitable conditions (due to very hot weather or very wet weather, for example) for certain construction activities; and
- Damage to construction materials, plant and equipment, including damage to temporary buildings/facilities within the site boundary, such as offices, compounds, material storage areas and worksites, for example for example from stormy weather.

#### Operational Impacts

11.9.8 The Proposed Scheme also has the potential to be impacted upon by a changing climate and, in particular, more frequent severe weather events, in the medium to longer-term. These are addressed by the mitigation measures in Section 11.12. Potential impacts on the Proposed Scheme during the operational phase include:

- Material and asset deterioration due to high temperatures;
- Health and safety risks to road users;
- Damage to roads from periods of heavy rainfall; and
- Flood risk (surface, groundwater, fluvial and snow/ice melt) on the network and damage to drainage systems with the potential for increased runoff from adjacent land contributing to surface water flooding.

## 11.10. Consideration of Cumulative Effects

11.10.1 The identified receptor is the global climate and all development results in GHG emissions. Effects are not geographically constrained which means all development has the potential to result in a cumulative effect on GHG emissions. For this reason, it is not possible to define a study area and carry out a cumulative effects assessment for GHG emissions. As a result, consideration of the effects of the proposed development, together with other developments on GHG emissions, is not considered to be applicable.

## 11.11. Mitigation and Monitoring

### GHG Impact Assessment

11.11.1 A series of mitigation measures have been identified to reduce GHG emissions from the Proposed Scheme. These measures include:

- Where feasible, carrying out measures to reduce GHG emissions from material use and waste, including:
  - The sustainable reuse of soil and aggregate materials won from excavation;
  - The reuse, where possible of materials and waste generated from construction works;
  - The use of materials with lower embodied carbon, such as those with a higher recycled content;
  - Procuring locally sourced materials where reasonably practicable; and
  - Careful consideration of material quantity requirements to avoid over-ordering and generation of waste materials, while also reducing transportation-related emissions.
- The appointed contractor will develop and implement a plan to reduce energy consumption and GHG emissions throughout construction, including, for example:
  - Monitoring of fuel use on site;
  - Training of plant operatives in fuel efficient driving techniques; and
  - Consideration of renewable/ and or low carbon energy sources.

### Climate Change Resilience

11.11.2 A number of mitigation and adaptation measures to address the potential impacts associated with climate change are presented below. Many of these have been identified within other topic chapters and through the Scheme design. These measures include:

- Consideration of the dangers associated with working in more extreme weather conditions within the Construction Environmental Management Plan (CEMP) to be submitted at reserved matters stage;
- Consideration of the use of construction materials with superior properties (such as increased tolerance to fluctuating temperatures) to be included within detailed designs;
- Consideration of climate change projections within maintenance plans and drainage systems to protect against a return period of 1-in-200 years flood event;
- Inclusion of flood compensation areas and compensatory floodplain within the design to account for future climate change;
- Application of engineering design standards for safety of road users and structural stability;
- Procedures in place for severe weather events including, identification of suitable network redundancies and diversion routes; emergency response and contingency plans; and standard operating procedures for use in the event of necessary road closure and/or traffic diversion; and
- Regular maintenance of assets.

#### Summary of Mitigation Measures

11.11.3 **Table 11-8** below provides a summary of the climate change mitigation measures proposed.

**Table 11-8: Summary of climate change mitigation measures**

Phase	Description	Mitigation Purpose / Objective
Throughout proposed scheme	<p>Where feasible, carrying out measures to reduce GHG emissions from material use and waste, including:</p> <ul style="list-style-type: none"> <li>• The sustainable reuse of soil and aggregate materials won from excavation;</li> <li>• The reuse, where possible of materials and waste generated from construction works;</li> <li>• The use of materials with lower embodied carbon, such as those with a higher recycled content;</li> <li>• Procuring locally sourced materials where reasonably practicable; and</li> <li>• Careful consideration of material quantity requirements to avoid over-ordering and generation of waste materials, while also reducing transportation-related emissions.</li> </ul>	To reduce GHG emissions from material use and waste

Phase	Description	Mitigation Purpose / Objective
Throughout proposed scheme	<p>The appointed contractor will develop and implement a plan to reduce energy consumption and GHG emissions throughout construction, including, for example:</p> <ul style="list-style-type: none"> <li>• Monitoring of fuel use on site;</li> <li>• Training of plant operatives in fuel efficient driving techniques; and</li> <li>• Consideration of renewable/ and or low carbon energy sources.</li> </ul>	To reduce GHG emissions from energy and fuel use during construction.
Throughout proposed scheme	Consideration of the dangers associated with working in more extreme weather conditions within a CEMP to be submitted at reserved matters stage.	To reduce the vulnerability of workers to climate change risks
Throughout proposed scheme	Consideration of the use of construction materials with superior properties (such as increased tolerance to fluctuating temperatures) to be included within detailed designs	To reduce the vulnerability of the Proposed Scheme to climate change risks.
Throughout proposed scheme	Consideration of climate change projections within maintenance plans and drainage systems to protect against a return period of 1-in-100 years flood event.	To reduce the vulnerability of the Proposed Scheme to flooding.
Throughout proposed scheme	Inclusion of flood compensation areas and compensatory floodplain within the design to account for future climate change.	To reduce the vulnerability of the Proposed Scheme to flooding.
Throughout proposed scheme	Application of engineering design standards for safety of road users and structural stability	To reduce the vulnerability of the Proposed Scheme to climate change risks
Throughout proposed scheme	Regular maintenance of assets	To reduce the vulnerability of the Proposed Scheme to climate change risks.

Phase	Description	Mitigation Purpose / Objective
Throughout proposed scheme	<p>Procedures in place for severe weather events including:</p> <ul style="list-style-type: none"> <li>• Identification of suitable network redundancies and diversion routes;</li> <li>• Emergency response and contingency plans; and</li> <li>• Standard operating procedures for use in the event of necessary road closure and/or traffic diversion.</li> </ul>	To reduce the vulnerability of the Proposed Scheme to climate change risks.

## 11.12. Consideration of residual effects

11.12.1 There will be unavoidable GHG emissions resulting from the construction and operation of the Proposed Scheme; however, none of the effects are likely to be significant.

11.12.2 The proposed development has the potential to be impacted by a changing climate during construction and operation; however, mitigation measures are in place to reduce these risks. A summary of effects on climate change (GHG) and their significance has been outlined in **Table 11-9**.

**Table 11-9: Summary of impacts and effects from climate change on the proposed development**

Climate Event	Impact (climate event & hazard occurring together)	Mitigation	Likelihood	Consequence	Significance of effect
Sever weather events	Health and safety risks to road users and disrupted and/or inaccessible network.	<p>Identification of suitable network redundancies and diversion routes.</p> <p>Emergency response and contingency plans in place.</p> <p>Standard operating procedures in place for use in the event of necessary road closure and/or traffic diversion.</p> <p>Regular maintenance of drainage systems.</p>	Low	Moderate adverse	Not significant

Climate Event	Impact (climate event & hazard occurring together)	Mitigation	Likelihood	Consequence	Significance of effect
Gradual climate change  Severe weather events	Traffic related rutting and migration of materials	Consideration of the use of construction materials with superior properties which offer increased tolerance to fluctuating temperatures.	Low	Minor adverse	Not significant
Increased frequency of heavy precipitation events	Damage to roads, cuttings and drainage systems due to flooding.	Consideration of climate change projections within maintenance plans and drainage systems to protect against a return period of 1-in-100 years flood event.  Inclusion of flood compensation areas and compensatory floodplain within the design to account for future climate change.  Regular maintenance of assets to detect deterioration and damage.	Medium	Minor adverse	Not significant
Snow and ice  Increased frequency of heavy precipitation events  Increasing average temperatures and increasing frequency of hot days and heatwaves	Reduced pavement friction coefficient	Consideration of the use of construction materials with superior properties which offer increased tolerance to fluctuating temperatures.  Regular maintenance of assets to detect deterioration and damage and sweeping and cleaning to remove debris.	Low	Minor adverse	Not significant

Climate Event	Impact (climate event & hazard occurring together)	Mitigation	Likelihood	Consequence	Significance of effect
Increasing average temperatures and increasing frequency of hot days and heatwaves	Material and asset deterioration due to high temperatures.	<p>Consideration of use of construction materials with superior properties which offer increased tolerance to fluctuating temperatures.</p> <p>Regular maintenance of assets to detect deterioration and damage.</p>	Medium	Minor adverse	Not significant
Increasing average temperatures and increasing frequency of hot days and heatwaves.	Thermal expansion and movement of bridge joints and paved surfaces.	<p>Consideration of use of construction materials with superior properties which offer increased tolerance to high temperatures.</p> <p>Regular maintenance of assets to detect deterioration and damage.</p>	Low	Minor adverse	Not significant
Severe weather events	Reduced safety and visibility as a result of standing water	<p>Regular maintenance and cleaning of drainage systems.</p> <p>Emergency response and contingency plans in place.</p>	Low	Minor adverse	Not significant
Severe weather events	Safety risks due to snow and ice.	<p>Road user warning systems in place. Ensure effective, essential winter maintenance.</p> <p>Emergency response and contingency plans in place.</p> <p>Standard operating procedures in place for use in the event of necessary road closure and/or traffic diversion</p>	Low	Minor adverse	Not significant

## 11.13. Summary and Conclusions

11.13.1 **Table 11-9** above summarises the climate change impacts of the proposed development.

- 11.13.2 The proposed development complies with applicable legislation and national and local planning policy to reduce the vulnerability of the scheme to the impacts of climate change. Appropriate mitigation measures have been identified in order to align with these.
- 11.13.3 As no significant effects have been identified for the climate assessment, no monitoring of significant effects is proposed.