

18.0 Climate Change

Introduction

- 18.1 This chapter presents the findings of the Environmental Impact Assessment (EIA) concerning the potential climate change-related environmental effects of the proposed development. This assessment is based on the description of the proposed development as detailed within **Chapter 2.0** (Project Description) of the EIA Report (EIAR).
- 18.2 Climate change in the context of EIA can be considered broadly in two parts:
- The potential impact of changes in climate on the proposed development, which could affect it directly or could modify its other environmental impacts; and
 - The impact of greenhouse gas emissions (GHGs) caused directly or indirectly by the proposed development, which contribute to climate change.
- 18.3 This chapter is supported by information contained within the following appendices:
- Appendix 18.1 – Climate Change Risk Assessment (**Volume 2** of the EIAR); and
 - Appendix 18.2 – GHG Emissions Assessment (**Volume 2**).

Competency Statement

- 18.4 The preparation of this chapter has been led by Alice Paynter (BSc (Hons), PISEP), a Principal Consultant at RPS Consulting Services Ltd. Alice has over 5 years' experience in the assessment of GHGs and climate change within the context of EIA, with project experience across an array of developments (predominantly energy infrastructure, and large scale industrial and residential developments). The chapter has been reviewed by Andrew Tasker, Associate Director at RPS Consulting Services Ltd. Andrew has comprehensive experience and technical knowledge in the principles of sustainability, impacts of climate change, and carbon footprint analysis. He is a Member of ISEP and Chartered Environmentalist and is a member of a working group with the Institute of Sustainability and Environmental Professionals (ISEP, formerly IEMA) and is co-author of the latest version of the EIA GHG Assessment Guidance.

Legislation, Guidance and Policy

Introduction

- 18.5 A summary of key policy and legislation relevant to this chapter is detailed below.
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Legislative and Policy Framework

- 18.6 The Climate Change Act 2008, as amended by the Climate Change Act 2008 (2050 Target Amendment) Order 2019¹, creates a framework for setting a series of interim national carbon budgets and plans for national adaptation to climate risks. The Act requires the UK Government to set carbon budgets (a carbon budget places a restriction on the total amount of GHGs that the UK can emit over a 5-year period if the budget for the period is to be met) for the whole of the UK. At present, the Third, Fourth, Fifth and Sixth Carbon Budgets, set through the Carbon Budget Orders 2009, 2019, 2017 and 2021 are 2,544 mega tonnes carbon dioxide equivalent (MtCO_{2e}) for 2018 to 2022, 1,950 MtCO_{2e} for 2023 to 2027, 1,725 MtCO_{2e} for 2028 to 2032 and 965 MtCO_{2e} for 2033 to 2037 respectively. The Sixth Carbon Budget is the first Carbon Budget that is consistent with the UK's net zero target, requiring a 78% reduction in GHG emissions by 2035 from 1990 levels.
- 18.7 The Climate Change (Scotland) Act 2009² details the Scottish Government's ambitious climate change legislation including a 2045 net zero emissions target year and interim carbon targets based upon a climate change plan for a just transition. The Climate Change (Emissions Reduction Targets) (Scotland) Act 2024³ legislates for five-year carbon budgets to set climate targets. This replaces annual emissions targets. The Climate Change (Scotland) Act 2009 (Scottish Carbon Budgets) Amendment Regulations 2025⁴ indicates the proposed Scottish carbon budgets: 175 MtCO_{2e} for 2026-2030, 126 MtCO_{2e} for 2031 to 2035, 82 MtCO_{2e} for 2036 to 2040, and 24 MtCO_{2e} for 2041 to 2045.

National Planning Policy Context

National Planning Framework 4 (NPF4)

- 18.8 Overarching planning policies for Scotland are contained within the 'National Planning Framework 4' (NPF4)⁵
- 18.9 Part 1 – National Spatial Strategy for Scotland 2045 states that “*Scotland's future places will be net zero, nature-positive places that are designed to reduce emissions and adapt to the impacts of climate change, whilst protecting, recovering and restoring our environment.*” The strategy also states that “*low and zero carbon design and energy efficiency... and expansion of renewable energy generation*” will be encouraged.
- 18.10 Part 2 – National Planning Policy contains a number of policies relevant to the proposed development. The most relevant policies in regards to climate change are detailed below.

¹ Climate Change Act 2008 (2050 Target Amendment) Order 2019

² Climate Change (Scotland) Act 2009

³ Climate Change (Emissions Reduction Targets) (Scotland) Act 2024

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⁵ Scottish Government: National Planning Framework 4: February 2023

- 18.11 Policy 1: Tackling the climate and nature crises: *“When considering all development proposals, significant weight will be given to the global climate and nature crises”.*
- 18.12 Policy 2: Climate mitigation and adaptation:
- *“Development proposals will be sited and designed to minimise lifecycle greenhouse gas emissions as far as possible.*
 - *Development proposals will be sited and designed to adapt to current and future risks from climate change.*
 - *Development proposals to retrofit measures to existing developments that reduce emissions or support adaptation to climate change will be supported”.*
- 18.13 Policy 10: Development proposals in developed coastal areas will only be supported where the proposal:
- *“does not result in the need for further coastal protection measures taking into account future sea level change; or increase the risk to people of coastal flooding or coastal erosion, including through the loss of natural coastal defences including dune systems; and*
 - *is anticipated to be supportable in the long-term, taking into account projected climate change”.*

Heat in Buildings Strategy (2021)

- 18.14 The Heat in Buildings Strategy⁶ sets out the Scottish Government’s plans to reduce GHGs from Scotland’s homes and buildings.
- 18.15 The plan states that *“by 2045 all homes and buildings in Scotland must have significantly reduced their energy use, and almost all must be using a zero emissions heating system”.*
- 18.16 The aim is that by 2030, a substantial majority of buildings are expected to attain a high level of energy efficiency, and all residences should meet a standard equivalent to at least an Energy Performance Certificate (EPC) band C by 2033. The policy aims to achieve a 68% reduction in emissions from heating in buildings by 2030 compared to the levels observed in 2020. To achieve this, the Scottish Government has pledged £1.8bn in funding to help the transition towards net zero and help buildings move from fossil fuel-reliant heating systems.
- 18.17 The provisional New Renewable Heat Target requires a least 22% of heat in buildings to be directly supplied from renewable sources by 2030.

⁶ Scottish Government: Heat in Buildings Strategy: Achieving Net Zero Emissions in Scotland’s Buildings: 2021.

Energy Strategy and Just Transition Plan (Draft), 2023

- 18.18 The Energy Strategy and Just Transition Plan⁷, while still in draft, is relevant as it sets out policy positions and route map of actions with a focus out to 2030 and achieve net zero in Scotland by 2045.
- 18.19 In reference to zero-carbon infrastructure, the plan states “*We will support local authorities to produce their Local Heat and Energy Efficiency Strategies (LHEES) and Delivery Plans by providing capacity support training in partnership with Zero Waste Scotland*”.
- 18.20 “*Local Heat and Energy Efficiency Strategies (LHEES) are the principal mechanism for locally-led heat planning in Scotland. LHEES will support local planning, coordination and delivery of the heat transition and provide an area-based ‘blueprint’ for decarbonising buildings. All local authorities must produce LHEES Strategies and Delivery Plans by the end of 2023 and update them every five years.*”
- 18.21 The bill expresses the “*need to transform the way we heat our homes, workplaces, communities and other public buildings. This will involve using less energy by improving energy efficiency and moving to zero emissions heating systems.*”

Local Policy and Guidance

Dumfries and Galloway Council Local Development Plan 2 (LDP2)

- 18.22 Dumfries and Galloway Council adopted a second Local Development Plan⁸ in 2019, which “*provides the planning framework and guides the future use and development of land in towns, villages and the rural area*”.
- 18.23 The plan itself has the aims of transforming the area into “*a thriving region with a sustainable economy built on sustainable principles,*” and more specifically, transforming Stranraer Waterfront “*into a sustainable extension of the town centre*”.
- 18.24 Key policy for sustainable development is found within Policy OP1 and states that “*developers are expected and encouraged to embrace sustainable development – and this Plan assumes that ‘development’ always means ‘sustainable development’. Planning has an obligation to contribute towards sustainable development, sustainable economic growth, reducing the impact of climate change and creating high quality places*”
- 18.25 Policy OP1: Development Considerations: “*Development proposals should limit the impacts of climate change, support resilience, and promote sustainable development by:...*
Supporting reduction in carbon emissions through:

⁷ Scottish Government: Draft Energy Strategy and Just Transition Plan: 2023.

⁸ Dumfries and Galloway Council: Local Development Plan 2 (LDP2): 3 October 2019.

- *a reduction in carbon dioxide emissions through the introduction of energy efficiency measures and, where feasible, the installation of on-site renewable energy generation technology (information on this matter is provided in supplementary guidance: Design Quality and Placemaking);*
- *passive aspects of design, including consideration of: location, layout, orientation, massing, materials, detailed design, topography, and vegetation; and*
- *all new buildings being required to demonstrate that a proportion of the carbon emissions reduction standard set by Scottish Building Regulations will be met through the installation and operation of low and zero carbon technologies.”*

Climate Change emergency declaration 2019

- 18.26 Dumfries and Galloway Council declared a climate emergency, in 2019. Upon doing so, the official declaration read *“We recognise the challenges ahead to tackle climate change and, whilst we have already made significant strides towards achievement of a regional net zero carbon status, we will seek to achieve this outcome by the year 2025 and, wherever possible embrace opportunities to accelerate our target date”*.
- 18.27 The climate emergency declaration included a 12-point plan to *“reinvigorate the pursuit of net zero carbon emissions in our region”*.
- 18.28 This included elements such as pledges to *“urgently review all policy and practice across our council directorates and departments to identify ways in which we can move further and faster on carbon reduction measures”* and to *“embrace innovative measures and respond as a priority to technological advances which can reduce our region’s impact on climate change”*⁹.
- 18.29 Councillors retrospectively declared the 2025 target for reaching net zero to be overambitious and so in 2024, a new action plan was passed with updated targets to achieve net zero regionally on or before 2040, with a move to become a carbon negative region by 2045.

Carbon Neutral Strategic Plan

- 18.30 The Route Map to Carbon Neutral (Carbon Neutral Strategic Plan)¹⁰ aims to assess and plan ways in which the region can meet its net zero targets. This provides a strategic action plan to provide a route map to achieving net zero carbon emissions across the council area.
- 18.31 Its key aims are to:
- *“Empower our communities and stakeholders to make significant changes to reduce emissions and adapt to a low carbon approach*
 - *Lead on the transition to cleaner and greener technologies*

⁹ Dumfries and Galloway Council: Route Map for Carbon Neutral in Dumfries and Galloway: n/d

¹⁰ Dumfries and Galloway Council: Carbon Neutral Strategic Plan: 2021.

- *Promote and protect our region's natural environment*
- *Contribute to a greener economy, maximising the region's green energy potential*

18.32 The plan itself also has the goals of:

- *Significant improvements in energy efficiency in buildings.*
- *Installing zero carbon heating systems such as heat pumps and biomass.*
- *Replace gas or oil heated council buildings with renewable heating by 2024.*

Local Heat and Energy Efficiency Strategy (LHEES)

18.33 The Dumfries and Galloway LHEES¹¹ forms the Council's strategy for heat decarbonisation across the region. The area-focussed strategy was developed to plan and implement measure for low carbon heating and energy efficiency improvements.

18.34 Findings in the report included:

- *"A robust decarbonisation plan is required for the Older Buildings and Unconventional Construction, with specialist support and more specialist building modelling.*
- *Many buildings, both domestic and non-domestic, off the gas grid currently use oil or solid fuel and therefore should be prioritised for decarbonisation action.*
- *There are 14 potential heat network zones across the local authority, eight of which have medium or high opportunity of feasibility.*
- *Many buildings have significant opportunity for fabric-based retrofit and suitability for heat pumps which could be integrated into existing regeneration area plans."*

2024 Net Zero Targets

18.35 Dumfries and Galloway councillors agreed to establish two new net zero targets, which would supersede those created by the climate emergency declaration.

- Council to become Carbon Neutral by 2033; and
- The region aims to reach net zero carbon by 2040 and net negative carbon by 2045.

18.36 The council's actions between the declaration of climate emergency and the 2024 establishment of new net zero targets were environmentally positive and significant, as council carbon emissions fell by 51% between 2018 and 2023.

Relevant guidance

18.37 The main guidance used for the assessment of GHG emissions in EIA is the IEMA guide to 'Assessing Greenhouse Gas Emissions and Evaluating their Significance'¹².

¹¹ Dumfries and Galloway Council: Local Heat and Energy Efficiency Strategy. 2023

¹² IEMA: Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance: 2022

- 18.38 The main guidance document with regard to climate risk and resilience assessment is the IEMA Environmental Impact Assessment Guidance on: Climate Change Resilience & Adaptation¹³.
- 18.39 Additional guidance used for the quantification of GHG emissions has included:
- the Greenhouse Gas Protocol suite of documents produced by the World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD)¹⁴;
 - UK Government GHG Conversion Factors for Company Reporting¹⁵; and
 - PAS 2080 – Carbon Management in Buildings and Infrastructure¹⁶.

Methodology Used for Assessment

Introduction

- 18.40 This section of the Chapter details the consultation undertaken, study areas, assessment methodology used, and applicable significance criteria. Given the assessment is divided between the potential impact of changes in climate on the proposed development (i.e. climate change risk), and the impact of GHGs which contribute to climate change, appropriate detail and methodology for each assessment is provided below.

Climate Change Risk Assessment – Overview

- 18.41 The Climate Change Risk Assessment (CCRA) considers climate projections at the site for the period 2070-2099 against the 1981-2010 baseline. These projections use the latest available UK climate projections from the Met Office Hadley Centre's UK Climate Projections 2018 (UKCP18) probabilistic projections. A precautionary approach is used for the climate projections which consider a high emissions scenario, the Representative Concentration Pathway (RCP) 8.5 scenario. This scenario assumes a future where global emissions continue to rise unmitigated. The 50th percentile has been selected which represents an 'as likely as not' probability of change, in addition to the 10th and 90th percentiles, which represent lower and higher extreme values.
- 18.42 The assessment will consider activities associated with the operational phase of the proposed development. Activities during the construction and decommissioning phase are not considered in the assessment as the climate is unlikely to experience significant changes

¹³ IEMA: Environmental Impact Assessment Guidance on: Climate Change Resilience & Adaptation: 2020

¹⁴ WRI and WBCSD: The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard: 2004

¹⁵ Department for Energy Security and Net Zero (DESNZ) and Department for Environment, Food and Rural Affairs (Defra): UK Government GHG Conversion Factors for Company Reporting: 2025

¹⁶ British Standards Institution (BSI): PAS2080 – Carbon Management in Buildings and Infrastructure: 2023

compared to the current baseline during construction due to the likely short duration (up to 24 months). Furthermore, it is anticipated that work practices would evolve with time and with climatic variations, and would therefore be adapted to future climate conditions and weather in the UK through the adoption of appropriate good working practices.

- 18.43 Further detail on the CCRA methodology is described in Appendix 18.1: Climate Change Risk Assessment. Whilst the CCRA touches on flood risk, it has been addressed in further detail within the **Chapter 10.0** of the EIAR(Flood Risk).

GHG Emissions Assessment – Overview

- 18.44 GHG emissions have been estimated by applying published emissions factors to activities required for the proposed development. The emissions factors relate to a given level of activity, or amount of fuel, energy or materials used, to the mass of GHGs released as a consequence. The GHGs considered in this assessment are those in the ‘Kyoto basket’ of global warming gases expressed as their CO₂-equivalent (CO₂e) global warming potential (GWP). This is denoted by CO₂e units in emissions factors and calculation results. GWPs used are typically the 100-year factors in the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report¹⁷ or as otherwise defined for national reporting under the United Nations Framework Convention on Climate Change (UNFCCC).
- 18.45 This approach involves obtaining emissions factors that are the most relevant to activities as a consequence of the proposed development, and applying these to a given level of activity or materials to estimate embodied and operational GHG emissions. The following sources were relied upon for the assessment:
- UK Government GHG Conversion Factors for Company Reporting¹⁸;
 - the Greenhouse Gas Protocol suite of documents¹⁹;
 - OneClick Life Cycle Analysis (LCA) Software;
 - Whole life carbon assessment for the built environment²⁰; and
 - Inventory of Carbon and Energy (ICE) database²¹.
- 18.46 GHG emissions caused by an activity are often categorised into ‘Scope 1’, ‘Scope 2’ or ‘Scope 3’ emissions, following the guidance of the Greenhouse Gas Protocol suite of guidance documents²².

¹⁷ IPCC: Fifth Assessment Report: 2013

¹⁸ DESNZ and Defra: UK Government GHG Conversion Factors for Company Reporting: 2025

¹⁹ WRI and WBCSD: The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard: 2004

²⁰ Royal Institution of Chartered Surveyors (RICS): Whole life carbon assessment for the built environment: 2024

²¹ Jones and Hammond: Inventory of Carbon and Energy (ICE) Database: 2024

²² WRI and WBCSD: The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard: 2004

- Scope 1 emissions: released directly by the entity being assessed, e.g. from combustion of fuel at an installation;
- Scope 2 emissions: caused indirectly by consumption of imported energy, e.g. from generating electricity supplied through the national grid to an installation; and
- Scope 3 emissions: caused indirectly in the wider supply chain, e.g. in the upstream extraction, processing and transport of materials consumed or the downstream disposal of waste products from an installation.

- 18.47 This assessment has sought to include emissions from all three scopes, where this is material and reasonably possible from the information and emissions factors available, to capture the impacts attributable most completely to the proposed development. Although, it should be noted that emissions have not been broken down into scopes in the assessment as it is more useful to assess emissions when categorised into activities that result in emissions.
- 18.48 The assessment has considered (a) the GHG emissions arising from the proposed development, (b) any GHG emissions that it displaces or avoids, compared to the current or future baseline, and hence (c) the net impact on climate change due to these changes in GHG emissions overall.
- 18.49 Some construction phase GHG emissions associated with the manufacturing of components may occur outside the territorial boundary of the UK and hence outside the scope of the UK's national carbon budget. However, in recognition of the climate change effect of GHG emissions (wherever occurring) and the need, as identified in national policy, to avoid 'carbon leakage' overseas when reducing UK emissions, the full life-cycle GHG emissions of the proposed development, including construction phase emissions, have been evaluated where possible when determining the significance of effects.
- 18.50 Further detail on the GHG assessment methodology is described in **Volume 2, Appendix 18.2: GHG Emissions Assessment**.

Consultation

- 18.51 A scoping report for the proposed development was issued on 29 June 2021, including an outline methodology regarding air quality and climate change. The response from Marine Scotland – Licencing Operations Team was issued in February 2023. With regards to the climate change assessment, the following comments were received:

"The Scottish Ministers agree with the Applicant's proposal to undertake the climate assessment using the Institute of Environmental Management and Assessment ("IEMA") Assessing Greenhouse Gas ("GHG") Emissions and Evaluating their Significance document, and further advise that the Greenhouse gas Assessment should be based on a Life Cycle Assessment ("LCA") approach and note that the IEMA GHG Guidance provides further insight on this matter. The Scottish Ministers highlight however that this should include the pre-

construction, construction, operation and decommissioning phases, including consideration of the supply chain as well as benefits beyond the life cycle of the Proposed Works”.

18.52 A climate risk and resilience workshop was held with key stakeholders during the design phase of the proposed development on 29th April 2025. The Applicant (Dumfries and Galloway Council), appointed pre-construction contractors (Balfour Beatty Civil Engineering Limited (BBCEL)) and members of the design and environmental team attended to discuss likely climate risks to the proposed development and its users, and appropriate mitigation to manage the risk. The assessment (see Appendix 18.1: Climate Change Risk Assessment) has accounted for these discussions where relevant.

Study Area

Climate Change Risk Assessment

18.53 The climate change risk study area is the climate projections 25 km grid cell, from the Met Office UKCP18 probabilistic projections²³, in which the site is located.

GHG Emissions Assessment

18.54 GHG emissions have a global effect rather than directly affecting any specific local receptor. The assessment on climate change will therefore focus on the impact of GHG emissions on the global climate and be considered in the context of Government projections consistent with national carbon budget commitments.

Baseline conditions

Climate Change Risk Assessment

18.55 The baseline climate data has been sourced from the Met Office climate station located in West Freugh (Dumfries & Galloway)²⁴ as it is the closest located climate station to the proposed development and provides records of observed climate averages covering the climate period 1981-2010. The future climate baseline has been informed by the Met Office UKCP18 tool²⁵ and its probabilistic projections which consider future temperature and precipitation trends.

GHG Emissions Assessment

18.56 The current and future baseline conditions relevant to the proposed development with regards to the impact of GHGs comprise the following:

- any existing GHG sources or sinks from current land use; and

²³ Met Office Hadley Centre: UK Climate Projections User Interface: 2024

²⁴ Met Office: UK location-specific long-term averages - West Freugh: n/d

²⁵ Met Office Hadley Centre: UK Climate Projections User Interface: 2024

- the current and future baseline for electricity and other appropriate fuels emissions intensity, established through the use of published benchmarks.

Impact Assessment Methodology

Climate Change Risk Assessment

18.57 Risks associated with climate change were identified using the current and future climate baseline for the site location. The risk assessment and determination of significance considers the vulnerability and exposure of the proposed development and its users to climate hazards.

18.58 Risk in the context of climate risks is defined as the risk that a weather or climate event occurs and results in an adverse impact. Impacts due to weather and climate typically take two forms: sudden-onset (acute) or slow-onset due to cumulative events over time (chronic). For example:

- Risk of sudden-onset damage to an asset following an extreme weather-related event such as surface water flooding; and
- Risk that asset condition deteriorates below acceptable standards following years of changing seasonal weather.

18.59 Given the variability in the nature of the potential effects of climate change, receptors have been identified on a risk-specific basis, whereby all receptors relate to the long-term use of residential housing and the safety and comfort of occupants. To classify each risk, relevant climate hazards were identified using the obtained climate projections with consideration for exposure and vulnerability.

18.60 The relationship between exposure and vulnerability is the defining factor to overall significance. A location can be exposed to a certain hazard but may not be vulnerable. Vulnerability can also be considered alongside coping capacity, or lack thereof. The combination of the two, with the identified exposure will be used to assign a significance rating. **Table 18.1** outlines definitions for hazard, exposure and vulnerability and **Table 18.2** outlines the significance matrix that is used to define the overall risk of a climate hazard on specific receptors.

Table 18.1: Climate Change Risk Assessment scoring definitions

Factor	Score definitions
Hazard: refers to the possible, future occurrence of natural or human physical events that may have adverse effects on vulnerable and exposed elements. The presence of a hazard is identified and weighted based on the location's exposure to that hazard. For example, a hazard may occur within a particular scenario, however the relative exposure to that hazard is how it will be measured.	
Exposure: considers the nature of the impacts and the degree of certainty based on the	Major: large change to climate condition and large increase in the frequency of the event.

Factor	Score definitions
obtained climate projections. Exposure is necessary, but not determinant of risk. A site can be exposed but not vulnerable.	Moderate: a large, measurable change in climate conditions at a regular frequency.
	Minor: change in climate conditions that may have measurable effect on a receptor, but which are low likelihood of occurring or infrequent.
Vulnerability: the degree of vulnerability of each receptor to the hazard. Vulnerability can be seen as situation specific.	High: short term, acute impact to functionality or a large, measurable decrease in receptor lifespan following the occurrence of a climate impact. Major increase in the need for maintenance and repairs.
	Medium: measurable decrease in receptor performance or lifespan or increase in necessary maintenance and repairs following the occurrence of a climate impact.
	Low: small measurable impact to a receptor's performance following climate impact, or deterioration of a receptors. Lifespan due to a chronic effect.

Table 18.2: Climate Change Risk Assessment significance matrix

Vulnerability	Exposure			
		Major	Moderate	Minor
High		Significant	Significant	Significant
Medium		Significant	Significant	Not Significant
Low		Significant	Not Significant	Not Significant

GHG Emissions Assessment

Receptor Sensitivity

- 18.61 The GHG assessment considers a single sensitive receptor. The sensitive receptor is defined as the global atmospheric concentration of GHGs and it is characterised as having a 'high' sensitivity, given the severe consequences of climate change and cumulative contributions of other sources. GHG emissions have a global effect rather than directly affecting specific local receptors to which levels of sensitivity can be assigned. The global atmospheric concentration of the relevant GHGs, expressed in CO₂-equivalents (CO₂e), is therefore to be treated as a single receptor of high sensitivity (given the severe consequences of climate change).

Magnitude of Impact

18.62 As GHG emissions can be quantified directly and expressed based on their GWP as tonnes of CO₂e (tCO₂e) emitted, the magnitude of impact of the assessment of effects on climate change is reported numerically. Where a quantifiable figure is not possible this is expressed qualitatively.

Significance of Effects

18.63 Assessment guidance for GHG emissions²⁶ describes five levels of significance for emissions resulting from a development, each based on how a proposed development contributes towards achieving net zero by 2050. To aid in considering whether effects are significant, the guidance recommends that resultant GHG emissions should be contextualised against pre-determined carbon budgets, or emerging policy and performance standards where a budget is not available. It is a matter of professional judgement to integrate these sources of evidence and evaluate them in the context of significance.

18.64 Taking the guidance into account, the following factors have been considered in contextualising the proposed development's GHG emissions:

- The magnitude of gross and net GHG emissions as a percentage of national and local carbon budgets (where feasible);
- The consideration of any increase/reduction in absolute GHG emissions in connection with the proposed development compared with current baseline scenarios, including projections for future changes in those baselines; and
- Whether the proposed development contributes to, and is in line with, the UK's policy for GHG emissions reductions, where these are consistent with science-based commitments to limit global climate change to an internationally agreed level (as determined by the UK's Nationally Determined Contributions to the Paris Agreement²⁷).

18.65 Effects from GHG emissions are described within this chapter as adverse, negligible or beneficial based on the definitions presented in **Table 18.3**, as stated within the IEMA guidance²⁸.

Table 18.3: GHG assessment significance criteria and definitions

Significance Criteria	Definition
Major Adverse	The proposed development's GHG impacts would not be compatible with the UK's net zero trajectory. Its GHG impacts would not be mitigated or

²⁶ IEMA: Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance: 2022

²⁷ DESNZ and BEIS: UK's 2030 Nationally Determined Contribution (NDC) emissions reduction target under the Paris Agreement: 2022

²⁸ IEMA: Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance: 2022

Significance Criteria	Definition
	would be compliant only with do-minimum standards set through regulation. The proposed development may not provide further emissions reductions required by existing local and national policy for projects of this type.
Moderate Adverse	The proposed development's GHG impacts would not be compatible with the UK's net zero trajectory. Its GHG impacts would be partially mitigated and may partially meet the applicable existing and emerging policy requirements, however it would not fully contribute to decarbonisation in line with local and national policy goals for projects of this type.
Minor Adverse	The proposed development's GHG impacts would be compatible with the UK's 1.5°C trajectory and would comply with up-to-date policy and 'good practice' emissions reduction measures. The proposed development would fully comply with, or exceed, measures necessary to achieve the UK's net zero trajectory.
Negligible	The proposed development would achieve emissions mitigation that goes substantially beyond existing and emerging policy compatible with the 1.5°C trajectory and would have minimal emissions. The proposed development would be fully consistent with good practice design standards for projects of this type.
Beneficial	The proposed development would result in emissions reductions from the atmosphere, whether directly or indirectly, compared to the without-project baseline. As such, its net GHG impacts would be below zero. The proposed development would substantially exceed net zero requirements.

18.66 Major and moderate adverse effects are both identified to be 'significant', and professional judgement is applied to differentiate between the 'level' of significant adverse effects. Beneficial effects are also considered to be significant. Minor adverse and negligible effects are not considered to be significant.

18.67 GHG emissions associated with a proposed project are often reported as a whole life figure (net emissions) that takes account of all stages of the proposed development. The net whole life figure is the key element for determining the proposed development's whole life impact on climate change. However, it is noted in the IEMA guidance²⁹ that due to the nature of GHG emissions, it is good practice to include a section that reports on the whole life GHG emissions associated with the proposed development, alongside the sections that assess construction, operation, and decommissioning effects in isolation. This approach has been taken for the purpose of this assessment.

²⁹ IEMA: Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance: 2022

Limitations to Assessment

- 18.68 Construction phase GHG emissions associated with the manufacturing of infrastructure associated with the proposed development may occur outside the territorial boundary of the UK and hence outside the scope of the UK's national carbon budget, policy and governance. However, in recognition of the climate change effect of GHG emissions (globally occurring), and to avoid 'carbon leakage' overseas when reducing UK emissions, emissions associated with the construction phase have been presented within the assessment and quantification of GHG emissions, as part of a life cycle GHG emission assessment of the proposed development.
- 18.69 Movements of vessels (i.e. from fishing, leisure and commercial vessels) to and from the proposed development during its operational phase form a key emissions source associated with the use of the proposed development. However, there is some uncertainty regarding the calculation of such emissions. Leisure vessels may include both sailboats and motorboats, both of which would have greatly differing associated emissions due to fuel consumption associated with their use. Approximations of the mix of such vessels using the proposed development can be approximated, however some uncertainty would accompany this estimation. Furthermore, the distance travelled by such vessels from the proposed development and fuel consumed during that journey (i.e. fuel consumption would greatly depend on weather conditions with regards to sailboat journeys) is not known. Additionally, the regional extent to which emissions associated with vessel movements can be attributed to the proposed development is undefined.
- 18.70 In order to manage such uncertainties, fuel consumption from the new refuelling capability within the proposed development has been used to inform emissions from all vessel movements associated with the proposed development. It is noted that this methodology has its limitations: vessels may not refuel at the proposed development when visiting, those that do refuel may use fuel purchased at the proposed development across a wide geographic region and for trips to other marinas/destinations which in some part might occur regardless of whether this proposed development occurs. Despite this, 100% of the fuel consumption has been attributed to the proposed development within the assessment. Furthermore, annual fuel consumption by vessels at the proposed development has been estimated, and may present an underestimate (e.g. poor weather conditions may limit vessel movements and associated fuel consumption). Despite such uncertainties, it is considered that this methodology presents the most robust assessment of emissions associated with activities resulting from the proposed development.
- 18.71 Regarding fuel consumption by vessels at the existing marina (i.e. under baseline conditions), there is no current refuelling capability at the site. Due to the limitations set out above, it has not been possible to approximate emissions associated with baseline vessel movements. It is considered that this presents a conservative assessment, as all fuel consumption associated

with vessel movements from the proposed development will be considered as additional, and will be assessed in full within the assessment of effects.

- 18.72 Maintenance dredging will take place throughout the proposed development's operational lifetime to ensure access channels and berths are maintained at their designed depths. At this stage of the design, operational dredging schedules are currently unknown and will be determined throughout the operation of the proposed development. In order to account for indicative emissions associated with such activity within the assessment of operational GHG emissions, it has been conservatively assumed that dredging will take place annually, with one week-long dredging event (informed Chapter 7.0 of the EIAR (Coastal Processes)).
- 18.73 Emissions factors and UK fleet mix used for the calculation of emissions arising from the construction, operation and decommissioning of the proposed development are current, available at the time of writing, and as such do not account for any future decarbonisation. Therefore, emissions presented within the assessment indicate a conservative estimate which do not account for decarbonisation of the UK construction industry, the National Grid, or other fuels used during the construction, operation and decommissioning of the proposed development (e.g. petrol and diesel), and do not account for the increased ownership of electric vehicles within the UK fleet.
- 18.74 The specific design of the proposed development, and related bill of quantities disclosing material weights and volumes that would be used to construct the proposed development have been specified at a high level. Detailed LCAs are not yet available for all materials and products specified, as such, the conservative estimate of construction materials or fuels has been scaled by relevant emissions factors. Where used to calculate the embodied carbon associated with materials, emissions factors do not account for emissions associated with the manufacture of products, and as such may underestimate embodied carbon emissions. Therefore, there is a degree of uncertainty regarding the construction stage GHG emissions resulting from the manufacturing of the proposed development.
- 18.75 Where an estimated bill of material quantities was not available (i.e. regarding the new coastguard and marine research facility), published benchmark factors were scaled by building areas to reach resultant emissions.
- 18.76 When assessing climate risks, uncertainty arises from both modelling uncertainty and natural variability in the potential magnitude of future changes in climate. A high magnitude of change scenario and the high end of probabilistic projections have therefore been used, to provide a precautionary reasonable adverse approach. This is further discussed in Appendix 18.1: Climate Change Risk Assessment.
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Baseline Conditions

Climate Change Risk Assessment

Current Baseline Conditions

- 18.77 The baseline climate data has been sourced from the Met Office climate station located in West Freugh as it is the closest located climate station to the proposed development and provides records of observed climate averages covering the climate period 1981-2010 and reviewed alongside regional observational data averaged over the same period (Met Office, 2020). Observational climate averages data for the site shows:
- Highest monthly average maximum temperature is in July at 18.5°C. This is higher compared to regional figures in July (17.65°C for West Scotland) and lower than national figures (19.45°C for the UK);
 - Lowest monthly average minimum temperature is in February at 1.79°C. This is higher compared to regional and national figures in February (0.59°C for West Scotland, and 0.72°C for the UK);
 - Wettest month is October, with average rainfall of 128.47 mm. This is lower than the regional figure in October (200.38 mm for West Scotland) and slightly higher than the national figure (125.61 mm for the UK);
 - Annual average precipitation is 1,048.55 mm, lower than the regional figure of 1,773.82 mm for West Scotland and higher than the UK annual average precipitation of 1,141.95 mm; and
 - 159 days of rain (>1 mm falling in a day) are experienced on average every year, lower than regional (192) and slightly higher than the UK (156) averages.
- 18.78 Overall, the proposed development is located in an area that is warmer and drier than the wider region (West Scotland). Further detail can be found in **Appendix 18.1: Climate Change Risk Assessment (Volume 2)**.

Future Baseline Conditions

- 18.79 The UKCP18 probabilistic projections using the emissions pathway RCP8.5, as a precautionary approach, for the period 2070-2099 against the 1981-2010 baseline shows:
- Precipitation is projected to decrease by up to 43.6% during the summer and increase by up to 74.3% in winter.
 - In the driest month (May), precipitation is projected to decrease by up to 27.6%, whilst in the wettest month (October), precipitation is projected to increase by up to 74.3%.
 - The annual average temperature is projected to increase by 4.6°C, with the maximum temperature in the hottest month (July) projected to increase by up to

7.4°C. The minimum temperature in the coldest month (February) could also increase by up to 5.5°C.

- 18.80 Overall, the proposed development is located in an area that is projected to show increased variation in precipitation trends, leading to greater seasonal extremes and an increase in temperature across the year by the end of the century. Further detail can be found in **Appendix 18.1: Climate Change Risk Assessment**.

GHG Emissions Assessment

Current Baseline Conditions

- 18.81 The current baseline is the site of the proposed development's current use. The site of the proposed development consists of Stranraer Marina. The current marina has approximately 70 berths over two locations within the harbour, and includes a number of larger commercial and fishing vessel berths against the harbour wall. The existing harbour also comprises a Harbourmaster and Coastguard building and Fisherman's compound. As such, emissions are considered to arise from electricity consumption within the buildings on site and vessel charging, and from fuel consumption from vessel and vehicle movements to and from the existing marina.
- 18.82 Baseline electricity consumption has been sourced from recorded consumption data at the existing marina across the period from 2019 to 2025. Annual consumption has been averaged across the period to provide an annual average of 51,908 kWh. When scaled by the UK GHG factor for grid electricity³⁰, annual baseline emissions from electricity consumption total 9 tCO_{2e}.
- 18.83 As detailed at paragraph 18.71, emissions associated with baseline fuel consumption by vessel movements has not been quantified. While it is anticipated that baseline and proposed development fishing vessel movements will remain consistent, a conservative approach has been adopted whereby all fuel associated with vessel movements from the proposed development is considered to be additional to the baseline.
- 18.84 Emissions from baseline vehicle movements have not been quantified, however they have been accounted for within the calculation of emissions associated with movements arising from the proposed development, given vehicle movements that inform the calculation present only additional movements to the baseline.
- 18.85 'Blue carbon' is a term that refers to organic carbon that has been captured and stored through biological processes in the coastal and marine environment. Blue carbon can be stored within living biomass, root systems and sediments. Where habitats are lost or disturbed, this affects the habitat's ability to store and sequester blue carbon. For example, where organic sediments

³⁰ DESNZ and Defra: UK Government GHG Conversion Factors for Company Reporting: 2025

are disturbed and enter the water column, stored blue carbon within these organic sediments can be converted to CO₂ through a process called remineralisation³¹. Site specific surveys of the marina have been undertaken, which do not identify any evidence of carbon rich habitats such as seagrass beds. It is not anticipated that any of the existing sediments present a significant store of carbon due to the relatively small scale of the site, and the dredging programme undertaken historically at the marina. It is considered that such disturbance will have resulted in remineralisation of any stored carbon within the sediments disturbed, and removal of carbon from the site through the removal of any sediments. As such, it is considered that the blue carbon stock within the existing marina is negligible.

Future Baseline Conditions

- 18.86 The future baseline trend is towards the decarbonisation of the built environment and transport. This is based within the context of the 'climate emergency' as declared by the Dumfries and Galloway Council in 2019, and the reaffirmed commitments to the Paris Agreement targets within the recent Conference of Parties (COP27). Further, under the Climate Change (Scotland) Act 2009³², Scotland is committed to achieving net zero emissions nationally by 2045.
- 18.87 The future baseline GHG emissions for the site arising from electricity and fuel consumption are expected to remain similar to the current baseline. However, the future baseline encompasses changes in the baseline carbon intensity of factors such as electricity and fuels, and the embodied carbon in construction materials. All of these are expected to decrease over time in line with national decarbonisation policy goals. For the purpose of this assessment, present-day values have been used (appropriately representative of the construction period and initial year of operation) to be conservative, but it is noted that notwithstanding the specific mitigation for the proposed development, its operational emissions from electricity and fuel consumption are likely to decrease during its lifetime due to the decarbonisation of the electricity grid, and increased provision of low carbon fuels.
- 18.88 With regards to blue carbon, the future baseline GHG emissions are expected to remain similar to the current baseline identified in paragraph 18.85. There are limited published data available regarding blue carbon sequestration rates for sedimentary marine habitat types. However, it is acknowledged that blue carbon sequestration rates in marine habitats are lower than those of terrestrial habitats, in particular sediment-based habitats. The total annual sequestration capacity for Scotland's seabed sediments is currently unknown due to a lack of available data to constrain burial rate estimates³³. The future baseline in the absence of the proposed

³¹ Cunningham, C. and Hunt, C.: Scottish Blue Carbon – a literature review of the current evidence for Scotland's blue carbon habitats: 2023

³² Climate Change (Scotland) Act 2009

³³ Cunningham, C. and Hunt, C.: Scottish Blue Carbon – a literature review of the current evidence for Scotland's blue carbon habitats: 2023

development is likely to continue in line with existing use (i.e. an operational marina), therefore any accumulated carbon is likely to be disturbed by the continued use of the marina, likely resulting in negligible organic carbon accumulation. As such, no material change to the blue carbon stocks currently present within the proposed development site is anticipated in the future baseline.

Impact Assessment

Embedded Mitigation

GHG emissions

18.89 The following mitigations have been included in the design fix and are deemed relevant to the reduction of GHG emissions:

Operation

18.90 With regards to measures implemented to reduce operational emissions, these are largely limited to the implementation of the following design measures associated with the new coastguard and marine research facility, fully detailed within the accompany Statement of Energy reports (individual reports provided for the workshop, coastguard building, and research facility):

- Installation of all-electric heating and hot water system.
- Installation of mechanical ventilation with heat recovery.
- Low energy lighting (e.g. LEDs) will be utilised within buildings at the proposed development.
- Installation of solar PV on the roofs of the coastguard and marine research facility to enable 20% of regulated energy consumption³⁴ to be met through low or zero carbon generating technologies.
- The existing harbour reception building will be retrofit to enhance energy efficiency.

Climate Change Risk Assessment

Operation

18.91 The following mitigations have been included in the design fix and are deemed relevant to mitigation of climate risk associated with the proposed development:

- A Flood Risk Assessment prepared for the application (**Volume 1, Chapter 10.0: Flood Risk**) has been informed by a wave study and coastal flood modelling to identify a 1 in 200 year extreme sea levels, accounting for future climate change. This has been taken as the design flood level for the proposed development and has informed the drainage design at the proposed development. Further information is detailed at **Volume 1, Chapter 10.0: Flood Risk**;
- The existing breakwater will be extended, and will act as coastal flood protection for the proposed development. The design of the breakwater includes a climate change consideration as outlined above;

³⁴ Regulated energy consumption arises from the specification of controlled, fixed building services and fittings (i.e. including space heating and cooling, hot water, ventilation and lighting).

- Reclaimed land area is raised to provide additional flood protection (similar height to existing Port Rodie car park area);
- A flood evacuation plan will be implemented as part of the resilience measures and suite of management plans at the proposed development;
- A resilience management plan will be implemented for the operation of the proposed development as part of the resilience measures and suite of management plans;
- All buildings will be built in line with current building regulations for structural design with safety margin; and
- Appropriate ventilation will be accounted for within the design of the buildings.

Construction Phase

GHG Emissions Assessment

18.92 This section considers the embodied carbon emissions associated with the consumption of materials and fuel required to construct the proposed development.

18.93 The associated GHG emissions are dependent on the location (and associated energy mix) of where these processes are occurring. For the purposes of quantifying the GHG emissions associated with the proposed development during construction, the following elements of the proposed development have been assessed:

- Fuel berth;
- Marina access bridge;
- New pontoons;
- New workshops;
- New floating harbour/marina facilities;
- Retrofitting of existing harbour reception building;
- New Fisherman's compound;
- New quay wall (sheet piled);
- New coastguard and marine research facility (Solway Coast and Marine Pilot Project);
- Redeveloped public slipway;
- New car parking and community space on reclaimed land;
- Upgrades to Breastworks and Marine Lake car parks;
- Extension to the breakwater;
- Material transport; and;
- Site construction emissions (including dredging).

18.94 The manufacturing, transportation and installation of materials for the proposed development would result in both direct and indirect GHG emissions. GHG emissions arising from the

manufacturing of material components, in addition to the construction transport movements and site construction activity emissions have been presented in **Table 18.4** below.

- 18.95 Emissions associated with the manufacture of material components have been calculated by scaling an estimated bill of material quantities by appropriate emissions factors sourced from the ICE database. As stated at paragraph 18.75, where an estimated bill of material quantities was not available (i.e. regarding the new coastguard and marine research facility), published benchmark factors were scaled by building areas to reach resultant emissions.
- 18.96 Emissions associated with the transport of materials to site have been informed by construction vehicle movements (provided by the project team’s transport consultant), scaled by an approximate distance of travel and appropriate emissions factor³⁵.
- 18.97 Emissions arising from on-site construction activity has been informed by the onshore construction area, scaled by an appropriate published benchmark factor for construction site emissions³⁶. Dredging activity has been accounted for by approximating the number of movements required, and scaling such activity by appropriate vessel specifications and emissions factors.
- 18.98 Construction phase emissions associated with the floating harbour/marina facilities (i.e. a floating WC and shower facilities), retrofitting of existing harbour reception (i.e. enhancements to energy efficiency), and fisherman’s compound (i.e. additional fencing and hardstanding to expand existing compound) have not been quantified , as the works associated with such elements are considered to be minimal, and would not result in material emissions within the context of the wider proposed development.
- 18.99 Further detail on the calculations behind the results stated within **Table 18.4** can be found within **Volume 2, Appendix 18.2: Greenhouse Gas Technical Appendix**.

Table 18.4: Total construction phase emissions

Element	Total Construction Emissions (tCO ₂ e)
Fuel berth	25
Marina access bridge	178
Pontoons	206
New workshops	164
Floating harbour/marina facilities	n/a
Retrofitting of existing harbour reception building	n/a
Fisherman’s compound	n/a
New Quay Wall (sheet piles)	3,369
Coastguard and marine research facility	334

³⁵ DESNZ and Defra: UK Government GHG Conversion Factors for Company Reporting: 2025

³⁶ OneClick LCA: Average construction site impacts: 2025

Element	Total Construction Emissions (tCO ₂ e)
Redeveloped public slipway	637
New car parking and upgrades to Breastworks and Marine Lake car parks	219
Reclaimed land, breakwater, revetment	1,984
Material transport to site	17,182
Site emissions (onshore plant)	2,595
Site emissions (dredging)	1,577
Total	28,469

Magnitude of Impact

18.100 As detailed in **Table 18.4**, construction phase emissions considered for magnitude of impact of the proposed development is 28,469 tCO₂e.

Sensitivity of Receptor

18.101 GHG emissions have a global effect rather than directly affecting any specific local receptor to which a level of sensitivity can be assigned. The global atmospheric mass of the relevant GHGs and consequent warming potential, expressed in CO₂-equivalents, has therefore been treated as a single receptor of **high** sensitivity (given the severe consequence of global climate change and the cumulative contributions of all GHG emissions sources).

Significance of Effect

18.102 Some construction phase emissions may occur from associated construction materials supply chains outside the territorial scope of the UK's national carbon budget (or any local carbon budgets). Nevertheless, total construction phase emissions have been contextualised within this budget in order to assess their significance.

18.103 As GHG impacts are global, regardless of where the release point is geographically located, for the purpose of EIA the GHG impacts of the proposed development are assessed against the significance criteria in UK guidance and goals for emission reduction.

18.104 **Table 18.5** provides context against the relevant UK carbon budget and **Table 18.6** provides context against the proposed Scottish carbon budget. Construction activities are assumed to begin in 2026 with the first year of operation 2028, as such total construction phase emissions have been contextualised within the Fourth UK Carbon Budget (2023-2027).

18.105 The Tyndall Centre for Climate Change Research (2024) has recommended district-specific carbon budgets up to 2100 that, in its research, are considered to be compatible with a 1.5°C aligned trajectory for the UK. However, Tyndall Centre carbon budgets are for energy-related CO₂ emissions only and are therefore not directly relevant for construction-related emissions. It is not certain whether the construction materials will be sourced from within or outside the

UK, therefore local level budgets would not be representative. As such, only the UK carbon budget has been considered.

Table 18.5: Proposed construction emissions in the context of the UK Carbon Budgets

	UK 4th Carbon Budget: 2023-2027
Carbon Budget (tCO ₂ e)	1,950,000,000
Total Construction Emissions (tCO ₂ e)	28,469
Total Construction Emissions as % of budget	<0.01%

Table 18.6: Proposed construction emissions in the context of the proposed Scottish Carbon Budgets

	2026-2030
Carbon Budget (tCO ₂ e)	175,000,000
Total Construction Emissions (tCO ₂ e)	28,469
Total Construction Emissions as % of budget	0.02%

18.106 **Table 18.5** and **Table 18.6** highlight that construction phase emissions make a minor contribution to the UK national carbon budget for the 2023-2027 period, and the proposed Scottish carbon budget for the 2026-2030 period. To determine significance, local and national policy goals should also be taken into account, as assessed below.

18.107 In the absence of mitigation measures to reduce emissions associated with the construction phase, it cannot be concluded that the construction of the proposed development is in line with good construction practice aligned with a 1.5°C compatible trajectory towards net zero, despite the minor contribution of such construction phase emissions to national carbon budgets.

18.108 Therefore, considering the absence of emissions reduction measures, and the potential magnitude of GHG emissions set out in **Table 18.4**, the impact on the high sensitivity receptor would result in a moderate adverse effect, which is considered significant in EIA terms.

Operational Phase

Climate Change Risk Assessment

18.109 The CCRA (see **Volume 2, Appendix 18.1: Climate Change Risk Assessment**) identifies the following hazards:

- Increased frequency of coastal flood events;
- Increased frequency and intensity of extreme weather (i.e. storms);
- Increased intensity in seasonal precipitation (i.e. drier summers and wetter winters);
- Increased summer temperatures;

- Low winter temperatures resulting in freeze thaw events;
- Increased humidity as a result of increased annual precipitation; and
- Increased sea surface temperature.

18.110 In summary, these risks could lead to the following impacts on the proposed development and its users:

- damage to land-based infrastructure from increased incidence of flooding (coastal and surface flooding);
- damage to land- and marine-based infrastructure from storm surges, wave slam, and high winds;
- temporary power loss causing failure of the marina's operations and services;
- subsidence and coastal erosion resulting in structural damage of land- and marine-based infrastructure;
- damage to/reduced access to the proposed development, causing disruption to marina operations;
- degradation of land- and marine-based infrastructure;
- safety risk to users of the proposed development, both on land-based infrastructure and marine-based infrastructure (including within vessels); and
- health impacts on users of the proposed development, particularly within buildings, as a result of high temperatures.

18.111 The risk assessment presented in **Volume 2, Appendix 18.1: Climate Change Risk Assessment** considers embedded mitigation (detailed at paragraph 18.91) within its assessment of significance of effects. Should an effect be significant, further mitigation is presented where relevant to reduce the residual effect to negligible and not significant in EIA terms.

18.112 No impacts on the proposed development and its users from climate change have been identified as significant, accounting for embedded mitigation. As such, the effect on the proposed development has been determined to be negligible which is not significant in EIA terms.

GHG Emissions Assessment

18.113 The use of the proposed development will result in direct and indirect GHG emissions due to the use of electricity within the buildings, road traffic generated by the proposed development, and fuel consumed by vessels.

18.114 Emissions associated with the above emission sources is detailed below. For detailed calculation methodology for each item see **Volume 2, Appendix 18.2: GHG Emissions Assessment**.

- 18.115 With regards to the electricity consumption, Statement of Energy reports have been prepared as part of the planning application which detail the anticipated operational regulated energy consumption associated with the workshops, and coastguard and marine research facility buildings. Unregulated energy consumption³⁷ has been approximated, informed by national energy intensity metrics. Additional energy consumption associated with vessels berthed at the marina have been estimated using existing baseline energy consumption, scaled by the proposed number of berths.
- 18.116 Total estimated energy consumption has been scaled by the UK emissions factor for grid electricity³⁸, and amounts to 6 tCO₂e per annum (associated with the workshops, and coastguard and marine research facility buildings) and 21 tCO₂e per annum (associated with the vessels).
- 18.117 When compared to total baseline electricity consumption and associated emissions resulting from the existing site use, additional emissions arising from the proposed development total 18 tCO₂e.
- 18.118 Road traffic generated by the proposed development has been informed by the project team's transport consultant. As a result of the proposed Marina Extension an additional 253 two-way daily trips have been identified, and as a result of the coastguard and marine research facility an additional 84 two-way daily trips have been identified (both additional to baseline traffic movements resulting from the existing land use). Associated total approximately 130 tCO₂ per annum.
- 18.119 To approximate emissions associated with vessel movements to and from the proposed development, the total anticipated refuelling capability of the proposed development has been used. Two fuel tanks will be installed at the proposed development with a total capacity of 10,000 litres. Conservative assumptions of annual fuel sales have been scaled by appropriate emissions factors to approximate associated annual emissions arising from such fuel consumption, totalling 153 tCO₂e.
- 18.120 As stated at paragraph 18.70 to 18.71, such emissions present an approximate estimate informed by available information and should therefore be treated as an indicative emissions total associated with vessel activity.
- 18.121 In the absence of information regarding an operational dredging schedule, and for the purpose of this assessment to provide indicative emissions associated with activities likely to result from the proposed development, it has been conservatively assumed that dredging will take place annually, with one week-long dredging event (informed by Chapter 7.0: Coastal Processes of the EIAR). Such emissions have been approximated to total 35 tCO₂e annually.

³⁷ Unregulated energy consumption arises from building system or processes that are not 'controlled', i.e. from systems on which Building Regulations do not impose a requirement ((i.e. IT equipment, refrigeration systems, external lighting).

³⁸ DESNZ and Defra: UK Government GHG Conversion Factors for Company Reporting: 2025

It should be noted that this is a conservative assessment to provide context regarding potential emissions.

18.122 **Table 18.7** summarises annual operational phase emissions resulting from the proposed development. For additional information regarding methodology, see **Appendix 12.2: GHG Emissions Assessment (Volume 2)**.

Table 18.7: Annual operational phase emissions

Element	Annual Operational Emissions (tCO ₂ e)
Electricity consumption (additional to baseline)	18
Transport movements	130
Vessel movements	153
Dredging	35
Total	336

Magnitude of Impact

18.123 As detailed in **Table 18.7**, construction phase emissions considered for magnitude of impact of the proposed development is 336 tCO₂e.

Sensitivity of Receptor

18.124 GHG emissions have a global effect rather than directly affecting any specific local receptor to which a level of sensitivity can be assigned. The global atmospheric mass of the relevant GHGs and consequent warming potential, expressed in CO₂-equivalents, has therefore been treated as a single receptor of **high** sensitivity (given the severe consequence of global climate change and the cumulative contributions of all GHG emissions sources).

Significance of Effect

18.125 Operational activities are scheduled to begin in 2028, as such total operational phase emissions have been contextualised within the Fifth UK Carbon Budget (2028-2032) and Sixth Carbon Budget (2033-2037), see **Table 18.8**, and against the relevant Scottish carbon budget periods, see **Table 18.9**.

Table 18.8: Proposed operational emissions in the context of the UK Carbon Budgets

	UK 5 th Carbon Budget: 2028-2032	UK 6 th Carbon Budget: 2033-2037
Carbon Budget (tCO ₂ e)	1,725,000,000	965,000,000
Total Operational Emissions (tCO ₂ e)	1,679	1,679
Total Operational Emissions as % of budget	<0.001%	<0.001%

Table 18.9: Proposed operational emissions in the context of the proposed Scottish Carbon Budgets

	2026-2030	2031-2035	2036-2040	2041-2045
Carbon Budget (tCO ₂ e)	175,000,000	126,000,000	81,000,000	24,000,000
Total Operational Emissions (tCO ₂ e)	1,007	1,679	1,679	1,679
Total Operational Emissions as % of budget	<0.001%	0.001%	0.002%	0.007%

18.126 The Tyndall Centre for Climate Change Research (2024) has recommended district-specific carbon budgets up to 2100 that, in its research, are considered to be compatible with a 1.5°C aligned trajectory for the UK. **Table 18.10** presents the proposed development’s operational phase emissions against such budgets for Dumfries and Galloway.

Table 18.10: Proposed operational emissions in the context of Tyndall Centre local carbon budgets for Dumfries and Galloway

	2028-2032	2033-2037
Carbon Budget (tCO ₂ e)	1,300,000	600,000
Total Operational Emissions (tCO ₂ e)	1,679	1,679
Total Operational Emissions as % of budget	0.13%	0.28%

18.127 **Table 18.8**, **Table 18.9** and **Table 18.10** highlight that operational phase emissions make a minor contribution to the UK national carbon budget for the periods 2028-2032 and 2033-2037, and the proposed Scottish carbon budgets to 2045. To determine significance, local and national policy goals should also be taken into account, as assessed below.

18.128 Embedded mitigation measures outlined in paragraph 18.90 focus on reduction to emissions from the coastguard and marine research facility. Such mitigation enables an 30% to 100% reduction in annual regulated emissions compared to a business as usual scenario (see the Statement of Energy reports for full detail); it is considered that the measures constitute good construction practice aligned with a 1.5°C compatible trajectory towards net zero. As stated at paragraph 18.87, notwithstanding the specific mitigation, operational emissions from electricity consumption are likely to decrease over the proposed development’s lifetime due to the decarbonisation of the electricity grid.

18.129 Emissions arising from fuel consumption by vessels and vehicles are also anticipated to decarbonise alongside national policy targets for the decarbonisation of fuel. As detailed in paragraph 18.73, associated emissions have been calculated using the current UK fleet mix

and current emissions factors for associated fuels, and does not incorporate an increased proportion of zero emissions vehicles, or increased blending of biofuels.

- 18.130 Considering the embedded mitigation measures to reduce emissions associated with operational phase, potential magnitude of GHG emissions set out in **Table 18.7**, and context within national and local carbon budgets, the impact on the high sensitivity receptor would result in a minor adverse effect, which is considered not significant in EIA terms.

Decommissioning Phase

GHG Emissions Assessment

- 18.131 The majority of emissions during the decommissioning of the proposed development relate to the use of plant/equipment for decommissioning, disassembly, transportation to a waste site, and ultimate disposal and/or recycling of the site materials.
- 18.132 In the absence of detail regarding the decommissioning phase, it has been assumed that the sequence of activities will generally be the reverse of the construction phase, and will involve similar equipment.
- 18.133 The materials associated with the proposed development are considered to be highly recyclable. When disposing of materials, recycling is the preferred option. This not only prevents the materials from being sent to landfills, but also reduces the need for the extraction of primary materials. Material which cannot be recycled may be used for incineration or energy from waste. This will be detailed within the Construction (Design and Management) Pack to be developed at the construction phase for handover upon completion. As such, emissions associated with the disposal of materials at the end of their lifetime is considered to be immaterial and may even result in future avoided emissions. This impact is not assessed further.
- 18.134 In the absence of detailed information regarding transport and plant movements during the decommissioning phase, it has been assumed that such emissions equal those associated with the construction phase, totalling 19,777 tCO₂e. Given carbon emissions associated with the use of plant and fuel is expected to have achieved good levels of decarbonisation by the decommissioning phase, this is likely to present a conservative estimate of emissions not accounting for such decarbonisation.

Magnitude of Impact

- 18.135 Decommissioning phase emissions considered for the magnitude of impact of the proposed development is 19,777 tCO₂e.

Sensitivity of Receptor

- 18.136 GHG emissions have a global effect rather than directly affecting any specific local receptor to which a level of sensitivity can be assigned. The global atmospheric mass of the relevant GHGs and consequent warming potential, expressed in CO₂-equivalents, has therefore been

treated as a single receptor of **high** sensitivity (given the severe consequence of global climate change and the cumulative contributions of all GHG emissions sources).

Significance of Effect

18.137 The magnitude of emissions is unable to be contextualised within the UK Carbon Budgets, as required by paragraph 18.63 given the likely decommissioning phase falls outside of such budgets when the UK will have achieved net zero. It is expected that the decommissioning activities will have achieved good levels of decarbonisation in line with applicable policy requirements at that time. The impact on the high sensitivity receptor would result in a minor adverse effect, which is not significant in EIA terms.

Net Whole Life GHG Emissions

Magnitude of Impact

18.138 As set out in paragraph 18.67, consideration of the proposed development's whole life impact is an important consideration when assessing the proposed development's impacts and subsequent effects on climate change. As such, net GHG emissions from the proposed development (total construction, operational and decommissioning emissions) are presented in **Table 18.11**.

Table 18.11: Proposed Development Net GHG Impacts

	Lifetime Emissions (tCO₂e)
Construction emissions	28,469
Operational emissions (annual)	336
Decommissioning emissions	19,777
Net (whole life) emissions	48,582

Sensitivity of Receptor

18.139 GHG emissions have a global effect rather than directly affecting any specific local receptor to which a level of sensitivity can be assigned. The global atmospheric mass of the relevant GHGs and consequent warming potential, expressed in CO₂-equivalents, has therefore been treated as a single receptor of **high** sensitivity (given the severe consequence of global climate change and the cumulative contributions of all GHG emissions sources).

Significance of Effect

18.140 Consistent with paragraph 18.63, **Table 18.12** presents the net emissions in the context of the UK Carbon Budgets. Annual operational emissions have been scaled over the relevant periods. It should be noted that reported emissions (i.e. associated with electricity and fuel consumption) are anticipated to decarbonise alongside national policy targets. As such, the emissions presented represent a conservative estimate that do not account for such decarbonisation.

Table 18.12: Net emissions in the context of the UK Carbon Budgets

	UK 4 th Carbon Budget: 2023-2027	UK 5 th Carbon Budget: 2028-2032	UK 6 th Carbon Budget: 2033-2037
Carbon Budget (tCO ₂ e)	1,950,000,000	1,725,000,000	965,000,000
Total Whole Life Emissions (tCO ₂ e)	28,469	1,679	1,679
Total Whole Life Emissions as % of budget	<0.01%	<0.001%	<0.001%

Table 18.13: Net emissions in the context of the proposed Scottish Carbon Budgets

	2026-2030	2031-2035	2036-2040	2041-2045
Carbon Budget (tCO ₂ e)	175,000,000	26,000,000	81,000,000	24,000,000
Total Whole Life Emissions (tCO ₂ e)	29,477	1,679	1,679	1,679
Total Whole Life Emissions as % of budget	0.02%	0.001%	0.002%	0.007%

18.141 **Table 18.12** and **Table 18.13** highlight that net whole lifetime emissions make a minor contribution to the UK national carbon budget for the periods 2023-2027 and 2028-2032, and the proposed Scottish carbon budgets to 2045. To determine significance, local and national policy goals should also be taken into account, as assessed below.

18.142 Given the scale of construction phase emissions within the context of the proposed development's net whole lifetime emissions, and the lack of associated embedded mitigation to enable emissions reductions, it cannot be considered that the proposed development is aligned with a 1.5°C compatible trajectory towards net zero. This is despite the minor contribution of the proposed development's whole lifetime emissions within the context of national carbon budgets, and the inclusion of operational emissions reduction measures listed at paragraph 18.90.

18.143 Considering the embedded mitigation measures to reduce emissions associated with the proposed development's operational phase, and the absence of embedded mitigation to reduce emissions associated with the proposed development's construction phase, the potential magnitude of GHG emissions set out in **Table 18.11** on the high sensitivity receptor would result in a moderate adverse effect, which is considered significant in EIA terms.

Do Nothing Scenario

18.144 This section considers GHG emissions under a 'Do Nothing' scenario, should the proposed development not go ahead. Under the 'do nothing scenario' it is assumed the proposed development does not go ahead. The site would remain in its current use: an existing marina.

Climate Change Risk Assessment

18.145 In the absence of the construction and operation of the proposed development, climate risk and associated impacts to the existing site and its users would be consistent with those identified within Volume 2, Appendix 18.1: Climate Change Risk Assessment, and summarised at paragraph 18.109 and 18.110.

18.146 However, in contrast to the proposed development, the existing marina is not considered to be sufficiently adapted and resilient to such risks and associated impacts, given information regarding best practice climate resilience measures and climate projection data has evolved since the construction of the existing marina. As such, it is conservatively assumed that the impacts identified within Volume 2, Appendix 18.1: Climate Change Risk Assessment would result in significant effects, should the proposed development not be constructed.

GHG Emissions Assessment

Magnitude of Impact

18.147 In the absence of the construction and operation of the proposed development, emissions associated with the existing site use would be consistent with those detailed regarding the baseline conditions from paragraph 18.81, and are limited to the use of electricity consumption within existing buildings and by vessel charging, vessel and vehicle movements. Emissions associated with such electricity and fuel consumption would decarbonise in line with national net zero targets, i.e. through the decarbonisation of grid electricity, the increased use of electric vehicles, and the increased mix of biofuels and associated decarbonisation of fuels.

Sensitivity of the Receptor

18.148 GHG emissions have a global effect rather than directly affecting any specific local receptor to which a level of sensitivity can be assigned. The global atmospheric mass of the relevant GHGs and consequent warming potential, expressed in CO₂-equivalents, has therefore been treated as a single receptor of high sensitivity (given the severe consequence of global climate change and the cumulative contributions of all GHG emissions sources).

Significance of Effect

18.149 The magnitude of impact associated with the 'do nothing scenario' is deemed to be negligible, and is assessed as having a negligible effect on the highly sensitive receptor, which is not significant in EIA terms.

Mitigation, Monitoring and Residual Effects

Mitigation/ Monitoring

Construction

18.150 Good working practices during the construction phase are being defined through a Construction Environmental Management Plan (CEMP) which will ensure that, where feasible, emissions associated with the construction of the proposed development are minimised.

18.151 It should be noted that given the location and the use of the proposed development, flexibility regarding material procurement and associated emission reduction is more limited due to additional requirements imposed on the specification of materials for use in the marine environment. Therefore, the following practices will be explored and implemented where feasible to deliver emissions reductions:

- Consideration of low carbon criteria within procurement activities and in partnership with the supply chain through:
 - the preferential procurement of materials with recycled content, lower embodied carbon, use of fewer resources and virgin materials, and use of materials that can be re-used, and recycled or recovered;
 - the use of a sustainability heat map tool to guide procurement decision making towards lower carbon materials and products;
 - completion of a pre-demolition audit to identify existing materials and structures for re-use on-site (i.e. re-use of asphalt within the car park upgrades) and off-site;
 - re-use of dredged material within the reclaimed land area, when consenting allows;
 - sourcing of documents relating to the embodied carbon of the products and services provided (in the form of a Life Cycle Assessment (LCA), Environmental Product Declaration (EPD), or carbon analysis).
- Working with the supply chain and its partners to reduce emissions during construction through:
 - the requirement for suppliers to have an independently validated Science Based Target in place, or have submitted their Science Based Target Commitment letter (where contracts have a collective value of £5 million or greater per annum) by 2050;
 - the consideration of sustainable practices during the tender process.
- Efficient construction practices to reduce fuel consumption and associated emissions, including:
 - plant efficiency improvements, such as the use of telematics and/or real-time operator feedback, would be implemented to reduce fuel consumption;

- use of hybrid generators where feasible, which enable the use of battery storage to make energy supply to site more efficient;
- use of electric plant and fleet where available, alongside the generation of renewable energy on site to power such plant and construction activities where it is feasible to do so;
- continuous review of alternative fuels as they become viable for use;
- where practicable, pre-fabricated elements would be delivered to the site ready for assembly, which will reduce on-site construction waste and reduce vehicle movements as part of the construction process;
- construction materials should be sourced locally where practicable, to minimise the impact of transportation;
- vehicles used in road deliveries of materials, equipment and waste arisings on- and off-site would be loaded to full capacity to minimise the number of journeys associated with the transport of these items;
- all machinery and plant would be procured to adhere with emissions standards prevailing at the time and should be maintained in good repair to remain fuel efficient;
- when not in use, vehicles and plant machinery involved in site operations would be switched off to further reduce fuel consumption;
- where possible, local waste management facilities would be used to dispose of all waste arisings, to reduce distant travelled and associated emissions;
- the volume of waste generated would be minimised, and resource efficiency maximised, by applying the principles of the waste hierarchy throughout the construction period. Segregated waste storage should be employed to maximise recycling potential for materials; and
- procedures should be implemented to ensure that staff adhere to good energy management practices, e.g. through turning off lights, computers and heating/air conditioning units when leaving buildings.

18.152 No further mitigation regarding the operation and decommissioning phases is considered necessary because the likely effects, accounting for embedded mitigation, are not significant in EIA terms.

18.153 No monitoring associated with either the GHG emissions assessment or the climate change risk assessment is proposed.

Residual Effects

Construction

18.154 Construction mitigation measures detailed within paragraphs 18.150 to 18.151 focus on reductions to construction phase emissions through appropriate construction practices. While these measures have not been quantitatively assessed at this stage, it is considered that the

measures constitute good construction practice aligned with a 1.5°C compatible trajectory towards net zero.

18.155 Considering the mitigation measures to reduce emissions associated with construction practices, and the potential magnitude of GHG emissions set out in **Table 18.5**, the impact on the high sensitivity receptor would result in a minor adverse residual effect, which is considered not significant in EIA terms.

Operation

18.156 No residual effects are assessed within the above impact assessment, and as such no further detail is required.

Decommissioning

18.157 No residual effects are assessed within the above impact assessment, and as such no further detail is required.

Net Whole Life GHG Emissions

18.158 Construction embedded mitigation measures outlined in paragraphs 18.150 to 18.151 focus on reductions to construction phase emissions through appropriate construction practices, which are considered to constitute good construction practice aligned with a 1.5°C compatible trajectory towards net zero. Furthermore, embedded operational emissions reductions listed at paragraph 18.90 focus on reductions within the Applicant's control (i.e. associated with energy demand on site). Emissions arising from such consumption, alongside indirect emissions arising from fuel consumption by vessels and vehicles are anticipated to decarbonise alongside national policy targets. As such, the emissions presented represent a conservative estimate that do not account for such decarbonisation.

18.159 Considering the embedded and additional mitigation measures to reduce emissions across the proposed development's whole lifetime, the potential magnitude of GHG emissions set out in **Table 18.11** on the high sensitivity receptor would result in a minor adverse effect, which is considered not significant in EIA terms.

Cumulative Effects

- 18.160 This section assesses the likely significant effects of the proposed development on climate change receptors when considered in the context of other committed and reasonably foreseeable future projects within close proximity.
- 18.161 As is detailed within the IEMA guidance on assessing GHG emissions³⁹, all developments that emit, avoid or sequester GHGs have the potential to impact the atmospheric mass of GHGs as a receptor, and so may have a cumulative impact on climate change irrespective of geographic location. Consequently, cumulative effects due to other specific local development projects are not individually considered, but are taken into account when considering the impact of the proposed development by defining the atmospheric mass of GHGs as a high sensitivity receptor.

³⁹ IEMA: Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance: 2022

Summary and Conclusions

18.162 Climate change in the context of EIA can be considered broadly in two parts:

- The potential impact of changes in climate on the proposed development, which could affect it directly or could modify its other environmental impacts; and
- The impact of greenhouse gas emissions (GHGs) caused directly or indirectly by the proposed development, which contribute to climate change.

18.163 The potential risks to the proposed development from a changing climate have been assessed and reported, with the impact of the effects of climate change on the proposed development being established through a risk assessment process. The GHG emissions arising from the proposed development are characterised by a series of desk-based assessments using published data and benchmarks to determine the impact of the proposed development on climate change.

18.164 The assessment of climate risk during the construction and decommissioning phases of the proposed development have been scoped out of the assessment on the basis that it is anticipated that work practices will evolve with time and with climatic variations, and would therefore be adapted to future climatic conditions and weather in the UK through the adoption of appropriate good working practices.

18.165 The conclusions of the assessment for each phase of the proposed development are summarised below and within **Table 18.14**.

Construction Phase

18.166 Emissions associated with the construction of the proposed development have been calculated to total 28,469 tCO_{2e}. In the absence of embedded mitigation, it cannot be considered that the construction of the proposed development aligns with a 1.5°C compatible trajectory towards net zero and as such results in a moderate adverse residual effect which is significant in EIA terms.

18.167 Accounting for additional mitigation measures implemented to reduce construction phase emissions, while they cannot be quantified, it is considered that the construction of the proposed development aligns with construction good practice and a 1.5°C compatible trajectory towards net zero and as such results in a minor adverse residual effect which is not significant in EIA terms.

Operational Phase

18.168 The CCRA identified a number of impacts to the proposed development and its users as a result of risks such as the increased frequency of coastal flood events, extreme weather, intensity of seasonal precipitation and heightened temperatures. As a result of the embedded mitigation measures implemented to manage such impacts to the proposed development and

its users, no risks have been identified as significant. As such, the effect on the proposed development has been determined to be negligible, which is not significant in EIA terms.

- 18.169 Emissions associated with the operation of the proposed development have been calculated to total 336 tCO₂e per annum (additional to baseline emissions). Accounting for embedded mitigation measures implemented to reduce operational phase emissions, it is considered that the operation of the proposed development aligns with a 1.5°C compatible trajectory towards net zero and as such results in a minor adverse effect which is not significant in EIA terms.

Decommissioning Phase

- 18.170 Emissions associated with the decommissioning of the proposed development have been calculated to total 19,777 tCO₂e. Given carbon emissions associated with the use of plant and fuel is expected to have achieved good levels of decarbonisation by the decommissioning phase, and that the materials associated with the proposed development are considered to be highly recyclable, it is considered that the decommissioning of the proposed development aligns with a 1.5°C compatible trajectory towards net zero and as such results in a minor adverse effect which is not significant in EIA terms.

Net Whole Life GHG Emissions

- 18.171 Emissions associated with the net whole lifetime of the proposed development have been calculated to total 48,582 tCO₂e. Accounting for the embedded mitigation measures implemented to reduce operational emissions, and the absence of embedded mitigation measures to reduce construction phase emissions, it cannot be considered that emissions arising from the whole lifetime of the proposed development aligns with a 1.5°C compatible trajectory towards net zero and as such results in a moderate adverse residual effect which is significant in EIA terms.
- 18.172 Accounting for additional mitigation measures implemented to reduce construction phase emissions, it is considered that emissions arising from the whole lifetime of the proposed development aligns with a 1.5°C compatible trajectory towards net zero and as such results in a minor adverse residual effect which is not significant in EIA terms.

Cumulative Effects

- 18.173 All developments that emit GHGs have the potential to impact the atmospheric mass of GHGs as a receptor, and so may have a cumulative impact on climate change irrespective of geographic location. Consequently, cumulative effects due to other specific local development projects cannot be individually identified and assessed in accordance with the IEMA GHG in EIA Guidance. When evaluating the impact of the proposed development the atmospheric mass of GHGs has been defined as a high sensitivity receptor.

Table 18.14: Summary of effects

Impact	Phase			Embedded Mitigation	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Additional mitigation	Residual effect	Proposed monitoring
	C	O	D							
The impact of GHG emissions arising from the construction of the proposed development	✓	×	×	None	28,469 tCO ₂ e	High	Moderate adverse effect (significant)	Emissions reductions to be achieved through material procurement, supply chain engagement and efficient construction practices.	Minor adverse (not significant)	None
The impact of GHG emissions arising from the operation of the proposed development	×	✓	×	Energy efficiency measures (mechanical ventilation with heat recovery), low energy lighting, installation of solar PV.	336 tCO ₂ e (per annum)	High	Minor adverse effect (not significant)	None	Minor adverse effect (not significant)	None
The impact of GHG emissions arising from the decommissioning of the proposed development	×	×	✓	None	19,777 tCO ₂ e	High	Minor adverse effect (not significant)	None	Minor adverse effect (not significant)	None
The impact of GHG emissions arising from the net whole	✓	✓	✓	See above.	48,582 tCO ₂ e	High	Moderate adverse	See above	Minor adverse	None

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lifetime of the proposed development							effect (significant)		effect (not significant)	
The impact of climate change on the proposed development and its users.	x	✓	x	<ul style="list-style-type: none"> • Designed flood level accounting for future climate change events. • Breakwater designed including climate consideration. • Reclaimed land to provide additional flood protection. • Flood evacuation plan. • Resilience management plan. • Buildings in line with building regulations for structural design with safety margin. • Ventilation within buildings. 	n/a	n/a	Negligible	None	Negligible	None