Connah's Quay Low Carbon Power

Environmental Statement Volume II
Chapter 20: Climate Change

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20. Climate Change

20.1 Introduction

Overview

20.1.1 This chapter of the Environmental Statement (ES) presents an assessment of the likely significant environmental effects of the Connah's Quay Combined Cycle Gas Turbine (CCGT) fitted with Carbon Capture Plant (CCP) (hereafter referred to as the Proposed Development) with respect to Climate Change during the construction, operation (including maintenance), and decommissioning phases of the Proposed Development. A description of the Proposed Development, including details of maximum parameters, is set out in **Chapter 4: The Proposed Development** (**EN010166/APP/6.2.4**).

20.1.2 This Climate Change chapter includes three sub-assessments which are presented in turn:

- Lifecycle Greenhouse Gas (GHG) assessment – to identify the impacts of GHG emissions from the Proposed Development on the climate;
- Climate Change Resilience (CCR) assessment – to understand the vulnerability of the Proposed Development to the impacts of future climate change; and
- In-Combination Climate Change Impact (ICCI) assessment – to identify the combined impacts of climate change and the Proposed Development on receptors in the surrounding environment.

20.1.3 This chapter is supported by **Figure 3-3: Areas Described in the ES** (**EN010166/APP/6.3**) which identifies the different components of the Order limits which are referenced throughout this chapter.

20.1.4 This chapter is supported by the following appendices in **EN010166/APP/6.4**:

- **Appendix 1-A: Scoping Report**;
- **Appendix 1-B: Scoping Opinion**;
- **Appendix 2-B**: **Scoping Opinion Responses**;
- **Appendix 7-A: Legislative, Policy and Guidance Framework for Technical Topics**;
- **Appendix 20-A: Greenhouse Gas Baseline Data and Methodology Report**;
- **Appendix 20-B: Climate Change Resilience Baseline Data and Methodology Report**;
- **Appendix 20-C: Climate Change Resilience Assessment**;
- **Appendix 20-D**: **In-combination Climate Change Assessment**;
- **Appendix 20-E**: **Greenhouse Gas Reduction Strategy**; and

- **Appendix 20-F: Cumulative In-combination Climate Change Assessment.**

Legislation, Policy and Guidance

20.1.5 Legislation, planning policy, and guidance relating to Climate Change and pertinent to the Proposed Development are listed in **Table 20-1**. Further detail regarding these can be found in **Appendix 7-A: Legislative, Policy and Guidance Framework for Technical Topics** (**EN010166/APP/6.4**).

Table 20-1: Legislation, Planning Policy, and Guidance relating to Climate Change

Type	Legislation, Policy, and Guidance
International	• United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement (2016) (Ref 20-1); and • Kyoto Protocol (1997) (Ref 20-2).
Legislation	• Infrastructure Planning (Environmental Impact Assessment (EIA)) Regulations 2017 (Ref 20-3); • Climate Change Act 2008 (Part 1) (Ref 20-4); • The Climate Change Act 2008 (2050 Target Amendment) Order 2019 (Article 2) (Ref 20-5); • The Carbon Budget Order 2021 (Article 2) (Ref 20-6); • The Sixth Carbon Budget: The UK's Path to Net Zero (2020) (Ref 20-7); • The Climate Change (Interim Emissions Targets) (Wales) Regulations 2018 (Ref 20-8); • The Climate Change (Interim Emissions Targets) (Wales) (Amendment) Regulations 2021 (Article 2) (Ref 20-9); • Net Zero Wales Carbon Budget 2 (2021-25) (2021) (Ref 20-10); • Environment (Wales) Act 2016 (Part 2) (Ref 20-11); and • Well-being of Future Generations (Wales) Act 2015 (Part 2) (Ref 20-12).
National Planning Policy	• The Overarching National Policy Statement (NPS) for Energy (EN-1) (Ref 20-13); • The NPS for Natural Gas Electricity Generating Infrastructure (EN-2) (Ref 20-14); • The NPS for Natural Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) (Ref 20-15); • The NPS for Electricity Networks Infrastructure (EN-5) (Ref 20-16); • Planning Policy Wales (PPW) (Ref 20-17); • Our Green Future: Our 25-year Plan to Improve the Environment (2018) (Ref 20-18);

Type	Legislation, Policy, and Guidance
	• Net Zero Strategy: Build Back Greener (2021) (Ref 20-19); • British Energy Security Strategy (2021) (Ref 20-20); • Clean Growth Strategy (2017) (Ref 20-21); • Clean Growth Strategy: The UK CCUS Deployment Pathway - An Action Plan (2018) (Ref 20-22); and • Welsh Climate Change Adaptation Plan (2019) (Ref 20-23).
Local Planning Policy	• Flintshire County Council (FCC) Local Development Plan (LDP) (2015-2030) (Ref 20-24); and • FCC Climate Change Strategy 2022/23 – 2029/30 (Ref 20-25).
International Guidance	• EU Commission Notice (2021/C 373/01) Technical guidance on the climate proofing of infrastructure in the period 2021-2027 (Ref 20-26).
National Guidance	• IEMA[1]: EIA Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance (2022) (IEMA Guidance (GHG Assessment)) (Ref 20-27); • IEMA: EIA Guide to: Climate Change Resilience and Adaptation (2020) (Ref 20-28); • GHG Protocol (2015) (Ref 20-29); • Carbon Management in Infrastructure (PAS 2080) (2023) (Ref 20-30); • Think Hazard (last updated 2020) (Ref 20-31); • Royal Institute of Chartered Surveyors Whole Life Carbon Assessment (WLCA) for the Built Environment (2024) (Ref 20-32); and • Water: An Action Plan for Reducing Water Usage on Construction Sites (2011) (Ref 20-33).

20.2 Consultation and Scope of Assessment

Consultation

Scoping Opinion

20.2.1 A request for an EIA Scoping Opinion was sought from the Secretary of State (SoS) through the Planning Inspectorate (PINS) in February 2024 as part of the EIA Scoping Process. The EIA Scoping Opinion was adopted on 20 March 2024 (**Appendix 1-B: Scoping Opinion** (**EN010166/APP/6.4**)).

[1] The Institute of Environmental Management Assessment (IEMA) has changed its name to the Institute of Sustainability and Environmental Professionals (ISEP). Where general reference is made to the institute in this document, the following distinction has been made: ISEP (formerly IEMA). When referencing legacy IEMA documents, this distinction is not made.

20.2.2 Key issues raised in the EIA Scoping Opinion are summarised and responded to in **Appendix 2-B: Scoping Opinion Responses** (**EN010166/APP/6.4**). A summary of consultation undertaken in relation to the climate change assessment through the Scoping process is provided in **Table 20-2**.

Statutory Consultation

20.2.3 A summary of consultation undertaken in relation to the Climate Change assessment through the Statutory Consultation is provided in **Table 20-3** below.

Targeted Consultation

20.2.4 Following Statutory Consultation changes were made to the heights of the proposed absorber and HRSG stacks and the Applicant undertook further targeted consultation. This consultation included a Supporting Information Report which detailed the environmental considerations associated with these changes. This Targeted Consultation was held between Thursday 8 May to Friday 6 June 2025. Responses to this targeted consultation are presented in the **Consultation Report** (**EN010152/APP/5.1**) and **Table 20-4** below outlines how and where these comments have been addressed within this chapter.

Additional Technical Engagement

20.2.5 No further topic specific engagement has been undertaken outside the EIA process and Statutory Consultation process in relation to the climate change assessment.

Table 20-2: Scoping Opinion Responses

Comment ID	Consultee	Comment	Response
3.12.1	PINS	'*No matters have been proposed to be scoped out of the assessment.*'	**Appendix 20-A: Greenhouse Gas Baseline Data and Methodology Report** (**EN010166/APP/6.4**) and **Appendix 20-B: Climate Change Resilience Baseline Data and Methodology Report** (**EN010166/APP/6.4**) detail that all relevant climate related have matters have been scoped into this climate change assessment.
N/A	Natural Resources Wales	'*We are content with the proposed scoping for each of the three methodological aspects of climate change assessment and note that the relevant data sources, climate hazards and impacts are referred to that we would expect for this type of development. For climate, we note that no elements are scoped out and the categorisation and thresholds for significance are as standard. Therefore, we have no concerns to raise at this scoping stage.*'	This position on the scope of the assessment is acknowledged. Further details of the methodologies are provided in **Appendix 20-A: Greenhouse Gas Baseline Data and Methodology Report** (**EN010166/APP/6.4**) and **Appendix 20-B: Climate Change Resilience Baseline Data and Methodology Report** (**EN010166/APP/6.4**).

Table 20-3: Statutory Consultee Responses

Consultee	Comment	Response
FCC	'*The submitted environmental statement will need to have regard for Planning Policy Wales (PPW) (edition 12, 2024) and any relevant legislation and guidance such as relevant Technical Advice Notes that is in force/adopted in Wales. Also the application should have regard to the respective and relevant policies within the Flintshire Local Development Plan (LDP) adopted by the Council on 24 January 2023.*'	The noted policies have been considered within the Climate Change assessment, and these have been specifically addressed within **Table 20-1** of this chapter and **Appendix 7-A: Legislative, Policy and Guidance Framework for Technical Topics** (**EN010166/APP/6.4**). There are no Technical Advice Notes relevant to the Proposed Development.

Table 20-4: Targeted Consultation

Consultee	Summary of Comment	Response
Flint Town Council	The Council expects: • Transparent, accountable mitigation strategies for all identified environmental risks—including noise and vibration (e.g., from pile driving) in relation to nearby Listed Buildings; • Clear summaries of these assessments for public understanding; • Full details of compensation mechanisms available to adversely affected residents and businesses, including: – How compensation will be calculated; – Who will administer the scheme; and – How the public will be made aware of it. Additionally, the Council requests: • Clarification on how often the project's environmental performance will be reviewed, and how local residents will be kept informed of those findings.	Details of all mitigation and monitoring proposed is included within the **Commitments Register** (**EN010166/APP/6.10**).

20.3 Lifecycle Greenhouse Gas Assessment – Scope and Methodology

Scope of the Assessment

20.3.1 The scope of the assessment considered in this chapter is as follows:

Construction

- any site enabling works (including demolition activities);
- land use change;
- raw material extraction and manufacturing of construction products/materials;
- transport of products / materials to site;
- on-site construction activity;
- transport of construction workers;
- transportation and disposal of construction waste; and
- provision and treatment of water.

Operation

- consumptions of fuels on-site (i.e., the combustion of natural gas and diesel), including:
  - well-to-tank (WTT) emissions from upstream fuel supply chains; and
  - emissions associated with the potential unavailability of the carbon dioxide (CO_2) transport and storage (T&S) infrastructure connected to the HyNet industrial cluster (see paragraphs 4.2.25 to 4.2.35 of **Chapter 4: The Proposed Development** (**EN010166/APP/6.2.4**));
- consumption of grid electricity on-site;
- transport of operational workers;
- disposal and transportation of operational waste;
- raw material extraction and manufacturing of operational products/ materials (e.g., raw chemicals);
- transport of operational products/ materials to site;
- provision of mains water and treatment of wastewater; and
- building/infrastructure maintenance.

Decommissioning

- on-site decommissioning activity;
- transport of decommissioning workers;
- transportation and disposal of waste; and
- provision and treatment of water.

20.3.2 A detailed breakdown of the GHG assessment scope is given in **Appendix 20-A: Greenhouse Gas Baseline Data and Methodology Report** (**EN010166/APP/6.4**).

20.3.3 When considering the scope and boundary for inclusion of emissions within a GHG assessment it is standard accounting practice (i.e., PAS 2080) to exclude emissions sources that contribute or remove less than 1% to the total inventory as 'immaterial' (Ref 20-30).

Assessment Methodology

20.3.4 This section provides a summary of the Lifecycle GHG Assessment methodology. The scope of assessment considers the impacts and resultant effects during all phases of the Proposed Development.

20.3.5 A detailed breakdown of the Lifecycle GHG Assessment methodology can be found within **Appendix 20-A: Greenhouse Gas Baseline Data and Methodology Report** (**EN010166/APP/6.4**).

Impact Assessment

20.3.6 In alignment with the NPS EN-1 (paragraph 5.3.4) (Ref 20-13), this GHG assessment adopts a whole life approach. This includes the assessment of GHG impacts across the construction, operation, and eventual decommissioning of the Proposed Development.

20.3.7 The output of this assessment has been used to identify key GHG emissions hotspots across the Proposed Development's life cycle (i.e., sources likely to generate the largest impact in terms of GHG emissions). This enables priority areas for mitigation to be identified. This methodological approach is consistent with the assessment principles set out with in the IEMA Guidance (GHG Assessment) and PAS 2080 guidance (Ref 20-27; Ref 20-30).

20.3.8 Any assumptions, inclusions and exclusions that inform the GHG emissions calculation have been clearly described in the sections below.

Sensitive Receptors

20.3.9 The identified receptor for GHG emissions is the global climate. As the effects are not geographically constrained, all development has the potential to result in a cumulative effect on GHG emissions. The sensitivity of the global climate to GHG emissions is 'high' (see paragraph 1.2.11 of **Appendix 20-A: Greenhouse Gas Baseline Data and Methodology** (**EN010166/APP/6.4**) for further detail).

20.3.10 As stated below, both the UK and Welsh five-year Carbon Budget has been used as a proxy for the global climate. These Carbon Budgets are described within Table 2 and Table 3 of **Appendix 20-A: Greenhouse Gas Baseline Data and Methodology** (**EN010166/APP/6.4**).

Classification of Effects

20.3.11 In line with IEMA Guidance (GHG Assessment) (Ref 20-27), lifecycle GHG emissions from the Proposed Development have been contextualised against both the UK (Ref 20-6) and Welsh Carbon Budgets (Ref 20-9).

20.3.12 In addition, this aligns further with the NPS EN-1 requirements for GHG emissions (paragraph 5.3.4) (Ref 20-13), in which the impact of estimated lifecycle emissions from the Proposed Development on regional and national targets to limit climate change is assessed.

20.3.13 It is essential to note that supplementary carbon budgets have not been formally adopted by the UK Government beyond 2037[2]. Therefore, to illustrate the Proposed Development's progress towards the UK's net-zero target by 2050, the GHG Assessment has utilised the Committee on Climate Change's (CCCs) balanced net-zero pathway (as outlined within the UK's Sixth Carbon Budget, Ref 20-7) to contextualize GHG emissions post-2037.

20.3.14 Beyond 2050, it is expected that the UK will remain at net zero. This has been illustrated in Table 2 of **Appendix 20-A: Greenhouse Gas Baseline Data and Methodology** (**EN010166/APP/6.4**).

Significance of Effects

20.3.15 The criteria used to determine the significance of GHG emissions is summarised in **Table 20-5** below.

Table 20-5: Definition of Levels of Significance (Ref 20-27)

Significance	Effects	Description	Example in the IEMA Guidance (GHG Assessment)
Significant	Major adverse	A project that follows a 'business-as-usual' or 'do minimum' approach and is not compatible with the UK's net zero trajectory or accepted aligned practice or area-based transition targets. It is down to the practitioner to differentiate between the 'level' of significant adverse effects e.g. 'moderate' or 'major' adverse effects.	The project's GHG impacts are not mitigated or are only compliant with do-minimum standards set through regulation, and do not provide further reductions required by existing local and national policy for projects of this type. A project with major adverse effects is locking in emissions and does not make a meaningful contribution to the UK's trajectory towards net zero.
	Moderate adverse		The project's GHG impacts are partially mitigated and may partially meet the applicable existing and

[2] The Committee on Climate Change (CCC) has now advised figures for the UK's 7th Carbon Budget (2038-2042). However, at the time of writing, these figures are yet to be adopted by government or ratified by parliament.

Significance	Effects	Description	Example in the IEMA Guidance (GHG Assessment)
			emerging policy requirements but would not fully contribute to decarbonisation in line with local and national policy goals for projects of this type. A project with moderate adverse effects falls short of fully contributing to the UK's trajectory towards net zero.
Not significant	Minor adverse	A project that is compatible with the budgeted, science based 1.5 °C trajectory (in terms of rate of emissions reduction) and which complies with up-to-date policy and 'good practice' reduction measures to achieve that. It may have residual emissions but is doing enough to align with and contribute to the relevant transition scenario, keeping the UK on track towards net zero by 2050 with at least a 78% reduction by 2035, thereby potentially avoiding significant effects.	The project's GHG impacts would be fully consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type. A project with minor adverse effects is fully in line with measures necessary to achieve the UK's trajectory towards net zero.
	Negligible	A project that achieves emissions mitigation that goes substantially beyond the reduction trajectory, or substantially beyond existing and emerging policy compatible with that trajectory and has minimal residual emissions. This project	The project's GHG impacts would be reduced through measures that go well beyond existing and emerging policy and design standards for projects of this type, such that radical decarbonisation or net zero is achieved well

Significance	Effects	Description	Example in the IEMA Guidance (GHG Assessment)
		is playing a part in achieving the rate of transition required by nationally set policy commitments.	before 2050. A project with negligible effects provides GHG performance that is well 'ahead of the curve' for the trajectory towards net zero and has minimal residual emissions.
Significant	Beneficial	A project that causes GHG emissions to be avoided or removed from the atmosphere. Only projects that actively reverse (rather than only reduce) the risk of severe climate change can be judged as having a beneficial effect.	The project's net GHG impacts are below zero and it causes a reduction in atmospheric GHG concentration, whether directly or indirectly, compared to the without-project baseline. A project with beneficial effects substantially exceeds net zero requirements with a positive climate impact.

Rochdale Envelope

20.3.16 The setting of design parameters using the Rochdale Envelope approach is described in **Chapter 2: Assessment Methodology** (**EN010166/APP/6.2.2**). The maximum parameters for the principal components of the Proposed Development are set out in the **Design Principles Document** (**EN010166/APP/7.8**) and are illustrated on the **Works Plans** (**EN010166/APP/2.4**) and the **Parameter Plans** (**EN010166/APP/2.5**). These parameters, together with assumptions regarding the future plans for the existing Connah's Quay Power Station set out in **Chapter 2: Assessment Methodology** (**EN010166/APP/6.2.2**) have been used to inform the representative worst-case scenario that has been assessed in this chapter, in order to provide a robust assessment of the impacts and likely significance of environmental effects of the Proposed Development at its current stage of design.

20.3.17 In particular, the Rochdale Envelope approach has been used to estimate emissions across a simultaneous approach for the construction, operation, and decommissioning of the Proposed Development (i.e., both Trains 1 and 2 are constructed, commissioned, and decommissioned at the same time).

20.3.18 Under the operational Reference Case, the Proposed Development is assumed to be operational 24 hours a day, 7 days per week for 30 years. Information regarding maintenance schedules is not currently available, therefore running hours are assumed to be approximately 8,760 hours per year. This operational scenario represents a worst-case scenario for operational GHG emissions as it allows for an unconstrained operation of the

Proposed Development. In reality, the Proposed Development is expected to operate in a dispatchable mode to flexibly generate low-carbon energy when power from renewable sources can't meet demand. Therefore, under a dispatchable mode, annual operating hours are expected to decrease over time as the capacity and reliability of renewable generation increases (see **Chapter 4: The Proposed Development** (**EN010166/APP/6.2.4**)). This is explored further within paragraphs 20.6.31 to 20.6.34 of this chapter.

Assessment Assumptions and Limitations

20.3.19 At the time of submission of this chapter (July 2025), the Lifecycle GHG Assessment has been based on available information for the Proposed Development's construction and operational phases, commensurate with the application status. Available activity and materials data has been sourced from the Applicant.

20.3.20 The Lifecycle GHG Assessment assumes a simultaneous construction scenario whereby the construction of both CCGT trains begins in Q4 2031, as stated in section 5 of **Chapter 5: Construction Management and Programme** (**EN010166/APP/6.2.5**). This has been considered as a worst-case scenario for GHG emissions because it represents the latest date, following potential grant of development consent, by which the Proposed Development would be constructed and commissioned. In line with the future baseline scenario presented below, this demonstrates the longest period that the UK's marginal generating capacity is supplied by an existing unabated CCGT power station before being displaced by the Proposed Development.

20.3.21 As is typical practice, a series of assumptions have also been made where specific data sets are not available to conduct a robust assessment of the likely impacts of the Proposed Development on climate change. Assumptions used to assess the likely impact of GHG emissions across the construction, operational, and decommissioning phases have been detailed in paragraphs 20.6.3, 20.6.20, and 20.6.70 of this chapter respectively.

20.4 Lifecycle GHG Assessment – Baseline Conditions and Study Area

Study Area

20.4.1 The study area for the Lifecyle GHG Assessment includes:

- All direct GHG emissions arising from within the Order limits across the construction, operation, and decommissioning phases of the Proposed Development; and
- Indirect GHG emissions occurring outside of the Order limits but ultimately relate to the Proposed Development. For example, this includes embodied GHG emissions resulting from the upstream production and transportation of the construction materials, the upstream supply of fuel, waste processing and waste disposal.

20.4.2 Paragraph 20.3.1 provides an overview of the Lifecycle GHG Assessment scope across the construction, operational, and decommissioning phases of the Proposed Development. Further details of the assessment scope,

including considered primary emission sources, is given in **Appendix 20-A: Greenhouse Gas Baseline Data and Methodology Report** (**EN010166/APP/6.4**).

Existing Baseline

20.4.3 The existing baseline scenario for this GHG assessment comprises existing sources of GHG emissions i.e., the existing Connah's Quay Power Station in its current operating mode providing 1,380 MWe of dispatchable power to the National Grid, as described in **Chapter 2: Assessment Methodology** (**EN010166/APP/6.2.2**).

Future Baseline

20.4.4 The future baseline scenarios are set out in paragraph 2.2.20 of **Chapter 2: Assessment Methodology** (**EN010166/APP/6.2.2**).

20.4.5 The future baseline scenario for this assessment is a projected 'business as usual' scenario which represents the GHG emissions from activities that would occur should the Proposed Development not be consented.

20.4.6 Currently within the UK, the marginal generating capacity (i.e. generating technology which responds to changes in grid electricity demand) is provided by existing, unabated CCGT power stations (c. 30 gigawatts) (Ref 20-34). As these CCGTs provide generational capacity balance across the UK grid, it is reasonable to assume that every MWh of electrical energy provided by a similar, dispatchable low-carbon installation (such as the Proposed Development) is a MWh of electrical energy that does not have to be generated by an existing unabated CCGT. Existing unabated CCGTs have a carbon intensity of 0.354 tCO_2e/MWh (Ref 20-35), with this figure accounting for direct emissions attributed to CCGT operation. For the purposes of developing a comparable future baseline for this assessment, an existing unabated CCGT is assumed to have an uplifted carbon intensity figure of 0.412 tCO_2e/MWh to account for emissions from the upstream supply chain (Scope 3) of natural gas[3] (see **Plate 20-2**). Furthermore, the most recent average grid carbon intensity for electricity generation, including associated upstream WTT emissions[4], is 0.227 tCO_2e/MWh (see **Plate 20-2**).

20.4.7 To determine the net operational carbon impact against a future baseline, the carbon intensity of the Proposed Development has been determined and subsequently compared against the existing unabated CCGT and UK grid average carbon intensities in **Plate 20-2** of this chapter.

20.4.8 Whilst it is recognised that EN-1 (paragraph 4.9.25, Ref 20-13) requires all new commercial scale combustion power stations to be constructed Carbon Capture Ready, this assessment solely compares the operational GHG

[3] The carbon intensity of Scope 3 emissions has been estimated applying a ratio derived from published emissions factors for Scope 1 and Scope 3 emissions from natural gas, as published annually by the UK Government (Ref 20-34). The ratio so derived is 0.165, meaning that for every tonne of CO_2 directly emitted to the atmosphere in the unabated power station's flue gases, a further 0.165 tonnes will have been emitted through venting, flaring and fugitive emissions in the upstream natural gas supply chain.
[4] But *excluding* downstream transmission and distribution losses and associated WTT emissions.

impact of Proposed Development with an existing, unabated CCGT technology and not with new installations. It is existing, unabated gas-fired power stations, such as the existing Connah's Quay Power Station, that low-carbon installations such as the Proposed Development must ultimately displace in support of the UK's net zero ambitions.

20.4.9 The methodology for calculating GHG emissions has been consistently used across the baseline, construction, and operational phases of the Proposed Development, as described below.

20.5 Lifecycle GHG Assessment - Development Design and Embedded Mitigation

20.5.1 The Overarching National Policy Statement for Energy (EN-1) (paragraph 5.3.9) (Ref 20-13) notes that the Secretary of State should be content that an Applicant has taken all reasonable steps to reduce GHG emissions across the construction and decommissioning stage of a development (**Chapter 7: Planning Policy and Need** (**EN010166/APP/6.2.7**).

20.5.2 To align with this EN-1 requirement, the Proposed Development has been designed, as far as possible, to avoid or minimise GHG impacts and their resultant effects on the climate. This has been implemented through the process of design development, and by embedding GHG mitigation measures into the design of the Proposed Development; these measures are outlined below.

20.5.3 By its overall design (i.e., 95% carbon capture rate), the Proposed Development offers the opportunity to reduce the GHG emissions emitted from operation of the CCGT and to aid the targeted decarbonisation of electricity supply to the national grid. Captured carbon dioxide (CO_2) emissions from the CCGT are proposed to be compressed and conditioned for export to a T&S network operated by Liverpool Bay CCS Limited. As described in **Chapter 4: The Proposed Development** (**EN010166/APP/6.2.4**), captured and transported CO_2 is expected to flow into an offshore permanent geological store (i.e., depleted oil and gas fields within the Liverpool Bay), therefore mitigating the release of this CO_2 to the atmosphere.

20.5.4 The GHG Reduction Strategy, as detailed in **Appendix 20-E: Greenhouse Gas Reduction Strategy** (**EN010166/APP/6.4**), sets out how the GHG emissions associated with the Proposed Development should be managed and reduced, including a framework for identifying and prioritising GHG reduction opportunities. This strategy covers GHG reduction opportunities across the Proposed Development's construction, operation, and decommissioning phases.

20.5.5 Other embedded measures incorporated in the operational design of the Proposed Development are described in the ES, in particular **Chapter 4: The Proposed Development** (**EN010166/APP/6.2.4**).

Construction Phase

20.5.6 The following standard construction practices are relevant to this assessment:

- As described within **Chapter 5: Construction Programme and Management** (**EN010166/APP/6.2.5**), a **Framework Construction Environmental Management Plan** (**CEMP**) (**EN010166/APP/6.5**) has been prepared as part of the DCO application. The **Framework CEMP** (**EN010166/APP/6.5**) sets out the key measures to control, monitor and report energy and water consumption, and associated GHG emissions, during the construction phase. In addition, the **Framework CEMP** (**EN010166/APP/6.5**) includes a **Framework Site Waste Management Plan** (**SWMP**) which sets out how waste would be managed during construction and identifies opportunities to prevent waste and promote material reuse. A final CEMP and detailed SWMP would be prepared by the principal construction contractor in accordance with the **Framework CEMP** (**EN010166/APP/6.5**) prior to construction (paragraph 5.1.1 of **Chapter 5: Construction Programme and Management** (**EN010166/APP/6.2.5**)).
- Encourage the use of construction materials with lower embodied carbon emissions (i.e. higher recycled content); this will be a requirement of the final CEMP.
- Construction staff are anticipated to travel to the Proposed Development via the existing trunk road and local networks, as described within **Chapter 4: The Proposed Development** (**EN010166/APP/6.2.4**) and **Chapter 10: Traffic and Transport** (**EN010166/APP/6.2.10**). The Applicant would seek to maximize sustainable transport options, such as public transport (including rail), cycling and car sharing in accordance with policy. This has been outlined in the **Framework Construction Workers Travel Plan (CWTP)** (**EN010166/APP/6.7**) which has been included within the DCO application and would be secured through a requirement in the DCO.
- Where possible, avoiding routing connections through natural habitats. Where this cannot be avoided, landscape management approaches would be developed to deliver net biodiversity benefit and minimise losses of soil and vegetation stores.

Decommissioning Phase

20.5.7 The Proposed Development is expected to have a design life of up to 30 years, as a reasonable worst-case scenario for this GHG assessment. On this basis, decommissioning activities are currently anticipated to commence after 2065. This is alignment with the simultaneous construction scenario adopted as a worst-case scenario for GHG emissions. The reason for the selection of this scenario as a worst-case for GHG emissions is described within paragraph 20.3.20 above.

20.5.8 At the determined end of its operational life, the Proposed Development would be shut down, with all above ground structures on the Main Development Area removed, and the ground remediated as required to facilitate future re-use.

20.5.9 As noted above, decommissioning activities would take place later than the year 2050, when the UK is anticipated to be net-zero (Ref 20-6). At this stage of the Proposed Development's design, details regarding these activities have not been developed; therefore, quantifying associated emissions is not possible. However, emissions associated with the decommissioning of the Proposed Development would need to align with the UK and Welsh net-zero requirements, as portrayed within Table 2 and Table 3 of **Appendix 20-A: Greenhouse Gas Baseline Data and Methodology** (**EN010166/APP/6.4**).

20.5.10 Limited specific additional mitigation measures have been identified for the decommissioning phase of the Proposed Development due to uncertainties in the activities that would be undertaken, future emission factors, and technologies available. A Decommissioning Plan (including a Decommissioning Environmental Management Plan (DEMP)) would be produced and agreed to appropriate guidance and legislation at the time, and would likely include measures to reduce GHG emissions, for example encouraging the contractors to re-use or recycle the bulk of the plant, equipment, and materials.

Operational Phase

20.5.11 The following standard operational mitigation and design principles are relevant to this assessment:

- The design of the Proposed Development will be based on European Best Available Technique (BAT) reference documents (BRefs) for CCGT plants and UK Guidance on Emerging Techniques for Post-Combustion Carbon Capture (Ref 20-36), including energy efficiency requirements. The Environmental Permit application (developed post submission) would include a report setting out how the Proposed Development would meet these BAT requirements. The GHG assessment presented within this chapter has been modelled for high levels of thermal efficiency. Further details are provided in the **Contents and Agreements Position Statement** (**EN010166/APP/3.3**);
- The Applicant will be required to comply with the Environmental Permit which would contain provisions to ensure that energy is used efficiently across all activities, including energy generation, and to regularly review and record whether there are opportunities to improve energy efficiency and to take such identified measures where appropriate;
- To reduce emissions associated with operational worker commuting, sustainable forms of travel would be promoted by provision of cycle storage areas, as detailed in the **Framework CWTP** (**EN010166/APP/6.7**); and
- The Proposed Development would implement and maintain an Environmental Management System (EMS) which would be certified to ISO 14001. This EMS would outline the requirements and procedures required to manage operational emissions (e.g., water use, energy use/efficiency, waste) and to ensure that the Proposed Development is operating to the appropriate standard.

20.6 Lifecycle GHG Assessment – Assessment of Likely Impacts and Effects

20.6.1 This section presents the assessment of impacts and likely significant effects for the lifecycle GHG assessment. Taking into account the embedded mitigation measures (detailed in Section 20.5 above), the potential impacts and effects of the Proposed Development have been assessed using the methodology as detailed in Section 20.3 of this chapter and **Chapter 2: Assessment Methodology** (**EN010166/APP/6.2.2**).

20.6.2 A more detailed breakdown of lifecycle GHG emissions is provided in **Appendix 20-E: Greenhouse Gas Reduction Strategy** (**EN010166/APP/6.4**). The strategy also provides more detail on the GHG management process and GHG reduction opportunities.

Construction Phase

20.6.3 To assess the magnitude of construction GHG emissions attributed to the Proposed Development on the climate, emissions have been calculated on the basis of a number of assumptions.

20.6.4 GHG emissions attributed to the Proposed Development's construction have been estimated using project-specific data covering quantities of key construction materials (and their transport to the Order limits), grid electricity use, diesel fuel use, transportation of construction workers, and waste generation. Where project-specific data was unavailable/inadequate for in scope emission sources (e.g., construction water use), GHG emissions have been estimated using industry benchmarks. Total estimated construction GHG emissions are summarised in **Table 20-6**.

20.6.5 The main construction materials considered for this assessment include aggregates for earthworks and backfill, concrete for foundations and piles, steel for structural reinforcement and pipework, asphalt for roads, and titanium for heat exchangers (seawater cooling circuit). Total quantities of each material type have been multiplied by relevant emission factors from DESNZ 2025 (Ref 20-37) emissions factors, the ICE Database Version 4.0 (Ref 20-38), and SimaPro (Ref 20-39).

20.6.6 For the transport of construction materials to the Order limits, assumptions for return trip journeys (total kilometers (km)) by HGV deliveries have been made using transport scenarios sourced from the latest Royal Institute of Chartered Surveyors (RICS) Whole Life Carbon Assessment (WLCA) Guidance (Ref 20-32). GHG emissions attributed to construction material transport have been calculated using the DESNZ 2025 (Ref 20-37) emission factor for a 100% laden (i.e., loaded to maximum capacity) rigid HGV journey. This calculation includes WTT emissions associated with the extraction, refining, and transportation of vehicle fuels.

20.6.7 GHG Emissions attributed to construction worker transport has been based on an assumed 1,374 daily two-way construction worker vehicle movements to the order limits, as detailed within Section 5 of **Chapter 5: Construction Programme and Management** (**EN010166/APP/6.2.5**). In addition, it has been assumed that construction staff travel approximately 50 km (round trip). GHG emissions have been calculated using the DESNZ 2025 (Ref 20-37)

emission factor for an average diesel car, as a reasonable worst-case scenario for GHG emissions. As above, this calculation includes WTT emissions associated with the supply of vehicle fuels.

20.6.8 The main construction waste types considered for this assessment include surplus excavated soil, non-hazardous and inert waste, hazardous waste, and municipal waste. Total quantities of each waste type have been multiplied by relevant emission factors from DESNZ 2025 (Ref 20-37).

20.6.9 A figure for the total GHG emissions attributed to grid electricity consumption during construction (e.g., temporary construction welfare and office facilities) has been taken directly from calculations completed by the design team. This figure has been estimated using Chartered Institute of Building Service Engineers (CIBSE) Energy Benchmark data (Ref 20-40). Adopting a conservative assessment approach, this figure has been assumed to only encompass Scope 2 emissions attributed to grid electricity consumption, given the CIBSE guidance was published in 2008. Therefore, WTT (Scope 3) emissions from the upstream UK electricity supply chain (including those attributed to electricity generation and transmission and distribution (T&D) losses) have been estimated by applying a ratio (0.241) to the Scope 2 emissions figure. This accounts for emissions from upstream activities including electricity generation (i.e., the extraction, refining and transportation of primary fuels before their use in the generation of electricity) and transmission and distribution (T&D) losses across the UK grid. This ratio has been derived from published DESNZ 2025 emissions factors (Ref 20-37) for Scope 2 and Scope 3 emissions from UK electricity.

20.6.10 Terrestrial plant fuel use has been estimated based on an assumed total diesel consumption of 1,487,411 litres across the construction period. Estimated diesel consumption was obtained from the project design team and was multiplied by a DESNZ 2025 (Ref 20-37) emissions factor for diesel. As above, this calculation included the WTT emissions associated with the upstream fuel supply chain.

20.6.11 In relation to water consumption for the construction phase, the GHG impact has been estimated using the Forum for Construction's (Ref 20-33) benchmark of 148 m^3/£ millions of construction value. This figure was multiplied by the maximum capital expenditure (CAPEX) of the Proposed Development's construction value. This is a worst-case estimate as the benchmarked emissions factor relates to standard construction projects.

20.6.12 The GHG impact attributed to the demolition of existing structures within the Order limits has been estimated using the RICS WLCA (Ref 20-32) benchmark of 40 $kgCO_2e/m^2$ for construction activities. This figure is likely to be conservative without the consideration of embedded construction mitigations (e.g., use of lower carbon fuels) outlined in Section 20.5.6. The total floor area assumed for demolition is 5,804 m^2, including the gas treatment plant (GTP), existing GTP above ground installation (AGI), stores building, and temporary modular structures (and removal of temporary modular structures) (see Section 5 of **Chapter 5: Construction Programme and Management** (**EN010166/APP/6.2.5**)).

20.6.13 Section 5 of **Chapter 5: Construction Management and Programme** (**EN010166/APP/6.2.5**) notes the beginning of construction to be in late 2031

(i.e., Q4), under the simultaneous CCGT construction scenario. However, this assessment assumes construction activities, and associated emissions, occur across a full five-year period from 2031-2035 to produce a standard annualised figure for scaling. The simultaneous construction programme is visualised within Table 5-2 of **Chapter 5: Construction Management and Programme** (**EN010166/APP/6.2.5**).

Construction Emissions

20.6.14 As detailed in **Table 20-5**, total construction GHG emissions from the Proposed Development are estimated to be 467,733 tCO_2e; this is based on construction occurring over a full five-year period. The majority of emissions (96.36%) are attributed to the embodied carbon and transport of construction materials and products, with the remaining 3.59% and 0.05% resulting from construction and preconstruction activities respectively.

20.6.15 Assuming that emission-related activities are similar across the Proposed Development's five-year construction, annual emissions are estimated to be approximately 93,547 tCO_2e/year (**Table 20-6**). As these activities would not happen without the Proposed Development's construction, these emissions are considered additional to the existing baseline scenario (see Section 20.5).

Table 20-6: Construction GHG Emissions

Lifecycle stage	Project activity/ Emission source	Emissions (tCO_2e) over approximate 5-year construction period	Percentage of total emissions
Preconstruction	Demolition activities	232	0.05%
Production	Embodied carbon of material and products	413,914	96.36%
	Transport of products/materials to site	36,772	
Construction and Commissioning	Electricity use	223	3.59%
	Fuel use onsite	4,646	
	Waste disposal	253	
	Water consumption	43	
	Worker commuting	11,650	
Total GHG emissions over construction period (tCO_2e)		467,733	
Average annualised GHG emissions during construction (tCO_2e/year)		**93,547**	

20.6.16 The receptor of the Lifecycle GHG Assessment is the global climate. However, in line with IEMA Guidance (GHG Assessment), and in addition to the NPS EN-1's requirements for GHG emissions, construction emissions from the Proposed Development have been contextualised nationally against

the UK and Welsh Carbon Budgets (**Table 20-7**). For this exercise, it has been assumed that construction commences at the beginning of 2031, until the end of 2035 to contexulise emissions across a full five-year construction, to produce a standard annualised figure for scaling. This methodology is further described in **Appendix 20-A: Greenhouse Gas Baseline Data and Methodology Report** (**EN010166/APP/6.4**).

Table 20-7: Significance Assessment of Construction Phase Emissions

Year	Potential Construction Phase Emissions (Million Tonnes (Mt) CO_2e	Welsh Carbon Budget (Mt CO_2e)	Percentage Contribution of Emissions to the Welsh Carbon Budget	UK Carbon Budget (Mt CO_2e)	Percentage Contribution of Emissions to UK Carbon Budget
2031	0.09	Welsh Carbon Budget 3 (2031-2035) **83 $MtCO_2e$**	0.56%	5th Carbon Budget (2028-2032) **1,725 $MtCO_2e$**	0.011%
2032	0.09				
2033	0.09			6th Carbon Budget (2033-2037) **965 $MtCO_2e$**	0.03%
2034	0.09				
2035	0.09				
2036	0				
2037	0				

20.6.17 Assuming construction commences from the beginning of 2031 to 2035, construction emissions are estimated to contribute to 0.56% of the total Welsh Carbon Budget 3 (2031-2035) (**Table 20-7**).

20.6.18 Estimated construction emissions are expected to contribute 0.011% and 0.03% of the 5th (2028-2032) and 6th (2033-2037) UK Carbon Budgets respectively (**Table 20-7**).

Significance of GHG Emissions

20.6.19 The impact of construction emissions on the delivery of the Welsh and UK Carbon Budgets, which is of high sensitivity (see paragraph 20.3.9), has been assessed in alignment with IEMA guidance (GHG Assessment) to have a **minor adverse** effect, which is considered to be **not significant** (**Table 20-5**).

Operation Phase

20.6.20 To assess the magnitude of the Proposed Development's operational emissions on the climate, emissions have been calculated on the basis of a number of assumptions.

20.6.21 Like construction, estimates assume a simultaneous construction scenario, commissioning, and operation of the Proposed Development (Train 1 and 2) (see **Chapter 5: Construction Management and Programme** (**EN010166/APP/6.2.5**)). As noted within paragraph 20.6.13, this construction scenario is considered a reasonable worst-case for GHG emissions. For this scenario, the Proposed Development's operation lifetime is anticipated to last 30 years from 2036 to 2065.

20.6.22 The Proposed Development is assumed to be operational 24 hours a day, 7 days per week for 30 years. Information regarding maintenance schedules is not currently available, therefore running hours are assumed to be approximately 8,760 hours per year under the Reference Case (see paragraph 20.6.32). This has been adopted as a worst-case scenario for this GHG assessment as it allows for the assessment of unconstrained operation. As noted in Section 20.3.18, it is more likely that the Proposed Development operates in a dispatchable mode which flexibly generates low-carbon energy when power from renewable sources can't meet demand. Under this more realistic mode, annual operating hours are expected to decrease over time as the capacity and reliability of renewable generation increases (see **Chapter 4: The Proposed Development** (**EN010166/APP/6.2.4**)).

20.6.23 GHG emissions attributed to fuel-use onsite across the Proposed Development's operation have been based off the following assumptions and data sources:

- emissions from natural gas combustion in the CCGT have been calculated using Heat and Material Balance (HMB) tables developed by the AECOM design team; these tables provide CO_2 flow rates of treated exhaust flue gases (i.e., post CCP) for differing operational modes (Section 20.6.32);
- the abated CCGT units (i.e., Trains 1 and 2) would produce up to a likely net electrical output of 1,380 megawatts (MWe), accounting for the parasitic load of CCS elements;
- in the absence of suitable data, WTT emissions from the upstream natural gas supply chain have been estimated by applying a ratio (0.165) to the gross unabated CO_2 emissions from the HMB tables (above). This accounts for emissions from upstream activities including venting, flaring, and fugitive emissions. This ratio has been derived from published DESNZ 2025 emissions factors (Ref 20-37) for direct (Scope 1) and indirect (Scope 3) emissions from natural gas. These are emissions over which the undertaker has no control;
- the CO_2 transport and storage (T&S) system is assumed to have a 95% availability rate. To account for potential T&S unavailability, the CCGT is assumed to run unabated (i.e., without carbon capture) for 5% of the

Proposed Development's operation. This is considered a worst-case scenario for GHG emissions; and

- diesel consumption is assumed to be 50 tonnes/year, in line with requirements from a similar CCGT CCP project. Diesel is assumed to be used in the emergency generator and fire suppression system (including testing). Total diesel requirements across operation have been multiped by a DESNZ 2025 (Ref 20-37) emissions factor for liquid diesel. This calculation included WTT emissions associated with the extraction, refining, and transportation of raw fuels.

20.6.24 The main raw materials (e.g., chemicals and gases) required for the Proposed Development are assumed to be: monoethanolamine (carbon capture), sodium hydroxide (pH control and acid washing), sulphuric acid (pH control and acid washing), and nitrogen (purging gas). Embodied GHG emissions have been calculated by multiplying the total quantities of each chemical by relevant SimaPro emission factors (Ref 20-39).

20.6.25 GHG emissions from chemical delivery have been calculated based on 23 HGV tankers arriving on-site per week. Assuming the regional manufacturing of chemicals, each HGV travels 160 km round-trip. The total distance traveled (5,740,800 km) was multiplied by the DESNZ 2025 emission factor (Ref 20-37) for a 50% laden average HGV.

20.6.26 GHG emissions from grid electricity consumption have been based on the following assumptions. During normal operations, power is assumed to be provided by the CCGT. After shutdowns, the CCGT is expected to start from either 'hot' or 'cold' scenarios across the following assumptions:

- during start-up, the plant requires the supply of 130 MW from the national grid;
- hot start-ups last 30 minutes, while cold start-ups last 200 minutes; and
- hot start-ups account for 60% of total start-ups, and cold start-ups account for 40%.

20.6.27 The estimated grid electricity requirements for both start up scenarios have been multiplied by grid decarbonisation scenario emission factors (last updated, 2025) from the DESNZ (Ref 20-37) across the Proposed Development's 30-year operation. These calculations included emissions attributed to electricity generation and transmission losses.

20.6.28 The GHG assessment considered three main operational waste types: reflux purge, acid wash purge, and amine reclaimer sludge. Quantities of each waste type have been multiplied by DESNZ 2025 emission factors (Ref 20-37). Waste disposal is assumed to occur off-site, with GHG emissions from transport calculated using the DESNZ 2025 (Ref 20-37) emission factor for a 100% laden HGV on a 40 km round-trip.

20.6.29 GHG emissions from operational staff transport assume 66 workers commuting solo to the Proposed Development per day, each traveling an average of 50 km round-trip in a medium diesel car as a worst-case for GHG emissions. The total distance traveled has been multiplied by relevant emissions factors; calculations include WTT emissions from the supply of vehicle fuel (Ref 20-37).

20.6.30 GHG emissions from operational water consumption are based on an assumed potable water demand of 10 m³/h from the local water mains. This volume was multiplied by the DESNZ 2025 emissions factor for water supply (Ref 20-37). Demand for cooling and demineralised water has been excluded from this assessment, assuming it would be supplied from the nearby River Dee, resulting in minimal GHG emissions. In addition, estuarine water is assumed to be desalinised (for demineralised water production) using process waste heat, therefore not adding any further GHG emissions attributed to operational energy demand.

Operational Modes

20.6.31 The Proposed Development would operate in dispatchable and load following mode (i.e., being able to export power to match the anticipated intermittency of renewable power in the future power market), as per **Chapter 4: The Proposed Development** (**EN010166/APP/6.2.4**).

20.6.32 The three operating cases used to form the basis of this assessment are summarised below:

- **Reference Case**: The Proposed Development will operate as a constant baseload generator for up to c.8,760 hours per year at 100% full load with an approximate 95% carbon capture rate;
- **Dispatchable Case (High)**: The Proposed Development will operate in a dispatchable mode in accordance with decreasing load factors for CCGT CCS across a counterfactual energy pathway[5], as outlined within the National Energy System Operator (NESO) UK Future Energy Scenarios (FES) 2024 (Ref 20-41). For this assessment, the counterfactual energy pathway is noted as high in terms of the estimated operational GHG emissions. This is because the counterfactual energy pathway projects the highest load factors for CCGTs with CCS across all the energy pathways; therefore, representing higher emissions attributed to the Proposed Development's operation under a dispatchable case (see footnote[5] for further detail). Under this case, the Proposed Development will operate at 100% full load with an approximate 95% carbon capture rate; and
- **Dispatchable Case (Low)**: The Proposed Development will operate in a dispatchable mode in accordance with decreasing load factors for CCGT CCS across an 'electric engagement' energy pathway[6], as outlined within the NESO FES 2024 (Ref 20-41). The counterfactual energy pathway is noted as low in terms of the estimated operational GHG

[5] NESO's 'counterfactual' energy pathway represents a UK FES which misses the UK's net zero 2050 target, however some grid decarbonisation progress is made compared to current (2024) grid carbon intensities. This FES sees the least renewable capacity of all scenarios which features a remained heavy reliance fossil fuel, supplying 56% of energy demand across all UK sectors, with such being supplied predominately by natural gas (i.e., the Proposed Development) (Ref 20-41).

[6] NESO's 'electric engagement' energy pathway represents a UK FES which meets the UK's net zero 2050 target, mainly through the electrification demand. Under this FES, electricity supplies 66% of the UK's overall energy demand in 2050, with such being driven by consumer engagement, insulation, and efficiency gained through electrification. In addition, hydrogen provides 19% of the overall energy demands from UK industry, aviation, and shipping (Ref 20-41).

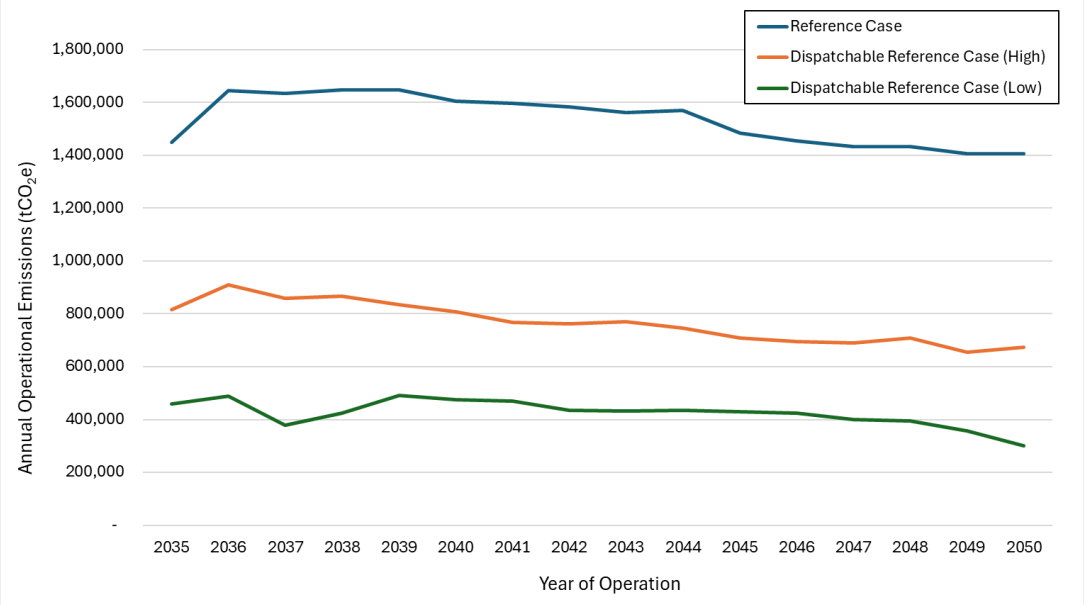
emissions. This is because the counterfactual energy pathway projects the lowest load factors for CCGTs with CCS across all the energy pathways; therefore, representing lower emissions attributed to the Proposed Development's operation under a dispatchable case (see footnote[6] for further detail). Like above, the Proposed Development will operate at 100% full load with an approximate 95% carbon capture rate.

20.6.33 Indicative operational emissions can be quantified for each operating case above (see **Plate 20-1**) based on the assumptions noted across paragraphs 20.6.21 to 20.6.30; this is explored further within Section 1.4 of **Appendix 20-A: Greenhouse Gas Baseline Data and Methodology Report** (**EN010166/APP/6.4**). However, it is the Reference Case that allows for the assessment of unconstrained operation (i.e., the worst-case scenario for GHG emissions); therefore, this operational case has been presented for this GHG assessment (see **Table 20-8**).

20.6.34 While the figures presented in this chapter represent the worst-case scenario for operational GHG emissions, it is more likely that the Proposed Development's operating hours will reduce over the course of its design life (i.e., more in line with the dispatchable cases noted above). This would more accurately reflect the Proposed Development's role in supporting the UK energy grid with firm low-carbon dispatchable power.

20.6.35 **Plate 20-1** provides a comparison of annual emissions attributed to the Proposed Development when operating under each of the three operating cases.

Plate 20-1: Comparison of Estimated Annual Emissions Attributed to the Operation of the Proposed Development Under Each Operating Case.



Operational Emissions (Reference Case)

20.6.36 Under the reference case for operation, total GHG emissions across the Proposed Development's 30-year operation are estimated to be 42,654,595 tCO_2e (**Table 20-8**); this accounts for a 95% carbon capture rate. The majority of operational emissions (~90%) are estimated to result from the upstream supply and combustion of natural gas (**Table 20-8**). Average

annual emissions over the 30-year design life of the Proposed Development are estimated to be approximately 1,421,820 tCO_2e/year (**Table 20-8**).

20.6.37 For assessment purposes, this annual figure is expected to remain constant over the entire operational period, therefore this is the worst-case assessment for annual carbon emissions (as noted in paragraph 20.6.22).

Table 20-8: Operational GHG Emissions (Reference Case)

Project activity/ Emission source	Emissions (tCO_2e) over 30-year operation period				Percentage of total
	Scope 1[7]	Scope 2[8]	Scope 3[9]	Total	
Grid Electricity Use	n/a	2,332,359	788,232	**3,120,591**	7%
Fuel Usage (CCGT emissions and other fuels)	6,653,318[a]	n/a	31,590,077[b]	**38,243,395**	90%
Waste Disposal	n/a	n/a	6,456	**6,456**	<1%
Worker Commuting	n/a	n/a	7,556	**7,556**	<1%
Raw Material Demand	n/a	n/a	1,270,383	**1,270,383**	3%
Raw Material Transport	n/a	n/a	5,813	**5,813**	<1%
Water Consumption	n/a	n/a	402	**402**	<1%
Total GHG emissions over operation period (tCO_2e)				42,654,595	
Average annualised GHG emissions during operation (based on 30-year life) (tCO_2e/year)				**1,421,820**	

a. Accounts for the direct emissions from on-site combustion of natural gas (assuming a 95% carbon capture rate) and diesel.
b. Accounts for the indirect emissions attributed to the natural gas and diesel supply chains, and the unavailability of the T&S system.

[7] Scope 1 emissions: Direct GHG emissions from sources that an organisation owns or controls (e.g., emissions from on-site fuel combustion).
[8] Scope 2 emissions: indirect GHG emissions from the generation of purchased electricity, steam, heating, and cooling consumed by the organisation.
[9] Scope 3 emissions: All other indirect GHG emissions that occur in the value chain of an organisation; this includes both upstream and downstream activities.

20.6.38 A breakdown and comparison of estimated operational emissions across each Proposed Development operating case (i.e., Reference Case, Dispatchable Case (High), and Dispatchable Case (Low)) has been provided within Table 5 of **Appendix 20-A**: **Greenhouse Gas Baseline Data and Methodology Report** (**EN010166/APP/6.4**).

Net Operational Carbon

20.6.39 The net benefit of the Proposed Development is centered on the anticipated capture and subsequent storage of approximately 95% of the direct emissions from the on-site combustion of natural gas (e.g., CCGT exhaust emissions) (**Chapter 4: The Proposed Development** (**EN010166/APP/6.4**)). The use of carbon capture and storage on dispatchable gas-fired generation is a key technology that will enable the UK, and more specifically Wales, to transition towards net-zero emissions by 2050; this includes the development of resilient electricity networks powered by low-carbon renewable generation technologies.

20.6.40 As noted within Section 20.4.3, the future baseline scenario for this assessment represents GHG emissions from activities that would occur should the Proposed Development not be consented. Currently within the UK, the marginal generating capacity (i.e. generating technology which responds to changes in grid electricity demand) is provided by existing, unabated CCGT power stations. As these CCGTs provide generational capacity balance across the UK grid, it is reasonable to assume that every MWh of electrical energy provided by a low-carbon installation (such as the Proposed Development) is a MWh of electrical energy that does not have to be generated by an existing unabated CCGT.

20.6.41 Although EN-1 (paragraph 4.9.25, Ref 20-13) mandates that all new commercial-scale combustion power stations (>300 MW) be built 'carbon capture ready', this assessment compares the Proposed Development with existing unabated CCGT technologies currently connected to the UK grid. This comparison reflects the energy generation capacity that the Proposed Development is likely to replace. Low-carbon installations like the Proposed Development need to displace existing unabated CCGT technologies to help achieve the UK's net zero goals.

Carbon Intensity

20.6.42 To quantify and contextualise the net benefit of the Proposed Development, an operational carbon intensity value has been calculated and compared to the carbon intensity of an existing unabated CCGT and the current UK grid average (**Plate 20-2**). This intensity value represents the tonnes of CO_2e expected to be produced per MWh of electricity generated.

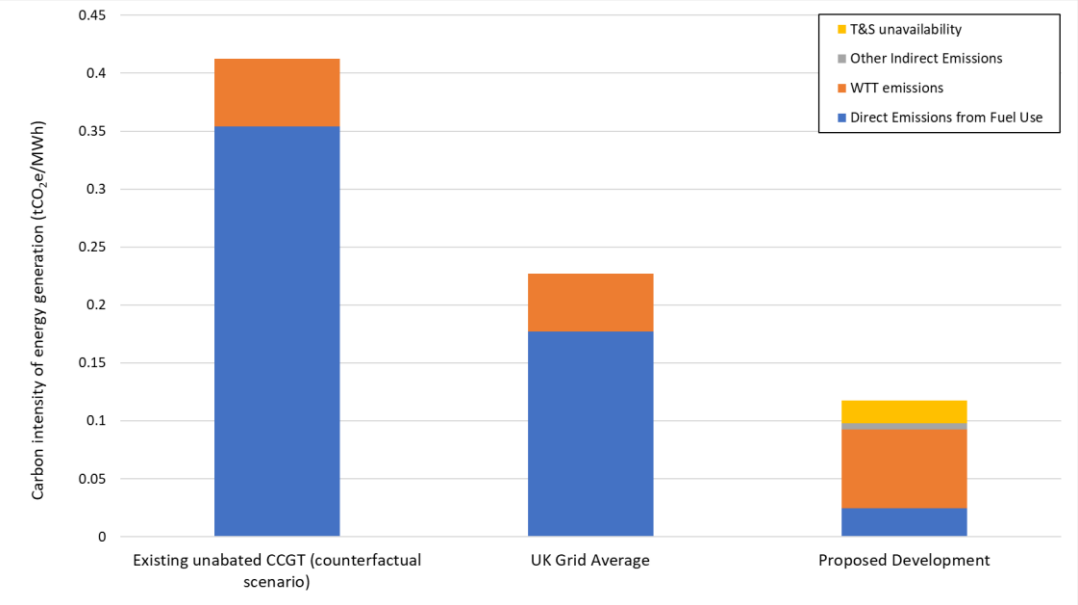
20.6.43 For this assessment, the Proposed Development is assumed to operate under the reference case (i.e., 8,760 hours per year, at full load capacity (1,380 MWe)) (paragraph 20.6.32). A carbon intensity value was subsequently calculated by dividing the total energy generation figure (362,664,000 MWh) into the estimated operational emissions total (42,654,595 tCO_2e) (see **Table 20-8**). Assuming a 95% capture rate of emissions attributed to on-site natural gas combustion, the operational carbon intensity value for the Proposed Development is estimated to be 0.118 tCO_2e/MWh (**Plate 20-2**).

20.6.44 Existing unabated CCGTs, which are currently the most carbon-efficient fossil-fueled technology, have a carbon intensity of 0.354 tCO_2e/MWh (Ref 20-42). This figure only accounts for direct emissions attributed to CCGT operation; therefore, an uplifted figure of 0.412 tCO_2e/MWh has been used for this assessment to account for emissions from the upstream supply chain (Scope 3) of natural gas[3] (**Plate 20-2**).

20.6.45 The most up-to-date UK grid average (2025), which represents the overall carbon intensity across all sources of UK electricity generation, is 0.177 tCO_2e/MWh (Ref 20-37). Like above, this figure only accounts for direct emissions attributed to fuel use; therefore, an uplifted figure 0.227 tCO_2e/MWh has been used for comparative purposes to account for upstream supply chain emissions across the UK electricity generation sources (**Plate 20-2**).

20.6.46 **Plate 20-2** shows a comparison of operational carbon intensities of electricity generation across existing unabated CCGTs, the UK grid average, and the Proposed Development.

Plate 20-2: Comparison of The Carbon Intensity of Electricity Generation (tCO_2e/MWh) Across an Existing Unabated CCGT Power Plant, the UK Grid Average, and the Proposed Development.[10]



20.6.47 As illustrated in **Plate 20-2**, the operational carbon intensity of the Proposed Development is estimated to be approximately 48% of the uplifted UK grid average and approximately 75% lower than that of existing unabated CCGTs when generating a MWh of electricity. This confirms the Proposed Development to be a low-carbon alternative to existing unabated CCGT power stations, and the overall UK grid, when meeting the UK's marginal generating capacity needs. This illustrates the Proposed Development's

[10] Direct Emissions for the Proposed Development Includes Scope 2 Emissions Due to Data Availability. It should also be noted that 'other indirect emissions' were not calculated for the counterfactual scenario due to limitations in data availability, particularly the absence of reliable activity data for an average existing unabated CCGT operating across the UK grid.

ability to support a future renewables-based UK energy grid with low-carbon dispatchable power.

Significance of GHG Emissions

20.6.48 The assessment of the significance of GHG emissions from Proposed Development has been undertaken in accordance with the IEMA guidance (GHG Assessment), with an acknowledgement to the requirements of NPS EN-1. The IEMA guidance (GHG Assessment) places an emphasis on mitigation and whether emissions from a project align with the UK and Welsh net zero target by 2050; this further described within **Appendix 20-A: Greenhouse Gas Baseline Data and Methodology Report** (**EN010166/APP/6.4**). In particular, the IEMA guidance (GHG Assessment) states that:

'The crux of significance is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050' (Ref 20-27).

20.6.49 The guidance goes on to state:

'For the avoidance of doubt IEMA's position that all emissions contribute to climate change has not changed … Major or moderate adverse effects and beneficial effects are considered to be significant. Minor adverse and negligible effects are not considered to be significant' (Ref 20-27).

20.6.50 **Table 20-5** above summarises how to apply significance criteria for the GHG impact of projects in accordance with the IEMA guidance (GHG assessment).

20.6.51 There are three key areas to be considered when evaluating the significance of a project's GHG impact:

a. The magnitude of overall emissions resulting from the project over its lifecycle, and its alignment with a relevant trajectory to net zero;

b. The estimated net emissions impact of the project, with reference to a business-as-usual scenario within which the project is not developed, the so-called 'without project baseline'; and

c. Consistency with applicable existing and emerging policy requirements and good practice design standards for projects of this type.

20.6.52 Each of these areas will be considered in turn.

Overall Magnitude of Emissions from the Proposed Development

20.6.53 Assuming a 30-year operational life (2036-2064), GHG emissions generated across the Proposed Development's operation would overlap numerous UK and Welsh carbon budgets.

20.6.54 The Proposed Development is projected to result in substantial emissions during its operation. Of the remaining 6th UK Carbon Budget period (2033-2037), operational emissions are estimated to contribute 0.29% to the UK budget (**Table 20-9**). Following the 6th UK Carbon Budget, emissions generated during the Proposed Development's operation (reference case) are expected to contribute 1.35%, 3.65%, and 25.09% of the remaining CCC

balanced net-zero pathways (**Table 20-10**). Thereafter, the budget effectively falls to zero making further percentage calculations meaningless. Any residual emissions after the net zero target date of 2050 would require to be balanced at a national level via removals within sectors such as agriculture and land use, land use change and forestry.

20.6.55 As noted above, the modelled reference case assumes that the Proposed Development runs in a constant baseload mode at full load as a worst-case operational scenario, with the dispatchable cases, shown in **Plate 20-1**, being considered more likely to represent the Proposed Development's future operational scenario. To contextualise the Proposed Development's potential operational scenarios further, the percentage contributions of the Proposed Development to the UK Carbon Budgets, when operating under each Dispatchable Case (High and Low), has also been illustrated within **Table 20-10**.

20.6.56 Under the dispatchable cases, the estimated contribution to the 6th UK Carbon Budget would be 0.16% and 0.08% for the high (counterfactual) and low (electric engagement) cases respectively **Table 20-10**. Thereafter, contributions to the remaining CCC balanced net-zero pathways are estimated to be 0.69%, 1.81%, and 12.43% for the high dispatchable case and 0.40%, 1.06%, and 6.42% for the low dispatchable case **Table 20-10**. These contributions have been based on the estimated annual emissions (standardised) across each operating case (see Table 5 of **Appendix 20-A: Greenhouse Gas Baseline Data and Methodology Report** (**EN010166/APP/6.4**)).

Table 20-9: Percentage contribution of operational emissions to the remaining UK Carbon Budgets

UK Carbon Budget and Period	Reference Case	Dispatchable Case (High)	Dispatchable Case (Low)
6th Carbon Budget (2033-2037)	0.29%	0.16%	0.08%
CCC's balanced net-zero pathway (2038-2042)	1.35%	0.69%	0.40%
CCC's balanced net-zero pathway (2043-2047)	3.65%	1.81%	1.06%
CCC's balanced net-zero pathway (2048-2050)	25.09%	12.43%	6.42%

20.6.57 With regards to the remaining Welsh Carbon Budgets, operational emissions under the Reference Case are estimated to contribute 14.81%, 26.33%, and 50.78% of the remaining Welsh Carbon Budgets 4, 5, and 6 (**Table 20-10**). It should be noted that the Welsh carbon budgets are significantly smaller than the UK-wide carbon budgets and these have been included to contextualise emissions on a regional level.

20.6.58 Like above, the percentage contributions of the Proposed Development to the Welsh Carbon Budgets, when operating under each Dispatchable Case (High and Low), has also been illustrated within **Table 20-10**. As shown, contributions to the remaining Welsh Carbon Budgets 4, 5, and 6 are estimated to be 7.97%, 13.05%, and 25.41% for the high dispatchable case and 4.21%, 7.65%, and 13.78% for the low dispatchable case.

Table 20-10: Percentage contribution of operational emissions to the remaining Welsh Carbon Budgets

Welsh Carbon Budget and Period	Reference Case	Dispatchable Case (High)	Dispatchable Case (Low)
Welsh Carbon Budget 5 (2036-2040)	14.81%	7.97%	4.21%
Welsh Carbon Budget 6 (2041-2045)	23.63%	13.05%	7.65%
Welsh Carbon Budget 7 (2046-2050)	50.78%	25.41%	13.78%

20.6.59 Under each operating case scenario, the Proposed Development contributes a substantial proportion of the UK and Welsh carbon reduction targets as the 2050 net zero date is approached. However, it should be noted that the majority of emissions attributed to the Proposed Development's operation result from indirect upstream WTT emissions from the gas supply network (**Table 20-8**). In reality, a substantial proportion of natural gas supply chain emissions are likely to fall outside of the UK's jurisdiction and would not be reported within the UK or Welsh carbon budgets. Therefore, by including these emissions and contextualising them against UK and Welsh carbon budgets, this is taking a conservative/worst-case assessment approach.

Comparision with a Future Baseline Scenario

20.6.60 The IEMA guidance (GHG assessment) refers to the need to assess a project's impact, '*whether directly or indirectly compared to the without project baseline'* (Ref 20-27). In this instance, the '*without project baseline*' is described within Section 20.4.5 (i.e., the future baseline) and can be considered as an operational scenario whereby the Proposed Development does not go ahead and the expected energy generating capacity is sourced from an alternative but comparable source.

20.6.61 In the case of the Proposed Development, it will provide secure, low-carbon dispatchable generation capacity that is able to displace existing unabated dispatchable gas-fired generation capacity elsewhere in the UK. Across the UK there is around 30 GW of unabated gas-fired capacity that continues to provide a substantial proportion of the UK's electricity generation, including marginal generating capacity (Ref 20-34); this is noted within paragraph 20.4.6 as the assessment future baseline. With the closure of the last coal-fired power station in Autumn 2024, the existing CCGT fleet represents the

largest single source of emissions to be addressed in support of the goal of effectively decarbonising the UK power grid.

20.6.62 But replacing existing secure, dispatchable power sources such as existing unabated gas-fired power stations can only be carried out by similarly secure, dispatchable units such as the Proposed Development to provide reliable security of supply. The proposed development, therefore, is vital in enabling this ongoing shift from unabated to abated gas-fired generation capacity to proceed over the coming years to support a future renewables-based UK energy grid. As noted above, the Proposed Development will generate secure electricity generating capacity with a carbon intensity 75% lower than that of existing unabated CCGTs (**Plate 20-2**).

Acknowledging a beneficial carbon impact of a low-carbon power source in comparison with an alternative, higher-carbon generation source, is supported by the recent Supreme Court ruling on the Finch Case. Paragraph 150 of the ruling notes that: *'Just as beneficial indirect effects of a project on climate - for example, the "green" energy that would be generated by a project to develop a wind farm or solar farm - are clearly a relevant matter for the planning authority to consider, so corresponding adverse effects are also a material planning consideration'* (paragraph 150, Ref 20-43).

20.6.63 The wind farm or solar farm mentioned in the Finch Ruling (Ref 20-43) are only "*green*" in that it generates electricity with a lower carbon intensity than the existing, higher carbon alternative that it displaces. Likewise, it is reasonable to assume that the lower-carbon electricity generated by the Proposed Development will displace the higher-carbon electricity currently supplied by an existing, unabated power station. According to the text of the Finch ruling, this displacement of higher-carbon generation is a relevant matter for a planning authority to consider.

Consistency with Existing and Emerging Policy and Good Practice

When evaluating the significance of a project's GHG impact, the IEMA guidance (GHG assessment) requires that consideration is given to the extent to which it is consistent with all relevant policy requirements and good practice design standards. The IEMA description of a project with minor adverse impacts include the following: '*The project's GHG impacts would be fully consistent with applicable existing and emerging policy requirements and good practice design standards for a project of this type'* (Ref 20-26).

20.6.64 As noted above, the Proposed Development is entirely consistent with relevant UK energy policy and planning requirements including:

a. Overarching NPS for Energy (EN-1) (Ref 20-13), referencing the importance for carbon capture ready dispatchable combustion plant to be available to support and complement the generation of power from renewable sources;

b. NPS for Natural Gas Electricity Generating Infrastructure (EN-2) (Ref 20-14), with reference to the classification of natural gas fired generation that is carbon capture ready as Critical National Priority Infrastructure;

c. Planning Policy Wales (Ref 20-17), referencing how local authorities should facilitate all forms of renewable and low carbon energy development; and

d. Flintshire County Council Local Development Plan 2025-2030 (Ref 20-24), with reference to Policy EN12 (new development and renewable and low carbon energy technology) and Policy EN13 (renewable and low carbon energy development).

20.6.65 See Section 14 of **Appendix 7A: Legislation, Policy and Guidance Framework for Technical Chapters** (**EN010166/APP/6.4**) for a more detailed overview of UK energy policy and planning requirements underpinning this GHG assessment.

Overall Evaluation of Significance of GHG Impact

20.6.66 Considering each of the issues discussed above – overall magnitude of emissions and alignment with trajectory to net zero; net impact relative to a without-project baseline; and consistency with policy and good practice, there is no one obvious way to evaluate significance. The net impact of the Proposed Development relative to a baseline suggests a beneficial impact, whilst the consistency with UK energy policy and good planning practice indicates a minor adverse impact.

20.6.67 However, as noted above, the receptor for the GHG assessment is the global climate with the corresponding UK and Welsh Carbon Budgets being used as a proxy (**Table 20-10**). The overall emissions that will result from the Proposed Development under the scenario identified as the reference case contribute substantially to UK, and particularly Welsh, carbon budgets and targets.

As noted, the IEMA guidance (GHG assessment) states that: *'The crux of significance is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050'* (Ref 20-27).

20.6.68 Overall emissions will be demonstrably lower than a corresponding, unabated power station (75% lower generation carbon intensity than the existing unabated CCGTs which continue to operate under the baseline 'do nothing' scenario), and the development is consistent with policy and good practice. But the contextualisation of emissions against the UK and Welsh carbon budgets and targets leads to an overall evaluation of significance for the Proposed Development's operational GHG impact of **moderate adverse** and **significant** (Ref 20-27).

As defined by IEMA, a Moderate Adverse rating applies where: *'The project's GHG impacts are partially mitigated and may partially meet the applicable existing and emerging policy goals for projects of this type. A project with moderate adverse effects falls short of fully contributing to the UK's trajectory towards net zero'* (**Table 20-5**, Ref 20-27).

20.6.69 It is important to recognise, as noted above, that the Proposed Development is fully aligned with policy goals for projects of this type and provides a net positive impact when compared to this assessment's future baseline. For this assessment, the GHG impact of the Proposed Development has been determined for the Reference Case, which enables an assessment of unconstrained operation and the subsequent presentation the worst-case scenario for GHG emissions. The evaluation of significance as moderate

adverse is made on the basis of the Proposed Development operating under the Reference case and the contribution of such to UK, and particularly Welsh, carbon budgets and targets since these are applied as proxies for a trajectory towards net zero as described in the IEMA guidance (GHG assessment) (Ref 20-27).

Decommissioning Phase

20.6.70 GHG emissions that would impact the climate during decommissioning of the Proposed Development are likely to include those associated with:

- demolition and excavation of all buildings and infrastructure, as required;
- disposal and treatment of all wastes; and
- return of the Main Development Area to an industrial brownfield under hard standing (i.e. no change in land use).

20.6.71 At this stage of the design, details regarding these activities have not been developed, however they are assumed to be commensurate with emissions generated during the construction stage (e.g. of the approximate magnitude of 467,733 tCO_2e). It should be noted that estimates of emissions attributed to decommissioning activities are of high uncertainty, given that they are expected to take place far into the future i.e., after 2065.

Significance of GHG Emissions

20.6.72 As noted above, the GHG impact of decommissioning activities has been assumed to correspond with those generated during construction. However, as the Proposed Development's decommissioning phase is set to occur after the expiry of the UK, and more specifically Wales, Carbon Budgets (2050) these emissions cannot be contextualised. Furthermore, given that the UK is legally required to have achieved net zero emissions, the demolition activities, transportation of waste materials, and waste disposal are likely to have been substantially decarbonised.

20.6.73 For the purpose of understanding their significance, decommissioning emissions has been assessed as having a magnitude of **minor adverse**, which is considered to be **not significant** (**Table 20-5**). The overall GHG impact from the decommissioning phase should be noted to be similar to the impact of the Proposed Development's construction phase.

20.7 Lifecycle GHG Assessment - Additional Mitigation and Enhancement Measures

20.7.1 Additional mitigation measures are only required where significant effects are identified following the application of embedded mitigation measures.

20.7.2 In line with IEMA guidance (GHG Assessment) (Ref 20-27), the operational GHG impact of the Proposed Development is assessed to be **moderate adverse** and **significant** (paragraph 20.6.68 above). However, the vast majority of estimated emissions are expected to occur across the Proposed Development's upstream and downstream supply chain (i.e., Scope 3) (**Table 20-8**). These emissions are considered to be outside of the direct control of the Applicant. Given this rationale, no additional mitigation or enhancement measures are proposed.

20.8 Lifecycle GHG Assessment - Summary of Likely Residual Effects

20.8.1 The receptor for the GHG assessment is the global climate, and the UK and Welsh carbon budgets are used as a proxy to assess the impacts to this receptor.

20.8.2 In line with IEMA Guidance (GHG Assessment) (Ref 20-27), emissions associated with the Proposed Development have been examined for their significance against the UK and Welsh Carbon Budgets. The significance of these lifecycle emissions, against the aforementioned budgets, are detailed in paragraphs 20.6.19, 20.6.48, and 20.6.72 above.

20.8.3 The below tables summarise the likely residual effects of the Proposed Development on climate change and receptors following implementation of mitigation. It should be noted that no significant effects are anticipated across the construction and decommissioning phases of the Proposed Development.

Table 20-11: Summary of Residual Effects (Construction)

Receptor	Sensitivity (value)	Description of Impact	Classification of Effect (prior to Additional Mitigation)	Additional Mitigation / Enhancement Measure	Magnitude of Impact after Additional Mitigation	Residual Effect after Additional Mitigation
UK and Welsh Carbon Budgets	High	Impact of GHG emissions arising during the construction of the Proposed Development in relation to the overall and ever decreasing UK and Welsh carbon Budgets. This has been assessed to have an adverse impact.	Minor adverse (not significant)	No additional measures identified	Not substantial	Minor adverse (not significant)

Table 20-12: Summary of Residual Effects (Operation)

Receptor	Sensitivity (value)	Description of Impact	Classification of Effect (prior to Additional Mitigation)	Additional Mitigation / Enhancement Measure	Magnitude of Impact after Additional Mitigation	Residual Effect after Additional Mitigation
UK and Welsh Carbon Budgets (as a proxy for the global climate)	High	Impact of GHG emissions arising during the operation of the Proposed Development in relation to the overall and ever decreasing UK and Welsh carbon Budgets. This has been assessed to have an adverse impact.	Moderate adverse (significant)	No additional measures identified	Substantial	Moderate adverse (significant)

Table 20-13: Summary of Residual Effects (Decommissioning)

Receptor	Sensitivity (value)	Description of Impact	Classification of Effect (prior to Additional Mitigation)	Additional Mitigation / Enhancement Measure	Magnitude of Impact after Additional Mitigation	Residual Effect after Additional Mitigation
UK and Welsh Carbon Budgets	High	Impact of GHG emissions arising during the decommissioning of the Proposed Development in relation to the overall and ever decreasing UK and Welsh carbon Budgets. This has been assessed to have an adverse impact.	Minor adverse (not significant)	No additional measures identified	Not substantial	Minor adverse (not significant)

20.9 Climate Change Resilience Assessment (CCRA) - Scope and Methodology

Scope of the Assessment

20.9.1 The CCRA has been carried out to qualitatively assess the Proposed Development's resilience to climate change. Potential climate hazards are identified using the UK Climate Projections 2018 (UKCP18) (Ref 20-44) for the geographical location and timeframe of the Proposed Development (including its construction, operation (including maintenance) and decommissioning).

20.9.2 The CCRA has been undertaken to identify potential climate change impacts on the Proposed Development, and to consider their potential consequence and likelihood of occurrence, taking account of the embedded mitigation measures incorporated into the Proposed Development's design.

Assessment Methodology

20.9.3 This section provides a summary of the CCRA methodology. The scope of assessment considers the resilience of the Proposed Development to climate change impacts, including how the design and construction will consider projected impacts of climate change.

Impact Assessment

20.9.4 The methodology in this chapter has been developed in line with appropriate industry guidance for assessing climate change resilience (CCR) and adaptation measures, such as Institute of Sustainability and Environmental Professionals (ISEP) (formerly IEMA) (Ref 20-28) and in accordance with the EU Commission Notice (2021/C 373/01) Technical guidance on the climate proofing of infrastructure in the period 2021-2027 (Ref 20-26).

20.9.5 The assessment includes all infrastructure and assets associated with the Proposed Development. It assesses the resilience against both gradual climate change i.e., chronic climate-related hazards and the risks associated with an increased frequency of severe weather events i.e., acute events.

Asset Components

20.9.6 When conducting a robust CCRA, it is important to understand the individual components that make up the asset as each may be vulnerable to different climate variables in different ways. The key asset components that have been considered in this climate assessment include:

- exhaust gas cooling and conditioning plant;
- CO_2 cooling and compression plant;
- cooling towers;
- effluent treatment plant;
- chemical and waste storage tanks;
- absorber tower(s) and associated stack(s);

- ducting and pipework;
- pylons;
- equipment;
- internal access roads;
- parking areas (including electric vehicle chargers); and
- electrical control room, administration building, workshops, staff offices, and welfare facilities.

20.9.7 The final technology selection for the CCGT and CCP has not yet been made, and will be determined by various technical, safety, environmental and economic considerations and vendor selection. The assumptions regarding the Proposed Development, therefore, incorporate a necessary degree of flexibility in the choice of technology and design, to allow for the future selection of the preferred technology in the light of prevailing policy and market conditions once development consent is granted.

Climate Change Data

Climate variables

20.9.8 Given the location of the Proposed Development in Flintshire, North-East Wales, and the classification of the asset as a CCGT Generating Plant fitted with CCP on land, the following climate hazards were identified as relevant following the scoping process (refer to **Appendix 1-B: Scoping Opinion** (**EN010166/APP/6.4**));

- storms (storm surges and lightning);
- extreme precipitation;
- sea level rise;
- extreme temperatures;
- precipitation change;
- wildfires;
- wind; and
- estuary temperature.

20.9.9 A detailed breakdown of scoped in climate variables, including rationale, are given in Table 1 in **Appendix 20-B: Climate Change Resilience Baseline Data and Methodology Report** (**EN010166/APP/6.4**).

Climate baseline data

20.9.10 For the purposes of the CCRA, the baseline conditions are based upon historic climate data. This data was obtained from the Met Office, recorded by the closest meteorological station to the Order limits with the largest range of historical data. The closest meteorological station is Hawarden Airport, approximately 6.9 km from the Order limits. Data was collected for the climate variables described previously for the period 1981-2010. This baseline period was chosen as it matches the baseline period the available climate change projections have been based on. The historical data collected is provided in **Table 20-16**.

Climate projection data

20.9.11 For this CCRA, two climate change timeframes have been reviewed to provide decision-makers with a more holistic understanding of the range of potential climate futures possible, which is essential when understanding risk and developing appropriate adaptation measures. These climate change projections have been based on Representative Concentration Pathway (RCP) 8.5.

20.9.12 RCP 8.5 was also used as it represents a worst-case scenario, which is useful in risk and contingency planning. This pathway has the highest emissions concentration and is marked by inadequate policy response and increased potential for physical asset damage.

20.9.13 The climate change projection data used was gathered from the Met Office. The data available on this platform is based on UKCP18. The Climate Data Explorer provides climate change projection data for a variety of climate variables for the periods 2020-2049 and 2040-2069[11] (compared to a 1981-2010 baseline). These periods are relevant as they encompass the construction and design life of the asset. The climate change projection data collected is provided in **Table 20-16**.

Risk Assessment

20.9.14 The CCRA considered the impact of climate on the Proposed Development by identifying likely changes to the climate and potential climate hazards over the life of the Proposed Development. The assessment has considered CCR over the Proposed Development's 30-year lifecycle, in addition to the construction period.

20.9.15 Using the climate change projection data gathered (refer to **Table 20-16**) a number of climate-related risks have been identified for the climate hazards determined to be relevant to the Proposed Development. For each risk identified, the asset components impacted have been noted and the planned or embedded controls identified. In this instance, embedded controls represent measures already included in the design and operation of the Proposed Development that work to mitigate climate risk. With this information, an initial assessment of CCRA was undertaken based on an analysis of likelihood and consequence. Adaptation measures have then been subsequently identified to further reduce risk and increase resilience, after which a residual assessment of risk was performed.

20.9.16 The following key terms and definitions relating to the CCRA are used, as derived from the Intergovernmental Panel on Climate Change (IPCC) Glossary (Ref 20-45):

- ***climate hazard*** – a weather or climate related event, which has potential to do harm to environmental or community receptors or assets, for example, increased winter precipitation;
- ***climate change impact*** – an impact from a climate hazard which affects the ability of the receptor or asset to maintain its function or purpose;

[11] The climate change projection periods are provided by the Met Office (UKCP18). As the construction and operation of the Proposed Development falls between 2020 to 2069, these two periods have been selected to cover each of these stages.

- ***consequence*** – any effect on the receptor or asset resulting from the climate hazard having an impact; and
- ***likelihood*** – provides calibrated language for describing quantified uncertainty. It can be used to express a probabilistic estimate of the occurrence of a single event or of an outcome such as a climate parameter or an observed trend.

20.9.17 The receptor for the CCRA is the Proposed Development itself, including the assets components identified in Section 20.9.6. Sensitive receptors affected by specific climate impacts are detailed in **Appendix 20-C: Climate Change Resilience Assessment** (**EN010166/APP/6.4**).

20.9.18 This assessment was informed by the risk framework and the descriptors of likelihood and consequence adopted from EU Technical guidance (Ref 20-46) (**Table 20-14**). The criteria used to determine the likelihood of the climate risk occurring is detailed within Table 2 in **Appendix 20-B: Climate Change Resilience Baseline Data and Methodology Report** (**EN010166/APP/6.4**). Following identification of the likelihood of the climate impact occurring, the consequences of the impact have been assessed according to Table 3 in **Appendix 20-B: Climate Change Resilience Baseline Data and Methodology Report** (**EN010166/APP/6.4**). When assessing the consequence of a specific risk, several categories have been considered including:

- asset damage / engineering / operational;
- safety and health;
- environment;
- social;
- financial (for single extreme event of annual average impact);
- reputation; and
- cultural heritage and cultural premises.

Table 20-14: Risk and Significance Matrix

		Consequence				
		Insignificant	**Minor**	**Moderate**	**Major**	**Catastrophic**
Likelihood	**Rare**	Low (NS)	Low (NS)	Medium (NS)	High (S)	Extreme (S)
	Unlikely	Low (NS)	Low (NS)	Medium (NS)	High (S)	Extreme (S)
	Moderate	Low (NS)	Medium (NS)	High (S)	Extreme (S)	Extreme (S)
	Likely	Medium (NS)	High (S)	High (S)	Extreme (S)	Extreme (S)
	Almost certain	High (S)	High (S)	Extreme (S)	Extreme (S)	Extreme (S)

NS – Not significant; S - Significant

20.9.19 Engagement has been undertaken with relevant environmental disciplines and the engineering design team to discuss the CCRA and identify mitigation measures for incorporation into the design of the Proposed Development. Measures to adapt the Proposed Development are identified where potential climate change consequences are identified as being potentially significant.

Rochdale Envelope

20.9.20 The setting of design parameters using the 'Rochdale Envelope' approach is described in **Chapter 2: Assessment Methodology** (**EN010166/APP/6.2.2**). The maximum parameters for the principal components of the Proposed Development are set out in the **Design Principles Document** (**EN010166/APP/7.8**) and are illustrated on the **Works Plans** (**EN010166/APP/2.4**) and **the Parameter Plans** (**EN010166/APP/2.5**). These parameters, together with assumptions regarding the future plans for the existing Connah's Quay Power Station set out in **Chapter 2: Assessment Methodology** (**EN010166/APP/6.2.2**) have been used to inform the representative worst-case scenario that has been assessed in this chapter, in order to provide a robust assessment of the impacts and likely significance of environmental effects of the Proposed Development at its current stage of design.

Assessment Assumptions and Limitations

20.9.21 For the purposes of the assessment, the construction phase includes enabling and demolition works required to facilitate the Proposed Development.

20.9.22 The CCRA covers the time period from the start of construction through to the end of decommissioning of the Proposed Development.

20.9.23 The design life of the Proposed Development is at least 30 years from 2035. UK Climate Projection 2018 (UKCP18) data is projected to 2100. The CCRA considered climate variables up to 2069 to assess the impact of climate change over the lifetime of the Proposed Development.

20.9.24 Where it is neither practical to quantify the required data nor to use reasonable assumptions, a qualitative statement has been made on the environmental impact based on professional experience and expert judgement.

20.9.25 Good practice methods and guidance have been used in the assessments, as stated in Section 20.9.4.

20.10 CCRA - Baseline Conditions and Study Area

Study Area

20.10.1 The study area for the CCRA is the area of temporary and completed works within the Order limits and surrounding areas that may impact the Order limits (e.g. River Dee).

Climate Baseline Data

20.10.2 To effectively use climate change projections for the purpose of a risk assessment, it is necessary to first understand the historical climate conditions experienced at the location. The current baseline for the CCRA is based on historic climate data obtained from the Met Office (Ref 20-44) recorded by the closest meteorological station to the Order limits (Hawarden Airport weather station, situated approximately 6.9 km away for the maximum temperature, and Royal Airforce (RAF) Shawbury weather station for the remaining climate conditions which is 54.4 km away). Data from this station provides the baseline climate average for 1981-2010, as summarised in **Table 20-16**.

Past Extreme Events

20.10.3 The following events are examples of extreme climatic conditions experienced at the site location in the past:

- the highest recorded temperature was 37.1°C in July 2022; and
- other recent extreme climatic events in Connah's Quay include extensive flooding in July 2023 (Ref 20-47) and heavy rainfall from Storm Babet in October 2023 (Ref 20-48).

Future Baseline

20.10.4 The future projections for construction, operation and decommissioning phases of the Proposed Development are based on future UKCP18 data from the Met Office for the 25 km grid square in which the Proposed Development is located (Ref 20-44). This projection data provides probabilistic indications of how global climate change is likely to affect areas of the UK using pre-defined climate variables and time periods. This data is provided within **Table 20-16**.

Climate Change Projection Data

20.10.5 In understanding how the climate is expected to change in the future it is important to consider broad, qualitative trends as well as location specific, quantitative projection data. Both are presented below (**Table 20-15**; **Table 20-16**).

Qualitative projection data

20.10.6 Future trends for key climate variables in the United Kingdom are summarised in **Table 20-15** using information available from Met Office's 'UK Climate Projections: Headline Findings' (Ref 20-49) and the Committee on Climate Change's 'UK Climate Change Risk Assessment 2017 Evidence Report: Summary for Wales' (Ref 20-50).

Table 20-15: Key Messages – Climate Change Projections United Kingdom

Climate Variable		Key Trend	Key Message
	Surface air temperature	Average surface air temperatures are expected to increase everywhere and across all seasons.	An increase in the intensity and duration of heatwaves is expected.
	Precipitation	An increase in seasonality in precipitation can be expected with significant decreases projected for summer and increases for autumn and winter.	An increase in the occurrence of extreme rainfall events is likely.
	Hydrology	Increasing seasonality in hydrological regimes can be expected with decreased summer and increased winter flows likely.	Flood risk is expected to increase across the UK while increases in the frequency of drought conditions is also expected. However, it is the distribution of rainfall throughout the seasons that will determine UK drought risk.
	Sea level rise	Sea level is expected to continue to rise to 2100 under all emissions pathways in the UK, and for Wales this is predicted to rise across the country by up to 24 cm by 2050.	Sea level is expected to rise.

Quantitative projection data

20.10.7 The quantitative climate change projection data for the MDA is presented in **Table 20-16** alongside the climate baseline data for the study area. The climate change data used for the assessment covers the Order limits. As previously discussed in Section 20.9.11 the climate change scenario adopted for this CCR assessment was RCP 8.5.

Table 20-16: Historical (1981-2010) and Projection Climate Data (2020-2049 and 2040-2069) for Connah's Quay

Climate Variable	Baseline 1981-2010	Projection (change) across project life cycle		Projected Change in Likelihood	Climate Projection Source
		2020-2049	2040-2069		
Temperature					
Mean annual maximum daily temperature (°C)	14.0	+0.95 °C (+0.39 °C to +1.52 °C)	+1.14 °C (+0.83 °C to +2.63 °C)	↑	2
Mean annual minimum daily temperature (°C)	6.1	+0.91 °C (+0.35 °C to +1.51 °C)	+1.66 °C (0.76 °C to 2.64 °C)	↑	2
Mean summer maximum daily temperature (°C)	20.2	+1.14 °C (+0.31 °C to +1.97 °C)	+2.09 °C (+0.79 °C to +3.43 °C)	↑	2
Mean winter minimum daily temperature (°C)	1.5	+0.80 °C (+0.04 °C to +1.60 °C)	+1.52 °C (+0.41 °C to +2.68 °C)	↑	2
Number of days of air frost per annum	42.8	Although frost days is depleted at the coast compared to inland, the Met Office has projected a trend towards fewer air frost days.		-	1
Highest temperature for baseline period (°C)	21.0 (July)	+1.27 °C (-0.10 °C to +2.63 °C)	+2.40 °C (+0.40 °C to +4.42 °C)	↑	2
Lowest temperature for baseline period (°C)	1.42 (January)	+0.81 °C (-0.26 °C to +1.94 °C)	+1.61 °C (+0.02 °C to +3.31 °C)	↑	2

Climate Variable	Baseline 1981-2010	Projection (change) across project life cycle 2020-2049	2040-2069	Projected Change in Likelihood	Climate Projection Source
Rainfall					
Mean annual rainfall (mm)	726.2	0.14% (-6.04% to +6.47%)	-2.73% (-10.04% to +4.64%)	↓	2
Mean summer rainfall (mm)	57.6	-4.89% (-21.95% to +10.48%)	-17.24% (-39.05% to +3.92%)	↓	2
Mean winter rainfall (mm)	59.8	+2.13% (-3.50% to +8.20%)	+4.56% (-3.59% to +13.69%)	↑	2
Wettest month on average (mm)	81.3 (October)	+5.49% (-6.67% to +19.02%)	+12.64% (-3.08% to +31.33%)	↑	2
Driest month on average (mm)	44.0 (February)	+3.56% (-8.46% to 15.99%)	+6.69% (-9.62% to +23.62%)	↑	2
Other					
Sea level rise (m) (for SSP scenarios)	0.11	0.17	0.31	↑	3
Storms	The UKCP18 model suggest a small contribution from storm surges; however, it is unclear if the frequency and severity of future storm surges is going to change. Rising sea levels due to climate change are expected to worsen the impacts of storm surges.			↑↓	2
Droughts	The Met Office has projected a trend towards drier summers on average, with the trend being stronger under a high GHG emission scenario compared to a low one; however, it is the distribution of rainfall throughout the seasons that will determine UK drought risk.			↑	1

Climate Variable	Baseline 1981-2010	Projection (change) across project life cycle 2020-2049	2040-2069	Projected Change in Likelihood	Climate Projection Source
Wildfires	The wildfire hazard is classified as medium according to the information that is currently available to the Think Hazard tool. This means that there is between a 10% and 50% chance of experiencing weather that could support a hazardous wildfire that may poses some risk of life and property loss in any given year.			↑	4

1 Met Office: https://www.metoffice.gov.uk/research/climate/maps-and-data
2 UKCP18 Tool (8.5 scenario): https://ukclimateprojections-ui.metoffice.gov.uk
3 IPCC AR6 Sea Level Projection Tool: https://sealevel.nasa.gov/data_tools/17
4 ThinkHazard: https://thinkhazard.org/en/report/24966-qatar-al-khawr-administrative-unit-not-available

20.11 CCRA - Development Design and Embedded Mitigation

Embedded Controls

20.11.1 The Proposed Development has been designed, as far as possible, to be resilient to the impacts of climate change through the process of design development, and by embedding measures into the design of the Proposed Development.

20.11.2 As aforementioned, planned or embedded controls represent measures already included in the design and operation of the Proposed Development that work to mitigate the climate risk. These measures are usually included in the design and / or operation of an asset as they represent best practice design or management. **Table 20-17** provides example embedded controls adopted for the Proposed Development, with a complete list included in the risk register in **Appendix 20-C: Climate Change Resilience Assessment** (**EN010166/APP/6.4**).

Table 20-17: Embedded Controls Adopted for the Proposed Development

Project Phase	Embedded Controls
Construction	Construction equipment used would be suitable to operate in the temperatures expected in North Wales.
	The Contractor would monitor weather forecasts and plan works accordingly, protecting workers and resources from any extreme weather conditions. This would include receiving Cyfoeth Naturiol Cymru (Natural Resources Wales) flood alerts and the works would be planned accordingly to protect workers and resources from any extreme weather conditions such as storms and flooding.
	Risks have been considered within the Flood Risk Assessment and summarised within **Chapter 13: Water Environment and Flood Risk** (**EN010166/APP/6.2.13**), with an **Appendix 13-D: Outline Surface Water Drainage Strategy** (**EN010166/APP/6.4**) to demonstrate management of surface water run-off from the Proposed Development during construction.
	Construction phase impacts would be mitigated through the implementation of standard construction techniques and mitigation measures, as are described in a wide range of good practice publications (e.g. C811 Environmental Good Practice on site (fifth edition). This involves flood consultations with local flood authorities, in particular in the approach to existing defenses.
Operational Phase	The Applicant has been certified under ISO 45001 for occupational health and safety since 2021, applying best practice for health and safety management. To mitigate potential impacts of extreme high temperatures, cooling provisions for both the plant and the gas turbine would comprise either an air-cooled condenser array or a hybrid cooling system, in addition to a CO_2 cooling and compression plant, and an exhaust gas cooling and conditioning plant.
	Due to anticipated extreme heat events, controls would be incorporated within the engineering design of buildings and structures and the appropriate engineering standards used so operations are unlikely to be interrupted. Controls include cooling provisions for both the plant and the gas turbine would comprise a hybrid cooling system, in addition to a CO_2 cooling and compression plant, and an exhaust gas cooling and conditioning plant.
	Snow loading and freezing liquids would be accounted for within the engineering design of buildings and structures and the appropriate engineering standards used so operations are unlikely to be interrupted by anticipated extreme cold temperatures.

Project Phase	Embedded Controls
	The risks are considered within **Appendix 13-C: Flood Consequence Assessment** (**EN010166/APP/6.4**) and summarised within **Chapter 13: Water Environment and Flood Risk** (**EN010166/APP/6.2.13**), with an **Appendix 13-D: Outline Surface Water Drainage Strategy** (**EN010166/APP/6.4**) to demonstrate management of surface water run-off from the Proposed Development during operation.
	The SuDS Manual Simple Index Approach (CIRIA C753) would be used to inform the design of the surface water drainage system so that it provides adequate treatment of run-off. Further details are provided in **Appendix 13-D: Outline Surface Water Drainage Strategy** (**EN010166/APP/6.4**)
	Current wind loadings are incorporated within the engineering design of buildings and structures and the appropriate engineering standards used so operations are unlikely to be interrupted.
	Design engineering standards to be incorporated for the provision of lightning protection systems on buildings and structures, such as lightning protections (rods) built into structures, which are also earthed.
	Location of Proposed Development (i.e. Industrial area) limits risk of wildfire. The Applicant will ensure that there are sufficient numbers of employees within the operational facility with specialist fire prevention training.

20.11.3 Limited specific mitigation measures have been identified for the decommissioning phase of the Proposed Development. A DEMP would be produced before the commencement of decommissioning, using appropriate guidance and legislation.

20.12 CCRA - Assessment of Likely Impacts and Effects

20.12.1 Taking into account the embedded mitigation measures as detailed in Section 20.11 above, the potential impacts and effects on the Proposed Development have been assessed using the methodology as detailed in Section 20.9 of this chapter and **Chapter 2: Assessment Methodology** (**EN010166/APP/6.2.2**).

Initial Risk Profile

20.12.2 In the example provided in **Table 20-18**, 'Low' and 'Medium' have been defined as 'Not Significant' whilst, 'High' and 'Extreme' have been defined as 'Significant' (Ref 20-28).

Table 20-18: Risk Rating Definitions

Risk Rating	Definition
Low (Not Significant)	The climate hazard has no (or an insignificant) impact.
Medium (Not Significant)	The climate hazard may have a slight impact on the Proposed Development but it is considered not significant.
High (Significant)	The climate hazard may have a significant impact on the Proposed Development.
Extreme (Significant)	The climate hazard will have a significant impact on the Proposed Development.

20.12.3 The CCRA identified 20 climate risks that may impact the Proposed Development, eight related to construction and twelve related to operation. The complete list of CCRs can be found in the risk register presented in **Appendix 20-C: Climate Change Resilience Assessment** (**EN010166/APP/6.4**), which details the likelihood of each risk occurring against asset components of the Proposed Development, and the corresponding consequence it would have. **Table 20-19** and **Table 20-20** below highlights the initial risk profile for both climate change scenarios assessed across construction and operation.

20.12.4 Of the eight risks identified for construction, three were related to extreme temperatures, two were related to storms, two were associated with flooding (tidal/coastal, pluvial and fluvial), and one was associated with wildfires. The high risks were associated with tidal/coastal flooding and wildfires.

20.12.5 As seen in **Table 20-19**, the construction period only accounts for the RCP 4.5 2020-2049 scenario, as this is when construction is expected to take

place. Therefore, an assessment of the eight risks were not assessed under the RCP8.5 2040-2069 scenario.

Table 20-19: Initial Risk Profile for the Proposed Development (Construction)

Risk Rating	Moderate emissions scenario RCP 4.5 2020-2049
	Initial risk profile
Low (Not Significant)	5
Medium (Not Significant)	1
High (Significant)	2
Extreme (Significant)	0

20.12.6 Of the twelve risks identified for operation, four were related to extreme temperatures, two were related to storms, three were associated with flooding, one was associated with drought and two were associated with wildfires. The high risks were associated with tidal/coastal flooding and wildfires.

Table 20-20: Initial Risk Profile for the Proposed Development (Operation)

Risk Rating	Moderate emissions scenario RCP 4.5 2020-2049	High emissions scenario RCP 8.5 2040-2069
	Initial risk profile	Initial risk profile
Low (Not Significant)	5	3
Medium (Not Significant)	5	7
High (Significant)	2	2
Extreme (Significant)	0	0

20.12.7 The nature of risks during decommissioning would be included in the DEMP, which would be developed before the commencement of decommissioning, a number of decades from now when climate conditions for the time period will be better understood and technologies and techniques best to mitigate any risks will have evolved.

20.12.8 As a result of the planned or embedded controls already included in the design and operation of the Proposed Development that work to mitigate the climate risk (as presented in **Table 20-17**), it is concluded that there are **significant** initial climate change risks identified in the construction and operation phases. For both the construction and operation phases, these risks relate to coastal flooding and wildfires.

20.13 CCRA - Additional Mitigation and Enhancement Measures

Adaptation Principles

20.13.1 Climate change adaptation for infrastructure projects is the process of adjustment to actual or expected climate and its effect to increase resilience, moderate harm and exploit beneficial opportunities. There are a range of measures or options that are available and appropriate for addressing climate change adaptation often described as either Grey, Green or Soft:

- **Grey Actions** - technical or engineering-oriented responses to climate impacts, for example the construction of a sea wall in response to sea level rise or the consideration of climate change projections in the design of drainage structures;
- **Green Actions** – use of nature-based solutions to enhance the resilience of human and natural systems, for example the addition of green spaces to infrastructure projects to counteract urban heat island effect, or the use of drought and heat tolerant species in landscaping; and
- **Soft Actions** - alterations in behaviour, regulation, or systems of management such as increased monitoring of climate change impacts during operation, or the consideration of climate risk in asset management plans. They are typically flexible and inexpensive to implement.

20.13.2 In the identification and implementation of adaptation measures, it is critical that early engagement between the relevant internal project stakeholders occurs i.e., engineers, environmental assessment professionals or asset owners. Early and proactive engagement is the most effective way of eliminating and reducing climate change impacts on a project, thereby reducing the need for additional and costly measures late in design or during operation.

Adaptation Measures Identified

20.13.3 A number of adaptation measures have been identified for consideration during the design, construction and operation of the Proposed Development. **Table 20-21** provides example adaptation measures identified for the Proposed Development, with a complete list included in the risk register in **Appendix 20-C: Climate Change Resilience Assessment** (**EN010166/APP/6.4**).

20.13.4 Limited specific mitigation measures have been identified for the decommissioning phase of the Proposed Development. A DEMP would be produced before the commencement of decommissioning, using appropriate guidance and legislation.

Table 20-21: Adaptation Measures for Consideration for the Proposed Development

Project Phase	Adaptation Measures	Proposed / Implemented
Construction	Use construction materials with superior properties that offer increased tolerance to fluctuating temperatures, heavy precipitation and other extreme weather events such as storms, where feasible.	Proposed
	Develop register of vulnerable construction assets and inspect after a hot day.	Proposed
	A fire management plan and an early warning and detection system will be developed and maintained.	Proposed
	As part of a wider Winter Service Plan (contained within the Operation and Mitigation Environmental Management Plan) a section would be prepared on freeze prevention for pipes, and snow and de-icing procedures for access roads during construction. Doing so would help prevent disruption and avoid possible health and safety incidences.	Proposed
	Install a water pump for the areas with critical infrastructure and a key part of construction operations. This would help increase the site's surface drainage capacity during construction.	Proposed
	Raise critical infrastructure to be above PMF level (Probable maximum flood).	Proposed
	Install additional attenuation features at key locations or identified flood risk areas, to increase the Proposed Development's drainage capacity.	Proposed
	Undertake regular monitoring of trees and vegetation in the area, pruning as necessary to avoid damage to the construction site or blocking access roads, in the event of a storm with high wind speed.	Proposed
Operational Phase	All outdoor workers will have access to indoor facilities, air conditioning, breaks in shaded areas and water breaks.	Proposed
	Outdoor and non-essential work will cease if working conditions are too dangerous and could result in injury to workers and damage to equipment.	Proposed

Project Phase	Adaptation Measures	Proposed / Implemented
	The frequency and magnitude of the impact of extreme temperature over time will be monitored, and (if required) further cooling mechanisms will be incorporated into plant upgrades and increased maintenance requirements will be implemented.	Proposed
	More durable, heat-resistant materials will be selected in upgrades.	Proposed
	As part of a wider Winter Service Plan a section would be prepared on Snow and de-icing procedures for when cold temperatures occur, and the roads become impacted by snow/ice during operation. Doing so would help prevent disruption and avoid possible fatalities.	Proposed
	For operational mitigation, the **Flood Consequence Assessment** (**EN010166/APP/6.4**) includes results from hydraulic modelling, providing further details on fluvial flood risk to inform mitigation measures. This includes the proposal to raise finished floor levels of critical infrastructure within the Main Development Area buildings to 7.7 m AOD which is 600 mm above the 1 in 200 year (0.5% Annual Exceedance Probability (AEP)) plus 2100 climate change event level in the Dee Estuary.	Proposed
	Install a water pump for the areas with critical infrastructure. This would help increase surface drainage capacity during operation.	Proposed
	Workers will be instructed to avoid any hazards that may increase the risk of being struck by lightning, including open spaces, tall objects, water, open wiring, metal fencing, and other metal objects.	Proposed
	Develop and maintain a Fire Management Plan and an early warning detection system.	Proposed
Decommissioning Phase	Based on appropriate guidance and legislation at the time.	Proposed

20.14 CCRA - Summary of Likely Residual Effects

Residual Impacts

20.14.1 Residual risk represents the risk profile resulting from the implementation of adaptation measures. The residual risk ratings for the Proposed Development, (assuming the implementation of the identified adaptation measures), are summarised in **Table 20-22** and **Table 20-23**.

20.14.2 The complete list of CCRs can be found in the risk register presented in **Appendix 20-C: Climate Change Resilience Assessment** (**EN010166/APP/6.4**), which details the likelihood of each risk occurring against asset components of the Proposed Development, and the corresponding consequence it would have once adaptation measures have been applied.

20.14.3 As seen in **Table 20-22**, the construction period only accounts for the RCP 4.5 2020-2049 scenario, as this is when construction is expected to take place. Therefore, an assessment of the eight risks were not assessed under the RCP8.5 2040-2069 scenario.

20.14.4 The high risks identified in construction and operation were associated with coastal flooding and wildfires.

Table 20-22: Residual Risk Profile Identified for the Proposed Development (Construction)

Risk Rating	Moderate emissions scenario RCP 4.5 2020-2049	
	Initial risk profile	Residual risk profile
Low (Not significant)	5	5
Medium (Not significant)	1	3
High (Significant)	2	0
Extreme (Significant)	0	0

Table 20-23: Residual Risk Profile Identified for the Proposed Development (Operation)

Risk Rating	Moderate emissions scenario RCP 4.5 2020-2049		High emissions scenario RCP 8.5 2040-2069	
	Initial risk profile	Residual risk profile	Initial risk profile	Residual risk profile
Low (Not significant)	5	7	3	5
Medium (Not significant)	5	5	7	7
High (Significant)	2	0	2	0
Extreme (Significant)	0	0	0	0

20.14.5 As observed, the implementation of the identified adaptation measures results in a reduction in the risk profile. For example, under the moderate emissions scenario RCP 4.5 and the high emissions scenario RCP 8.5, the high risks reduced from 2 to 0 for both construction and operation phases. This is primarily due to the development of flood risk and temperature-related adaptation measures. Assuming the implementation of the identified adaptation measures, the residual risks associated with flooding and wildfire would be **not significant**.

20.14.6 Limited specific mitigation measures have been identified for the decommissioning phase of the Proposed Development. A DEMP would be produced before the commencement of decommissioning, using appropriate guidance and legislation.

20.14.7 The Applicant would support the implementation of the adaptation measures discussed in this report to maintain the residual risk profile presented above.

Significance

20.14.8 Using the risk matrix in **Table 20-14** which includes the significance criteria for CCR, the significance of CCR for the Proposed Development can be assessed.

Construction

20.14.9 The risks assessed in the CCRA at the construction phase of the Proposed Development predominantly cover workforce exposure to dangerous working conditions and damage to physical structures/asset damage.

20.14.10 Major climatic variables contributing to these risks include, but are not limited to, increased temperatures, flooding, wildfires and storms.

20.14.11 Prior to the implementation of adaptation measures, the assessment identified 2 initial high risks associated with climate change (**Table 20-22**). According to the significance criteria in **Table 20-14**, the high risks were associated with coastal flooding and wildfires.

20.14.12 As a result of the adaptation climate change mitigation measures (as presented in **Table 20-21** and **Appendix 20-C: Climate Change Resilience Assessment** (**EN010166/APP/6.4**)), it is concluded that all residual climate change risks during the construction phase have been identified to be **not significant**.

Operation

20.14.13 The risks assessed in the CCRA at the operational phase of the Proposed Development predominantly encapsulate asset damage from extreme weather conditions and changes in annual precipitation and temperatures, as well as workforce exposure to dangerous working conditions.

20.14.14 Major climatic variables contributing to these risks are changes in temperatures and precipitation, as well as an increase in extreme weather events.

20.14.15 Prior to the implementation of adaptation measures, the assessment identified two initial high risks associated with climate change (**Table 20-19**). Based on the significance criteria in **Table 20-14**, the high risks are associated with coastal flooding and wildfires.

20.14.16 As a result of the adaptation climate change mitigation measures (as presented in **Table 20-21** and **Appendix 20-C: Climate Change Resilience Assessment** (**EN010166/APP/6.4**)), it has been concluded that all residual climate change risks during the operation phase have been identified to be **not significant**.

Decommissioning

20.14.17 As mentioned in Section 20.12.7 the nature of risks during decommissioning would be included in the DEMP, which would be developed before the commencement of decommissioning, a number of decades from now when climate conditions for the time period would be better understood and technologies and techniques best to mitigate any risks would have evolved.

Cumulative effects

20.14.18 An assessment of cumulative effects with other proposed schemes that could interact with the effects of this Proposed Development, is detailed in **Chapter 24: Cumulative and Combined Effects** (**EN010166/APP/6.2.24**). **Chapter 24: Cumulative and Combined Effects** (**EN010166/APP/6.2.24**) also assess the in-combination effects of multiple aspects on one receptor. For example, other nationally significant infrastructure projects (NSIPs) may affect the climate vulnerability of this Proposed Development, specifically in relation to flooding and urban heat island effect.

Summary

20.14.19 In summary, the CCRA presented in this chapter illustrates that climate change presents **no significant risk** to the Proposed Development. Considering the identified adaptation measures, the risk profile has been reduced to eliminate high risks associated with coastal flooding and wildfires for the construction and operation phases. As the Proposed Development has no residual 'high' or 'extreme' CCRs for either phase, it can be concluded that CCR is **not significant** for the Proposed Development.

20.14.20 The nature of risks during decommissioning are considered similar to those during construction. These would be reviewed and considered in detail as part of the DEMP; recognising that the DEMP would be developed before the commencement of decommissioning, a number of decades from now when climate conditions for the time period will be better understood and technologies and techniques best to mitigate any risks will have evolved.

Table 20-24: Summary of Likely Significant Residual Effects (Construction/Decommissioning)

Receptor	Sensitivity (value)	Description of Impact	Classification of Effect (prior to Additional Mitigation)	Additional Mitigation / Enhancement Measure	Magnitude of Impact after Additional Mitigation	Residual Effect after Additional Mitigation
Proposed Development[12]	Various	The full list of impacts related to various climate variables and specific asset types can be found in **Appendix 20-C: Climate Change Resilience Assessment** (**EN010166/APP/6.4**).	Significant	The full list of mitigation is listed in **Table 20-21** and in **Appendix 20-C: Climate Change Resilience Assessment** (**EN010166/APP/6.4**).	Various	Not significant

[12] A full breakdown of climate variables and asset types which have been assessed can be found in **Appendix 20-C: Climate Change Resilience Assessment** (**EN010166/APP/6.4**).

Table 20-25: Summary of Likely Significant Residual Effects (Operation)

Receptor	Sensitivity (value)	Description of Impact	Classification of Effect (prior to Additional Mitigation)	Additional Mitigation / Enhancement Measure	Magnitude of Impact after Additional Mitigation	Residual Effect after Additional Mitigation
Proposed Development[13]	Various	The full list of impacts related to various climate variables and specific asset types can be found in **Appendix 20-C: Climate Change Resilience Assessment** (**EN010166/APP/6.4**).	Significant	The full list of mitigation is listed in **Table 20-21** and in **Appendix 20-C: Climate Change Resilience Assessment** (**EN010166/APP/6.4**).	Various	Not significant

[13] A full breakdown of climate variables and asset types which have been assessed can be found in **Appendix 20-C: Climate Change Resilience Assessment** (**EN010166/APP/6.4**).

20.15 In-combination Climate Change Impact (ICCI) Assessment - Scope and Methodology

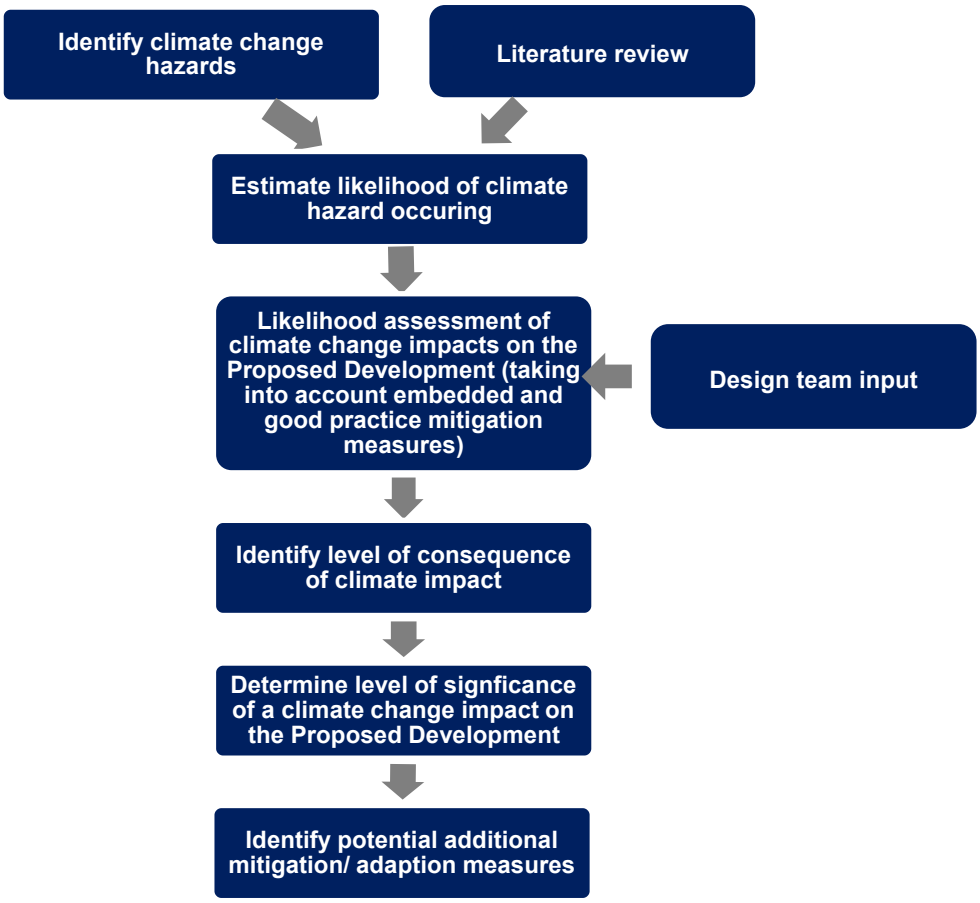
Scope of Assessment

20.15.1 The ICCI assessment considers the combined impacts of climate change and the Proposed Development on receptors in the surrounding environment. It considers the ways in which projected climate change will influence the significance of the effects of the Proposed Development on the identified receptors.

Assessment Methodology

20.15.2 This section provides a summary of the ICCI methodology. An overview of the ICCI assessment methodology applied within this assessment is illustrated in **Plate 20-3**. The overall methodology is in line with IEMA guidance (Ref 20-28).

Plate 20-3: ICCI Assessment Methodology Flow Diagram



Impact Assessment

Study area: Spatial Scope of Assessment

20.15.3 The study area for the ICCI assessment has been determined by the EIA topic assessments, as described in other technical sections of this ES. Topic chapters in **ES Volume II** (**EN010166/APP/6.2**) where in-combination climate change impacts have been identified include:

- **Chapter 8: Air Quality** (**EN010166/APP/6.2.8**);
- **Chapter 9: Noise and Vibration** (**EN010166/APP/6.2.9**);
- **Chapter 10: Traffic and Transport** (**EN010166/APP/6.2.10**);
- **Chapter 11: Terrestrial and Aquatic Ecology** (**EN010166/APP/6.2.11**);
- **Chapter 13: Water Environment and Flood Risk** (**EN010166/APP/6.2.13**);
- **Chapter 14: Geology and Ground Conditions** (**EN010166/APP/6.2.14**);
- **Chapter 16: Physical Processes** (**EN010166/APP/6.2.16**); and
- **Chapter 21: Human Health** (**EN010166/APP/6.2.21**).

20.15.4 The following disciplines have considered ICCIs but have not identified any:

- **Chapter 12: Marine Ecology** (**EN010166/APP/6.2.12**);
- **Chapter 15**: **Landscape and Visual Amenity** (**EN010166/APP/6.2.15**);
- **Chapter 17: Terrestrial Heritage** (**EN010166/APP/6.2.17**);
- **Chapter 18: Marine Heritage** (**EN010166/APP/6.2.18**);
- **Chapter 19: Socio-Economics, Recreation and Tourism** (**EN010166/APP/6.2.19**);
- **Chapter 22: Major Accidents and Disasters** (**EN010166/APP/6.2.22**);
- **Chapter 23: Materials and Waste** (**EN010166/APP/6.2.23**); and
- Soils and Agricultural Land (as part of **Chapter 14: Geology and Ground Conditions** (**EN010166/APP/6.2.14**)).

20.15.5 The ICCI assessment considers the ways in which projected climate change will influence the significance of the effects of the Proposed Development on receptors in the surrounding environment.

20.15.6 The ICCI assessment considers how the resilience of various receptors in the surrounding environment (such as local waterways or local heritage assets) are affected by the Proposed Development in combination with future climatic conditions as identified using UKCP18 projections data from the Met Office for the 25 km grid square in which the Proposed Development is located. The impacts are considered for the construction, operation (including maintenance), and decommissioning phases of the Proposed Development.

Proposed Development Environment

20.15.7 The ICCI considers a 'do something' scenario with the delivery of the Proposed Development, including its construction, operation (including maintenance), and decommissioning.

Sensitive Receptors

20.15.8 The ICCI assessment considers the sensitive receptors as identified by each technical discipline in **Chapters 8 to 23** (**EN010166/APP/6.2**). The ICCI assessment is undertaken by individual technical disciplines in regard to the identified sensitive receptors in each assessment.

Likelihood of climate change hazard occurring

20.15.9 Once climate hazards are identified for the receptors associated with the Proposed Development, the likelihood of their occurrence and the sensitivity of the receptor is considered to determine the likelihood of a climate impact occurring during the Proposed Development's lifespan is categorised as per **Table 20-26** (Ref 20-26).

Table 20-26: Level of likelihood of the climate hazard occurring

Level of likelihood of climate hazard	Qualitative description	Quantitative Description
Very likely	Likely that the event will occur many times (reoccurs frequently).	90-100% probability that the hazard will occur during the life of the project
Likely	Likely that the event will occur sometimes (reoccurs infrequently).	66-90% probability that the hazard will occur during the life of the project
Possible, about as likely as not	Possible that the event will occur (has occurred rarely).	33-66% probability that the hazard will occur during the life of the project
Unlikely	Unlikely that the event will occur (not known to have occurred).	10-33% probability that the hazard will occur during the life of the project
Very unlikely	Almost inconceivable that the event will occur.	0-10% probability that the hazard will occur during the life of the project

Likelihood of climate impact occurring

20.15.10 Once climate hazards are identified for the receptors associated with the Proposed Development, the likelihood of their occurrence and the sensitivity of the receptor is considered in order to determine the likelihood of a climate impact occurring during the Proposed Development's lifespan is categorised as per **Table 20-27**. Where an effect has been identified as moderate or high it was classed as a significant ICCI effect.

Table 20-27: Level of Likelihood of the climate-related impact occurring

Level of likelihood of climate impact occurring	Definition of likelihood
High	Likelihood of climate hazard occurring is high and impact is always/ almost always going to occur.
Moderate	Likelihood of climate hazard occurring is high and impact occurs often or the likelihood of climate hazard occurring is moderate and impact is likely to occur always/ almost always.
Low	Likelihood of climate hazard occurring is high but impact rarely occurs or the likelihood of climate hazard occurring is moderate and impact sometimes occurs or the likelihood of climate hazard occurring is low and impact is likely to occur always/ almost always.
Negligible	All other eventualities - highly unlikely but theoretically possible.

20.15.11 Once the likelihood of an ICCI has been identified, the assessment then considers the consequence of the effect on the identified receptors.

20.15.12 The ICCI consequence criteria are defined in **Table 20-28** (Ref 20-28) and are based on the change to the significance of the impact already identified by the environmental discipline. To assess the consequence of an ICCI, each discipline has assigned a level of consequence to an impact based on the criteria description and their discipline assessment methodology.

Table 20-28: Consequence criteria for in-combination climate change impact assessment

Consequence	Consequence criteria
High	The climate change parameter in-combination with the effect of the Proposed Development causes the significance of the impact of the Proposed Development on the resource/receptor, as defined by the topic, to increase from negligible, low, or moderate to major.
Moderate	The climate change parameter in-combination with the effect of the Proposed Development causes the effect defined by the topic to increase from negligible or low, to moderate.
Low	The climate change parameter in-combination with the effect of the Proposed Development, causes the significance of effect defined by the topic, to increase from negligible to low.
Negligible	The climate change parameter in-combination with the effect of the Proposed Development does not alter the significance of the effect defined by the topic.

Significance criteria

20.15.13 The likelihood of a climate hazard occurring and the likelihood of an impact of a receptor is then combined to determine the likelihood of an ICCI occurring. This criterion is illustrated in **Table 20-29** (Ref 20-28).

Table 20-29: ICCI significance criteria

Consequence	Likelihood			
	Negligible	**Low**	**Moderate**	**High**
Negligible	Not Significant	Not Significant	Not Significant	Not Significant
Low	Not Significant	Not Significant	Not Significant	Significant
Moderate	Not Significant	Not Significant	Significant	Significant
High	Not Significant	Significant	Significant	Significant

20.15.14 The significance of potential effects is determined using the matrix in **Table 20-29**. Where an effect has been identified as Moderate or High is classed as a significant ICCI effect. If significant ICCI effects are assessed, then appropriate additional mitigation measures are identified.

Rochdale Envelope

20.15.15 The setting of design parameters using the 'Rochdale Envelope' approach is described in **Chapter 2: Assessment Methodology** (**EN010166/APP/6.2.2**). The maximum parameters for the principal components of the Proposed Development are set out in the **Design Principles Document** (**EN010166/APP/7.8**) and are illustrated on the **Works Plans** (**EN010166/APP/2.4**) and the **Parameter Plans** (**EN010166/APP/2.5**). These parameters, together with assumptions regarding the future plans for the existing Connah's Quay Power Station set out in **Chapter 2: Assessment Methodology** (**EN010166/APP/6.2.2**) have been used to inform the representative worst-case scenario that has been assessed in this chapter, in order to provide a robust assessment of the impacts and likely significance of environmental effects of the Proposed Development at its current stage of design.

Assessment Assumptions and Limitations

20.15.16 For the purposes of the assessment, the construction phase includes enabling and demolition works required to facilitate the Proposed Development.

20.15.17 It is assumed that the start date of the ICCI assessment is the start of the construction period.

20.15.18 The design life of the Proposed Development is 30 years from 2035. The UK Climate Projection 2018 (UKCP18) data is limited to the projected time period of 2100 ((Ref 20-44). While modelled climate change projections represent anticipated changes to average weather conditions, they cannot predict the frequency and severity of acute events such as droughts, heatwaves, and prolonged heavy rainfall, making the UKCP18 the most

appropriate database for the assessment (Ref 20-44). The ICCI considered climate variables up to 2069 to assess the impact of climate change over the lifetime of the Proposed Development. Only a high-level assessment of acute events is included in this assessment.

20.15.19 It is assumed that sufficient necessary quantitative data was available to inform the ICCI. Where quantitative data is not available, reasonable assumptions have been made.

20.15.20 Where it is neither practicable to quantify the required data nor to use reasonable assumptions, a qualitative statement has been made on the environmental impact based on professional experience and expertise.

20.15.21 The ICCI is limited by the availability of data and Proposed Development design information at the date this assessment was prepared.

20.16 ICCI Assessment - Baseline Conditions and Study Area

Study Area

20.16.1 To effectively use climate change projections for the purpose of a risk assessment, it is necessary to first understand the historical climate conditions experienced at the location. The current baseline for the CCRA is based on historic climate data obtained from the Met Office (Ref 20-44) recorded by the closest meteorological station to the Order limits (Hawarden Airport weather station, situated approximately 6.9 km away). Data from this station provides the baseline climate average for 1981-2010, as summarised in **Table 20-16**, in the CCRA section of this report.

Past Extreme Events

20.16.2 To see the past extreme events around Connah's Quay and Flintshire, please refer to Section 20.10 of the CCR Assessment.

Future Baseline

20.16.3 The future baselines for construction, operation and decommissioning phases of the Proposed Development are based on future UKCP18 data from the Met Office for the 25 km grid square in which the Proposed Development is located (Ref 20-44). This projection data provides probabilistic indications of how global climate change is likely to affect areas of the UK using pre-defined climate variables and time periods. This data is provided within **Table 20-16** in Section 20.10 of this chapter.

Climate Change Projection Data

20.16.4 In understanding how the climate is expected to change in the future it is important to consider broad, qualitative trends as well as location specific, quantitative projection data. Both are presented below.

Qualitative projection data

20.16.5 Future trends for key climate variables in the United Kingdom are summarised below using information available from Met Office's 'UK Climate Projections: Headline Findings' (Ref 20-49) and the Committee on Climate

Change's 'UK Climate Change Risk Assessment 2017 Evidence Report: Summary for Wales' (Ref 20-50).

Quantitative projection data

20.16.6 The quantitative climate change projection data for the MDA is presented in **Table 20-16** in Section 20.10, alongside the climate baseline data for the study area. As previously discussed in Section 20.9.12, the climate change scenario adopted for both the ICCI and CCRA assessments was RCP 8.5.

20.17 ICCI Assessment - Development Design and Embedded Mitigation

20.17.1 The Proposed Development has been designed, as far as possible, to avoid or minimise impacts and effects on receptors in the surrounding environment as a result of the combined impacts of the Proposed Development and Climate Change. This has been achieved through the process of design development, and by embedding measures into the design of the Proposed Development and surrounding environment as necessary.

20.17.2 The embedded controls referred to in Section 20.11.1 in the CCRA assessment apply for the ICCI assessment.

20.17.3 The scope for mitigating measures for the ICCI was informed by the design team and other relevant ES technical assessments. These focused on measures to increase the resilience of the receptors in the surrounding environment to the combined impacts of the Proposed Development and climate change. For example, this may include designing surface water drainage systems to make sure flows up to the 1 in 100-year return period can be contained and managed within the Proposed Development, so as not to impact receptors in the surrounding environment.

20.17.4 Full details of embedded design measures for construction that reduce the likelihood or severity of ICCIs to receptors are detailed within the **Framework Construction Environmental Management Plan** (**CEMP**) (**EN010166/APP/6.5**).

20.17.5 Technical disciplines have included mitigation measures for construction and operation within their respective chapters (summarised in Table 20-1 in **Appendix 20-D: In-combination Climate Change Assessment** (**EN010166/APP/6.4**)), such as that detailed in **Chapter 9: Noise and Vibration** (**EN010166/APP/6.2.9**), **Chapter 13: Water, Environment and Flood Risk and Water Resources** (**EN010166/APP/6.2.13**), **Chapter 15: Landscape and Visual Amenity** (**EN010166/APP/6.2.15**), **and Chapter 21: Human Health** (**EN010166/APP/6.2.21**). This is also summarized in **Table 20-30** below.

20.17.6 Limited specific mitigation measures have been identified for the decommissioning phase of the Proposed Development. A DEMP would be produced before the commencement of decommissioning using appropriate guidance and legislation at the time and would likely be similar to that of the construction phase but reflect future climatic conditions.

20.18 ICCI Assessment - Assessment of Likely Impacts and Effects

20.18.1 Taking into account the embedded mitigation measures as detailed in Section 20.17, the potential impacts and effects of the Proposed Development combined with climate change on receptors in the surrounding environment have been assessed using the methodology as detailed in Section 20.15 of this chapter and **Chapter 2: Assessment Methodology** (**EN010166/APP/6.2.2**).

20.18.2 Potential ICCIs, including the likelihood, consequence, and significance are detailed in **Appendix 20-D: In-combination Climate Change Assessment** (**EN010166/APP/6.4**).

20.18.3 Future climate projections have been reviewed and the sensitivity of receptors to both climate change and the Proposed Development have been examined, before commenting on the adequacy of the climate change resilience measures built into the Proposed Development.

20.18.4 The table of ICCIs identified can be found in **Appendix 20-D: In-combination Climate Change Assessment** (**EN010166/APP/6.4**). **Table 20-30** shows the disciplines that undertook an assessment for ICCIs where likely impacts have been identified. The table also summarises the embedded and good practice mitigation measures across construction and operation, and how these influence the ICCI assessment.

Table 20-30: Identified ICCI's, embedded and good practice mitigation measures - construction and operation

Discipline and Climate Hazard	Changes and effects		Embedded and good practice mitigation measures (where mitigation is not necessary, this has been specified)
	Construction	Operation	
Air Quality (**Chapter 8 EN010166/APP/6.2.8**) *Change in mean annual air temperature*	N/A	Ambient weather conditions, including barometric pressure and temperature can slightly affect the amount of natural gas fuel burned within the combustion process for a given output. The consequence of an increase in fuel consumption would be a corresponding increase in stack mass flow rate and emission rates of trace pollutants in the stack plume.	An increase in stack gas mass flow rates is likely to lead to an increase in the residual CO_2 content and mass emission rate in the plume. Warmer conditions result in a slight decrease in fuel consumption, while cooler conditions generally result in a slight increase. The 'reference' emissions case used for the air quality assessment considers a conservative scenario with upper range estimates of both stack mass flow and trace pollutant emission rate. The dispersion modelling assessment has used five years of meteorological data, which accounts for the full range of weather conditions experienced in the area around the Main Development Area.
Noise and Vibration (**Chapter 9 EN010166/APP/6.2.9**) *Increase in mean summer air temperature*	N/A	Increased temperatures may require greater cooling which will increase the number of cooling fans in operation, which could then result in potential increase in noise effects to receptors in the surrounding environment.	The assessment has been based on the worst-case scenario so there would be no further impact on noise effects impacting the surrounding environment.

Discipline and Climate Hazard	Changes and effects		Embedded and good practice mitigation measures (where mitigation is not necessary, this has been specified)
	Construction	Operation	
Noise and Vibration (**Chapter 9 EN010166/APP/6.2.9**) *Increase in mean summer air temperature*	N/A	Potential to exacerbate noise effects on communities in terms of individual dwellings and on a wider community, due to windows being open more often due to an increase in high temperatures.	The noise assessment criteria assume windows are open and closing windows is a form of mitigation against noise. Consequently, there is no further impact on noise effects arising from the ICCI.
Noise and Vibration (**Chapter 9 EN010166/APP/6.2.9**) *Increase in mean summer air temperature*	N/A	Increases in temperature and humidity of the air reducing the atmospheric attenuation of noise.	Over distances of a few hundred meters, which covers the noise study area, atmospheric effects can be ignored. Consequently, increases in temperature and humidity is unlikely to affect noise sources during the construction phase and operational phase.
Transport and Traffic (**Chapter 10 EN010166/APP/6.2.10**) *Increase in winter precipitation rate*	Increases in precipitation may increase the potential for disruption on the wider road network due to increased frequency of transport routes becoming unviable or inaccessible.	N/A	The **Construction Traffic Management Plan** (**CTMP**) (**EN010166/APP/6.6**) considers vehicle routing options during the construction phase, including details of any planned road closures / diversions.

Discipline and Climate Hazard	Changes and effects		Embedded and good practice mitigation measures (where mitigation is not necessary, this has been specified)
	Construction	Operation	
Aquatic Ecology (**Chapter 11 EN010166/APP/6.2.11**) *Increase in winter rainfall*	N/A	Increased winter rainfall combined with the Proposed Development could impact on receiving waterbodies' (ponds and drains) flow regime and water quality impacting on the aquatic environment.	Increased surface water runoff and sedimentation. The impact of climate change on expected flows would be accommodated in the design of drainage infrastructure to ensure appropriate treatment and attenuation of anticipated flows, as outlined above.
Aquatic Ecology (**Chapter 11 EN010166/APP/6.2.11**) *Increased droughts/ reduced water levels in summer*	N/A	Reduced water levels as a result of climate change and the Proposed Development could negatively impact on receiving waterbodies' (ponds and drains) flow regime and water quality impacting on the aquatic environment.	Prolonged drought periods in combination with higher temperatures could lead to dissolved oxygen crashes and fish mortalities The impact of climate change on expected flows would be accommodated in the design of drainage infrastructure to ensure appropriate treatment and attenuation of anticipated flows, as outlined above.
Water Environment (**Chapter 13 EN010166/APP/6.2.13**) *Increased rainfall intensity*	N/A	Increased peak fluvial flows resulting in increased flood risk to the site, impacting the drainage network, and increasing potential loss of floodplain associated with land raising.	Flood consequence assessment has been based on flood risk incorporating estimated climate change over the life of the project.

Discipline and Climate Hazard	Changes and effects		Embedded and good practice mitigation measures (where mitigation is not necessary, this has been specified)
	Construction	Operation	
Water Environment (**Chapter 13 EN010166/APP/6.2.13**) *Increase in winter rainfall*	N/A	Increased precipitation can impact the frequency and duration of flooding from all sources (e.g. tidal, fluvial, surface water, artificial sources, groundwater and infrastructure) – could lead to flooding off-site.	Drainage infrastructure (including attenuation) would be designed to accommodate anticipated flows, with an appropriate allowance for increases in rainfall intensity due to climate change. The drainage strategy will consider the Supplementary Planning Guidance LPGN 29 – Management of Surface Water for New Development, adopted by Flintshire County Council (Ref 20-51). In accordance with this guidance, surface water runoff from the Proposed Development in undeveloped (greenfield) areas would be limited to the greenfield runoff rate. For any previously developed (brownfield) areas, surface water discharge would be limited to greenfield rates of runoff (or as close as reasonably practical). The drainage network will be designed so that there is no flooding in the 1 in 30-year AEP simulated storm event, in accordance with the Supplementary Guidance LPGN 29. Attenuation would be appropriately sized to accommodate the 1 in 100-year AEP event, with a minimum 20% allowance for increases in rainfall intensity due to climate change, in accordance with Welsh Government guidance for climate change allowances. Both the central and upper (20% and 40%) climate

Discipline and Climate Hazard	Changes and effects		Embedded and good practice mitigation measures (where mitigation is not necessary, this has been specified)
	Construction	Operation	
			change allowances will be assessed to understand the range of impact. The design will also consider the impacts of tide levels on new drainage infrastructure.
Water Environment (**Chapter 13 EN010166/APP/6.2.13**) *Increased sea levels and storm surges*	N/A	Increased sea levels resulting in flooding to the site and impacts to the drainage network. The Proposed Development requires raising land levels and as it is located in a coastal flood plain, this could have an impact on off-site receptors due to changes to flow pathways.	Flood consequence assessment has been based on flood risk incorporating estimated climate change over the life of the project.
Water Environment (**Chapter 13 EN010166/APP/6.2.13**) *Increase in winter rainfall*	N/A	Increased precipitation can impact peak discharge rates for surface water runoff, which can impact receiving waterbodies (receptors) if the capacity of the drainage infrastructure is exceeded in extreme events. If this results in the storage capacity of attenuation features being exceeded, then there is potential for the River Dee to receive	The impact of climate change on expected flows has been accommodated in the design of drainage infrastructure to ensure appropriate treatment and attenuation of anticipated flows, as outlined above.

Discipline and Climate Hazard	Changes and effects		Embedded and good practice mitigation measures (where mitigation is not necessary, this has been specified)
	Construction	Operation	
		untreated water. This could lead to a deterioration in water quality.	
Water Environment (**Chapter 13 EN010166/APP/6.2.13**) *Increased sea temperature*	N/A	Discharge of cooling water with increased sea temperature due to climate change could result in impacts to marine environments.	Any increases in discharge temperature, in addition to climate change increases could result in increased temperatures locally and regionally across the River Dee SSSI, potentially impacting on habitats. However, the operational discharge temperature of cooling water discharges would comply with the existing Environmental Permit with no changes proposed to the permitted levels.
Water Environment (**Chapter 13 EN010166/APP/6.2.13**) *Increased droughts*	N/A	Reduction in water availability for abstraction and impact on nearby existing abstractions.	Increases in abstraction from surface water and groundwater sources could reduce availability of water for other users. However, there is no change proposed to the existing abstraction volume from the River Dee for cooling water, and no new additional abstractions from other sources required. As such, no additional pressures on abstraction would result from the Proposed Development. The existing levels will have been factored into forecasting with Dwr Cymru Welsh Water's Water Resources Management Plan 2024 (Ref 20-52).

Discipline and Climate Hazard	Changes and effects		Embedded and good practice mitigation measures (where mitigation is not necessary, this has been specified)
	Construction	Operation	
Water Environment (**Chapter 13 EN010166/APP/6.2.13**) *Increase in winter precipitation rate*	N/A	Increased peak discharge rates for surface water runoff, impacting receiving waterbodies if the capacity of the drainage infrastructure is exceeded in extreme events. If this results in attenuation storage capacity being exceeded then there is potential for the Dee Estuary WFD water body to receive untreated and polluted water, potentially leading to a deterioration in water quality.	The impact of climate change on expected flows has been accommodated in the design of drainage infrastructure to ensure appropriate attenuation and storage for anticipated flows.
Water Environment (**Chapter 13 EN010166/APP/6.2.13**) *Decrease in summer precipitation rate*	Reduction in precipitation could reduce aquifer storage and groundwater levels. Construction activities such as dewatering can reduce groundwater levels. This potential impact would be localised and unlikely to impact the surrounding environment.	N/A	Reduction in groundwater levels could reduce water availability for water dependent receptors and water users (i.e. groundwater abstractions). Dewatering during construction would be kept to a minimum and only undertaken where required to limit any reduction in groundwater recharge.

Discipline and Climate Hazard	Changes and effects		Embedded and good practice mitigation measures (where mitigation is not necessary, this has been specified)
	Construction	Operation	
Water Environment (**Chapter 13 EN010166/APP/6.2.13**) *Increase in winter precipitation rate*	Changes in groundwater flow and levels. Construction and operation: An increase in groundwater level may increase the possibility of groundwater levels rising closer to the ground surface/mixing with potential shallower contamination (within Made Ground) which would otherwise not be encountered. This would increase the likelihood of potential impact on groundwater quality locally.		Potential for increase in groundwater levels and associated groundwater flooding. Flood consequence assessment has been based on flood risk incorporating estimated climate change over the life of the project. It is likely that the adjustment to the hydrogeological regime would remain localised and of relatively low magnitude.
Water Environment (**Chapter 13 EN010166/APP/6.2.13**) *Sea Level rise*	Changes in groundwater flow and levels. And potential to move saline interface landward. Construction and operation: An increase in groundwater level may increase the possibility of groundwater levels rising closer to the ground surface/mixing with potential shallower contamination (within Made Ground) which would otherwise not be encountered. Dewatering activities can lead to the saline interface being drawn in land. This potential impact would be localised and unlikely to impact the surrounding environment.		Potential for saline interface to move landward. Dewatering during construction would be kept to a minimum and only undertaken where required to limit saline intrusion. It is likely that the potential saline intrusion would remain localised and of relatively low magnitude.
Water Environment (**Chapter 13 EN010166/APP/6.2.13**) *Storm surges*	Changes in groundwater flow and levels. Construction and operation: An increase in groundwater level may increase the possibility of groundwater levels rising closer to the ground surface/mixing with potential shallower contamination (within Made Ground) which would otherwise not be encountered. Dewatering activities can lead to the saline interface being drawn in		Potential for increase in groundwater levels and associated groundwater flooding. Flood consequence assessment has been based on flood risk incorporating estimated climate change over the life of the project. It is likely that the adjustment to the hydrogeological

Discipline and Climate Hazard	Changes and effects		Embedded and good practice mitigation measures (where mitigation is not necessary, this has been specified)
	Construction	Operation	
	land. This potential impact would be localised and unlikely to impact the surrounding environment.		regime would remain localised and of relatively low magnitude.
Water Environment (**Chapter 13 EN010166/APP/6.2.13**) *Increase in occurrences of drought*	Reduction in precipitation could reduce groundwater levels. Summer droughts could also reduce water quality from reduced dilution of pollutants during the summer therefore increasing pollutants when precipitation events occur. This potential impact would be localised and unlikely to impact the surrounding environment.	N/A	Reduction in groundwater levels could reduce water availability for water dependent receptors and water users (i.e. groundwater abstractions). Dewatering during construction would be kept to a minimum and only undertaken where required to limit any reduction in groundwater recharge. Construction works would have a negligible impact on water quality due to mitigation measures implemented through the **Framework CEMP** (**EN010166/APP/6.5**).
Geology and Ground Conditions (**Chapter 14 EN010166/APP/6.2.14**) *Increase to winter rainfall*	An increase in groundwater level may increase the possibility of groundwater levels rising closer to the ground surface / mixing with potential shallower contamination (within Made Ground) which would otherwise not be encountered. This would increase the likelihood of potential impact on groundwater quality		During construction, groundwater quality may be temporarily adversely affected due to potential ground disturbance/dewatering. The potential rise in groundwater level may require additional dewatering considerations, which may decrease groundwater quality through mobilising existing contamination. However, these would be incorporated into the design works.

Discipline and Climate Hazard	Changes and effects		Embedded and good practice mitigation measures (where mitigation is not necessary, this has been specified)
	Construction	Operation	
			Contamination which may be encountered during construction will have been removed, remediated or mitigated to some extent. Maintenance and operation of the Proposed Development will be in accordance with environmental legislation and good practice. Therefore, it is unlikely that there will be an increased risk to groundwater quality should levels rise.
Geology and Ground Conditions (**Chapter 14 EN010166/APP/6.2.14**) *Increase in annual temperature*	Increase in dust generation which may increase potential exposure to dusts/contaminants impacting human health	N/A	During the construction phase, extended dry spells may cause increased dust production. This consequence is minimized as far as reasonably practicable, through the measures incorporated into the **Framework CEMP** (**EN010166/APP/6.5**) (e.g. reduce dust emissions through the effective transportation and storage of materials).
Physical Processes (**Chapter 16 EN010166/APP/6.2.16**) *Sea level rise*	Due to sea level rise and increased storminess associated with climate change the estuary morphology may change over time. Section 16.4.6 of **Chapter 16: Physical Processes** (**EN010166/APP/6.2.16**) states that despite there being no defined receptor for the physical environment, and instead the physical processes act as a pathway which has the potential to impact other		During construction, the decision to replace the existing intake screens rather than installing new infrastructure elsewhere in the water connection corridor, means that the Proposed Development will maintain the baseline conditions and therefore not exacerbate

Discipline and Climate Hazard	Changes and effects		Embedded and good practice mitigation measures (where mitigation is not necessary, this has been specified)
	Construction	Operation	
	receptors. Despite this, estuary morphology has been considered a receptor in its own right.		potential future sea level rise-related change to the estuary morphology.
Human Health (**Chapter 21 EN010166/APP/6.2.21**) *Increase in mean annual maximum air temperature*	Increased dust production during construction due to more hot days, impacting human health.	N/A[14]	During construction, an increase in air temperatures may cause increased dust pollution which could affect human receptors suffering from respiratory conditions. This consequence would be minimised as far as is reasonably practicable, through measures required by the **Framework CEMP** (**EN010166/APP/6.5**) (e.g. reduce dust emissions through the effective transportation and storage of materials), including the proposed monitoring regime.

[14] Receptors related to Noise and Air Quality are relevant to Human Health, however these have not been replicated.

20.18.5 Each discipline identified the likelihood of each ICCI occurring, the consequence, and the overall significance, as detailed in **Appendix 20-D: In-combination Climate Change Assessment** (**EN010166/APP/6.4**). As a result, **no significant effects** have been identified.

20.19 ICCI Assessment - Additional Mitigation and Enhancement Measures

20.19.1 Additional mitigation measures are only required where significant effects are identified following the application of embedded mitigation measures. **No significant effects** have been identified in this assessment therefore no additional mitigation or enhancement measures are proposed.

20.19.2 The flood consequence assessment accounts for climate change projections and this has been taken into account within **Appendix 13-C: Flood Consequence Assessment** (**EN010166/APP/6.4**).

20.19.3 Hydraulic modelling has been undertaken at the ES stage to provide further details on fluvial flood risk and inform mitigation measures. Refer to **Appendix 13-C: Flood Consequences Assessment** (**EN010166/APP/6.4**) **and Appendix 13-F: Hydraulic Modelling Report** (**EN010166/APP/6.4**) for details of the modelling undertaken.

20.20 ICCI Assessment - Summary of Likely Residual Effects

20.20.1 The ICCI Assessment, included as **Appendix 20-D: In-combination Climate Change Assessment** (**EN010166/APP/6.4**), concludes that there are **no significant** residual ICCIs on receptors in the surrounding environment identified.

Table 20-31: Summary of Likely Residual Effects (Construction)

Receptor	Sensitivity (value)	Description of Impact	Classification of Effect (prior to Additional Mitigation)	Additional Mitigation / Enhancement Measure	Magnitude of Impact after Additional Mitigation	Residual Effect after Additional Mitigation
Proposed Development[15]	Various[16]	The full list of impacts related to various climate variables and specific asset types can be found in **Appendix 20-D: In-combination Climate Change Assessment** (**EN010166/APP/6.4**).	Significant	The full list of mitigation measures are listed in **Table 20-21** and in **Appendix 20-D: In-combination Climate Change Assessment** (**EN010166/APP/6.4**).	Various[17]	Not significant

[15] A full breakdown of climate variables and asset types which have been assessed can be found in **Appendix 20-D: In-combination Climate Change Assessment** (**EN010166/APP/6.4**).
[16] A list of sensitivities related to different receptors can be found in **Appendix 20-D: In-combination Climate Change Assessment** (**EN010166/APP/6.4**).
[17] The magnitude of impact on various receptors, following the implementation of additional mitigation measures, is detailed in **Appendix 20-D: In-combination Climate Change Assessment** (**EN010166/APP/6.4**).

Table 20-32: Summary of Likely Significant Residual Effects (Operation)

Receptor	Sensitivity (value)	Description of Impact	Classification of Effect (prior to Additional Mitigation)	Additional Mitigation / Enhancement Measure	Magnitude of Impact after Additional Mitigation	Residual Effect after Additional Mitigation
Proposed Development[18]	Various[19]	The full list of impacts related to various climate variables and specific asset types can be found in **Appendix 20-D: In-combination Climate Change Assessment** (**EN010166/APP/6.4**).	Significant	The full list of mitigation measures are listed in **Table 20-21** and in **Appendix 20-D: In-combination Climate Change Assessment** (**EN010166/APP/6.4**).	Various[20]	Not significant

[18] A full breakdown of climate variables and asset types which have been assessed can be found in **Appendix 20-D: In-combination Climate Change Assessment** (**EN010166/APP/6.4**).
[19] A list of sensitivities related to different receptors can be found in **Appendix 20-D: In-combination Climate Change Assessment** (**EN010166/APP/6.4**).
[20] The magnitude of impact on various receptors, following the implementation of additional mitigation measures, is detailed in **Appendix 20-D: In-combination Climate Change Assessment** (**EN010166/APP/6.4**).

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