

12. Climate Change

12.1. Introduction

12.1.1. This chapter of the Draft Environmental Statement presents an assessment of the likely effects of the Proposed Development on climate (greenhouse gas (GHG) emissions) and the vulnerability of the Proposed Development to climate change, as per the requirements of the 2017 EIA Regulations and in line with the Climate Change Act 2008 (2050 Target Amendment) Order 2019.

12.1.2. This climate change chapter has been prepared by Arup on behalf of St Modwen.

12.1.3. The climate change assessment comprises two parts:

- Impact of the Proposed Development on climate – the Greenhouse Gas (GHG) assessment considers the change in GHG emissions due to the Proposed Development; and
- Vulnerability of the Proposed Development to climate change – the Climate Change Resilience assessment (CCRA) considers the resilience of the Proposed Development in the context of projected future changes in climate variables.

12.1.4. To take account of the potential impacts of future climate conditions to act in-combination with the impacts of the Proposed Development on other environmental receptors, the future projected climate conditions for the area have been incorporated into the future baseline conditions and considered for relevant EIA topics in their assessment of likely significant effects. This ensures that environmental receptors that are vulnerable to impacts from both the Proposed Development and climate factors are considered in the context of the changing climate.

12.1.5. This chapter details:

- the legislative and policy framework related to climate change;
- the methodology followed in the assessment including any guidance followed, and any limitations and assumptions that have been applied;
- a description of the existing and projected future baseline environment in the area surrounding the Proposed Development at a local and regional scale;
- the assessment of GHG emissions and vulnerability to climate change; and
- potential mitigation and the residual effects of the Proposed Development.

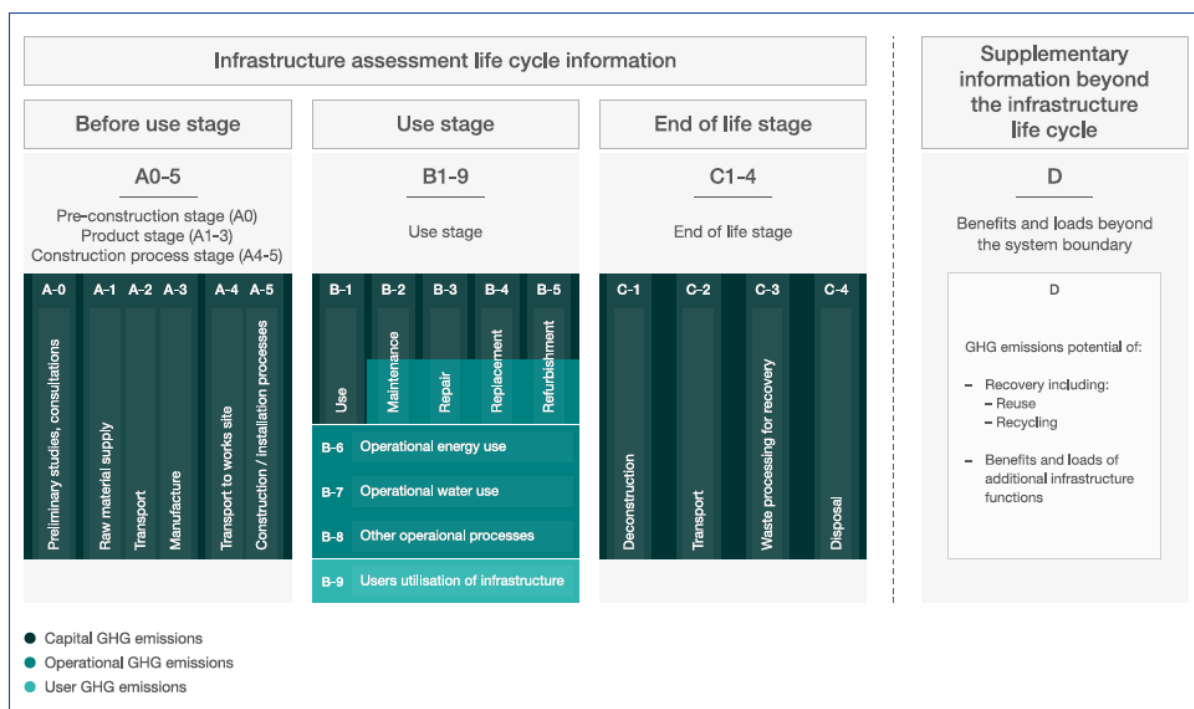
12.2. Assessment criteria & methodology

12.2.1. This section outlines the methodology for assessing the likely significant effects relating to GHG emissions from the construction and operation of the Proposed Development.

- 12.2.2. The GHG assessment quantifies the tonnes of carbon dioxide equivalent (tCO₂e) that would be produced during construction and operation of the Proposed Development. CO₂e refers to a common unit employed to compare the emissions from various GHGs (methane, ozone, nitrous oxide etc.) based on their global-warming potential, by converting the amounts of other gases to the equivalent amount of CO₂ with the same global warming potential. The adoption of CO₂e as the common metric, rather than CO₂, allows all GHGs to be included in the assessment and contextualised against local and national targets.
- 12.2.3. The goal of the emissions quantification exercise is to calculate the emissions likely to be generated or avoided by the Proposed Development. The purpose of this is to:
- determine the magnitude of the Proposed Development's GHG emissions;
 - enable comparison of the Proposed Development's GHG emissions and the UK, Welsh and local carbon budgets and targets; and
 - enable identification of GHG emissions hot spots to inform identification and prioritisation of mitigation measures.
- 12.2.4. The current version of the assessment estimates three sources of GHG emissions during the construction and operational (use) life cycle stages (phases) of the project, including materials, traffic/transport, operation of buildings, land use change and lighting public realm.
- Quantification of GHG emissions*
- 12.2.5. The GHG assessment quantifies and reports the GHG emissions anticipated to be generated or avoided by the Proposed Development in the form of a 'carbon footprint'. The carbon footprint is reported in tCO₂e.
- 12.2.6. The GHG assessment has taken a 60 year appraisal period to measure the operational emissions of the Proposed Development. This is consistent with the RICS guidance¹, which states the reference study period for domestic projects should be 60 years.
- 12.2.7. In order to adequately capture direct and indirect emissions associated with the Proposed Development, a lifecycle approach has been adopted. The lifecycle stages are defined in Image 12.1. The scope of the GHG emissions assessment includes the before use stage (A) and the use stage (B). It is not anticipated that the site will be fully decommissioned at the end of the design life of the Proposed Development, given that people will be residing there. The end of life stage (C) has therefore not been assessed as agreed in the Scoping Report submitted to NPTCBC.
- 12.2.8. For the purpose of this assessment the 'before use stage' is referred to as the 'construction phase' and the 'use stage' is referred to as the 'operational phase'.

¹ RICS (2017) Whole life carbon assessment for the built environment 1st edition <https://www.rics.org/uk/upholding-professional-standards/sector-standards/building-surveying/whole-life-carbon-assessment-for-the-built-environment> [last accessed 03.08.21]

Figure 12.1: The GHG emissions assessment scope includes the before use stage (A) and the use stage (B)1.



- 12.2.9. Some GHG emissions from the Proposed Development are quantified by using 'activity data' (such as material quantities, energy consumption and transport kilometres travelled) to quantify GHG emissions through the use of emissions conversion factors. Benchmarks for 'activity data' are used to estimate the potential GHG emissions of the Proposed Development where specific design data was not available at this stage of the project design.
- 12.2.10. The benchmarks used, the assessment methodology applied and the data sources for each aspect of the development which make up the quantification of GHG emissions for this assessment are summarised in Table 12.1 below.

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Table 12.1: Methodology for estimating emissions sources included in the GHG emissions assessment

Aspect of development (as shown in Image 1 above)	Assessment methodology	Data sources
Stage A – Construction Phase		
GHG emissions associated with the planning and consenting phases (A0)	Carbon emissions from preliminary studies and works are largely desk-based and for this reason are assumed to be not significant.	N/A – Not assessed

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Aspect of development (as shown in Image 1 above)	Assessment methodology	Data sources
Materials - Raw material extraction & supply, transport to manufacturing plant, manufacturing & fabrication (A1 to A3)	These assessments took the Proposed Development footprint area (m²) of the design features and industry benchmarks to calculate the GHG emissions. The benchmarks are based averages from multiple projects across types of development. For example, benchmarks were available for residential homes, educational buildings and associated highways and footpaths. Three benchmarking tools were used and the largest number was taken in line with the precautionary principle.	Carbon Leadership Forum – CO₂ Benchmarks Available at: https://carbonleadershipforum.org/embodied-carbon-benchmark-study-data-visualization/ RICS (2012) Available at: https://www.igbc.ie/wp-content/uploads/2015/02/RICS-Methodology_embodied_carbon_materials_final-1st-edition.pdf WRAP Embodied Carbon Database (2014) Available at: https://environment-analyst.com/global/29640/wrap-launches-embodied-carbon-database
Traffic (A4)	The methodology for modelling the additional traffic volumes due to the Proposed Development is included in the Chapter 5 Transport and Travel. Traffic volumes on roads surrounding the Proposed Development were modelled for the scenarios with and without the construction of the development. The operational transport emissions predicted do take into account engine efficiency upgrades and partial uptake of EVs, however do not take account of the ban on the sale of cars with internal combustion engines for 2030, announced by the UK Government. This makes the operational estimation a precautionary estimate of emissions.	DEFRA (2020) Emissions Factor Toolkit V10.1 Available at: https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html#:~:text=The%20Emissions%20Factors%20Toolkit%20(EFT,under%20the%20Environmental%20Act%201995.

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Aspect of development (as shown in Image 1 above)	Assessment methodology	Data sources
	The DEFRA Emissions Factor Toolkit (EFT) includes assumptions about the predicted mix of vehicles for operation. It has fleet mix assumptions up to 2030. It provides emission rates for 2018 through to 2030 and takes into consideration the following information: ▪ Fleet composition data for motorways, urban and rural roads in the UK (excluding London); ▪ Fleet composition based on European emission standards from pre-Euro I to Euro 6/VI (including Euro 6 subcategories); ▪ Scaling factors reflecting improvements in the quality of fuel and some degree of retrofitting; and ▪ Technology conversions in the national fleet. As this is the latest year the EFT as assumptions for, these assumptions have been used to map the emissions from 2030 to 2036.	
Construction / installation process (A5)	Data from the Biodiversity Net Gain calculation from Chapter 9 Biodiversity has been used to estimate the carbon stocks within the habitats and soils lost as a result of the proposed development. Carbon storage estimates were calculated using factors for the relevant habitat type from a Natural England Report multiplied by the area of lost habitat. The assumptions and limitations of this methodology are outlined in Table 12.2. Emissions from recycling the c.150,000 m³ excess materials offsite have been determined to be 0.001tCO₂e per tonne of recycled waste, calculated on the basis of benchmarks from the Inventory of Carbon and Energy (ICE). This does not include the HGV fuel emissions to transport this material as the current location of the recycling centres are unknown.	Natural England (2021) Carbon Storage and Sequestration by Habitat 2021. Available at: http://publications.naturalengland.org.uk/publication/5419124441481216 Embodied Carbon – the Inventory of Carbon and Energy (ICE): Available at: https://greenbuildingencyclopaedia.uk/wp-content/uploads/2014/07/Full-BSRIA-ICE-guide.pdf

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Aspect of development (as shown in Image 1 above)	Assessment methodology	Data sources
Stage B – Operational Phase		
Transport emissions (B1)	The methodology for modelling the additional traffic volumes due to the Proposed Development is included in the Chapter 5 Transport and Travel. Traffic volumes on roads surrounding the Proposed Development were modelled for the scenarios with and without the development for operation. The operational transport emissions predicted do take into account engine efficiency upgrades and partial uptake of EVs, however do not take account of the ban on internal combustion engines for 2030 announced by the UK Government. This makes the operational estimation a precautionary estimate of emissions. The DEFRA Emissions Factor Toolkit (EFT) includes assumptions about the predicted mix of vehicles for operation. It has fleet mix assumptions up to 2030. As this is the latest year the EFT as assumptions for, these assumptions have been used to map the emissions from 2030 to 2086.	DEFRA (2020) Emissions Factor Toolkit V10.1 Available at: https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html#:~:text=The%20Emissions%20Factors%20Toolkit%20(EFT,under%20the%20Environmental%20Act%201995.
Public realm (B1)	Energy requirements to light the footpaths, cycle paths and highways have been estimated on a linear basis, using benchmarks developed based on Arup's professional experience. Emissions calculated over the 60-year design life using projected emissions intensity of the electricity grid.	Arup professional experience DECC (2015) Energy and Emissions Projections Available at: https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2015
Buildings – maintenance and refurbishment (B2 to B5)	The embodied emissions from maintenance and refurbishment over the life of the buildings have been estimated based on the ratio of embodied emissions in the phases 'to practical completion' and 'in use', applied to the benchmarks for calculating embodied emissions of building materials (as described above). Using this method, a benchmark that defined the embodied emissions during the operation phase was developed and applied to each building type.	RICS (2017) Whole life carbon assessment for the built environment Available at: https://www.rics.org/globalassets/rics-website/media/news/whole-life-carbon-assessment-for-the-built-environment-november-2017.pdf

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Aspect of development (as shown in Image 1 above)	Assessment methodology	Data sources
Buildings – operation (B6)	Annual energy consumption for buildings has been taken from the Energy Strategy, that has been submitted as part of this application. This includes the residential, commercial, educational and mixed-use buildings. The energy consumption figures taken into account solar PV onsite and EV charging from residential buildings. This energy consumption has then been converted into GHG emissions and takes into consideration the national grid de-carbonisation over time.	BEES building energy efficiency survey (2019) Figure 5.2 Available at: https://www.gov.uk/government/publications/building-energy-efficiency-survey-bees
Operational water use (B7)	BEIS produce benchmarks for carbon costs of water supply and water treatment. The benchmarks have been adjusted to make allowance for improvements in carbon costs in line with Welsh Water's net zero by 2040 targets.	BEIS (2021) Conversion factors for water use and treatment and carbon can be found on here: https://www.gov.uk/government/publications/green-house-gas-reporting-conversion-factors-2021
Other operational processes (B8)	Information on other process carbon emissions arising from the Proposed Development to enable it to operate and deliver its service, such as management of operational waste, were not available for assessment and will not be available for this submission.	N/A – Not assessed
Users utilisation of infrastructure (B9)	All of the uses of the site have been covered by the assessment of operational emissions above.	N/A – Not assessed

Significance criteria

- 12.2.11. The IEMA Guide provides the following overarching principle for assessing the significance of GHG emissions:

“The GHG emissions from all projects will contribute to climate change; ...as such any GHG emissions or reductions from a project might be considered to be significant...”

- 12.2.12. In accordance with this, any carbon emissions associated with the Proposed Development are deemed significant.

- 12.2.13. Whilst the guidance does not provide criteria against which to assess potential effects against a scale of significance in the context of the EIA Regulations, it recommends that the development's GHG emissions should “be contextualised against sectoral, local or national carbon budgets” and that it is down to the practitioner's professional judgement on how best to contextualise a project's GHG impact.

- 12.2.14. Therefore, the GHG assessment contextualises the emissions with national, regional and local carbon budgets in order to develop appropriate mitigation measures. The UK carbon budgets are set out in **Error! Reference source not found..**

- 12.2.15. There are currently no relevant established sectoral or local emissions budgets, targets or reduction requirements. Therefore, in the absence of these budgets, the project's emissions are presented against the latest emissions recorded at a local level as this is the best available means of contextualising the project's emissions at the local scale.

- 12.2.16. It should be noted however that local and sectoral carbon emissions need to reduce over time to meet broader national budgets, and therefore the project's emissions if remaining stable over time are likely to increase as a proportion of local emissions.

GHG assessment limitations and assumptions

- 12.2.17. The full GHG emissions assessment is provided in Appendix 12.1. The limitations of the GHG emissions assessment are as follows:

- all assessments and conclusions have been based on the data available at the time of writing this report;
- the benchmarking approach uses average carbon emission rates for development types by using data from previous projects to estimate the potential GHG emissions. The GHG assessment used to estimate the carbon output of the Proposed Development assumes it is typical of the benchmark type and previous projects, which carries a degree of uncertainty;
- requirements for bulk infrastructure, e.g. water and power, have not been assessed as it is assumed the development will connect to existing utilities in the nearby area, the specific details of which are currently unknown.

- 12.2.18. The assumptions made in the GHG emissions assessment are set out in Table 12.2 below.

Table 12.2 GHG emissions assessment assumptions

Emissions source	Assumptions
Construction	
Embodied Carbon (A1 to A3)	The building areas have been based on the maximum applied for in the outline planning application. This is used as it is the worst-case scenario for emissions. Buildings have been assigned to a typology which represents most closely the use type of the building. For the assessment it is assumed to include 400,000m² of class C2, 26,000m² D1 uses, 2,100m² of commercial uses, 1,134m² mixed commercial uses and 17,780m² of associated highways works. The benchmarks for embodied carbon in buildings are based on collated life cycle assessment data for the production stage emissions. As such, these benchmarks cover production of raw materials and manufacturing emissions. Further detail of the benchmarks used to calculate the emissions and the emissions breakdown per asset are included in Appendix 12.1, GHG Assessment.
Operational	
Transport emissions (B1)	The DEFRA Emissions Factor Toolkit (EFT) includes assumptions about the predicted mix of vehicles for operation. It has fleet mix assumptions up to 2030. As this is the latest year the EFT as assumptions for, these assumptions have been used to map the emissions from 2030 to 2086 as seen in Appendix 12.1 GHG assessment. The Proposed Development has been assumed to be fully operational from 2026, therefore traffic emissions have been measured for a 60 year period between 2026 to 2086.
Public realm (B1)	Street lighting is operated for an average of 12 hours per day, 365 days per year. This is considered the worst case scenario and could be improved by light reduction design measures.

Emissions source	Assumptions																				
Buildings – maintenance and refurbishment (B2 to B5)	To calculate the carbon associated with maintenance and refurbishment RICS (2017) whole life carbon assessment, has produced a ratio that calculates “in use” carbon from embodied carbon. The “in use” definition captures the emissions arising during the life of a building from its components, e.g. the release of GHG from maintenance and refurbishment ¹ . The ratios used are shown in the RICS ratio table below.																				
	<table><tr><th>Building type</th><th>Embodied emissions</th><th>Carbon</th><th>‘In use’ carbon</th><th>Ratio</th></tr><tr><td>Office</td><td>35%</td><td></td><td>32%</td><td>91%</td></tr><tr><td>Warehouse</td><td>47%</td><td></td><td>29%</td><td>62%</td></tr><tr><td>Residential</td><td>51%</td><td></td><td>18%</td><td>35%</td></tr></table>	Building type	Embodied emissions	Carbon	‘In use’ carbon	Ratio	Office	35%		32%	91%	Warehouse	47%		29%	62%	Residential	51%		18%	35%
	Building type	Embodied emissions	Carbon	‘In use’ carbon	Ratio																
	Office	35%		32%	91%																
	Warehouse	47%		29%	62%																
	Residential	51%		18%	35%																
The “Office” ratio has been used for the educational and mixed-used space and “Warehouse” has been used for commercial space because values are not available for these uses and the substitute building types are considered to be most closely aligned.																					
Operational water use (B7)	To calculate water use of the development the following assumptions have been used: 149 litres is used per person per day, as per the Wales’ national statistics²; - There will be an average of 2.26 people per household as per Wales’ national statistics³; - There will be a gradual reduction in carbon associated with water supply and treatment in line with Welsh Water targets to be net zero carbon by 2040⁴.																				

Vulnerability of the development to climate change and ICCI assessments

Assessment methodology

12.2.19. The approach and methodology for the CCRA is as follows:

- analysis of relevant climate change and weather data, emissions scenarios and probability levels;

² Welsh Government (2021) Daily water consumption per person in Wales. Available at: <https://stats.wales.gov.wales/Catalogue/Environment-and-Countryside/State-of-the-Environment/Sustainable-Use-of-Resources/CHART-PerCapitaConsumptionOfWater-by-Year>

³ Welsh Government (2021) Estimated households for Wales. Available at <https://gov.wales/household-estimates-mid-2020-html>

⁴ Welsh Water (2021) Welsh Water to deliver net zero carbon emissions by 2040. Available at: <https://corporate.dwrcymru.com/en/news-media/2021/welsh-water-to-deliver-net-zero-carbon-emissions-by-2040>

- assessment of climate hazards;
- identification of potential risks from these climate hazards to the assets and occupants of the Proposed Development;
- consideration of the resilience of the Proposed Development within the context of any incorporated mitigation measures, including resilience measures which are embedded within the design due to regulations and design guidelines; and
- identification of need for any further resilience measures to protect the Proposed Development against the effects of climate change.

12.2.20. The CCRA is composed of three main parts:

- the identification of climate hazards and benefits;
- the assessment of likelihood and consequences; and
- the evaluation of significance.

12.2.21. There is no legislative definition of 'significance' for a CCRA. IEMA states the conclusion of whether an effect is significant/the level of significance is down to the project designer in conjunction with the EIA Coordinator.

12.2.22. The project designers and EIA assessment team therefore conducted an assessment based on the methodology set out in this section.

12.2.23. The potential likelihood and consequence of impacts on the Proposed Development was scored by the project designers using a qualitative five-point scale, as set out in Table 12.3 and Table 12.4.

Table 12.3: Qualitative five-point scale of likelihood of hazard impact⁵

Descriptor	Description
Very unlikely	The event may occur once during the lifetime of the project (60 years).
Unlikely	The event occurs during the lifetime of the project (60 years), e.g. once in 60 years.
As likely as not	The event occurs limited times during the lifetime of the project (60 years), e.g. approximately once every 15 years, typically 2 events.
Likely	The event occurs several times during the lifetime of the project (60 years), e.g. approximately once every five years, typically 3 events.
Very likely	The event occurs multiple times during the lifetime of the project (60 years), e.g. approximately annually, typically 27 events.

⁵ Adapted by Arup from IEMA (2020) Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation. Available at: <https://www.iema.net/resources/reading-room/2020/06/26/iema-eia-guide-to-climate-change-resilience-and-adaptation-2020> [last accessed 03.08.21]

Table 12.4 Qualitative five-point scale of consequences of hazard impact⁶

Descriptor	Description
Negligible	Minor cuts/abrasions requiring minimal treatment; Causing minimal work interruption; No financial loss or costs; No environmental consequence.
Slight	Injury requiring first aid treatment; Causing interruption of work for 3 days or less; Slight financial loss or cost; Slight environmental consequence.
Moderate	4 - 14 day lost-time injury(s). Medical treatment required; Substantial work interruption; Considerable financial loss; Moderate environmental implications.
Major	Major injuries, including permanent disabling injuries of over 14 days; Major work interruption; Serious financial loss; Severe environmental implications.
Catastrophic	Single or multiple deaths involving any persons; Disastrous work interruption; Huge financial loss; Devastating environmental implications.

- 12.2.24. The vulnerability to climate change in the construction phase was not assessed as the construction programme is not expected to be long enough to experience any notable changes in the climate. Even so, extreme weather events are a feature of the baseline climate and projected climate at the time of construction and therefore it is expected that a detailed CEMP would be prepared by the appointed contractor and implemented during the construction period. The detailed CEMP includes measures such as ensuring construction materials are covered when stored, and pro-active planning undertaken that accounts for the possibility of extreme weather events, including the use of extreme weather alert systems.
- 12.2.25. Whilst the impacts of climate change are already being experienced, particularly in terms of increased frequency and severity of extreme weather events such as storms and heatwaves, due to the short-term phase of construction, it is considered that good construction practice measures alongside the detailed CEMP will appropriately mitigate climate change risks during the construction phase.
- 12.2.26. Issues related to vulnerability to climate change predominantly concern the operational phase and how buildings and infrastructure have been designed and developed to integrate resilience to a changing climate.

⁶ Adapted by Arup from IEMA (2020) Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation, description text amended to focus on added to include injury to people, financial loss and environmental implications.

12.2.27. Flood risk has been assessed within Chapter 9 Water environment.

Significance criteria

12.2.28. The significance of the risks identified in the CCRA is evaluated based on a qualitative assessment, carried out by the project designer, of the likelihood of a hazard having an impact on the Proposed Development and the consequence of the impact as set out in Table 12.5.

Table 12.5 Significance matrix⁷

		Measure of consequence				
		Negligible	Slight	Moderate	Major	Catastrophic
Measure of likelihood	Very likely	Medium	Medium	High	Very high	Very high
	Likely	Low	Medium	Medium	Very high	Very high
	As likely as not	Low	Low	Medium	High	High
	Unlikely	Very low	Very low	Low	Medium	Medium
	Very unlikely	Very low	Very low	Low	Low	Medium

12.2.29. For this assessment, significant risks have been defined as those that are of medium, high or very high significance. Significant risks for each impact have also been assessed considering the design mitigation known at the time of assessment.

CCRA and ICCI assessment limitations and assumptions

12.2.30. The CCRA and ICCI assessments are based on the assumption that mitigation measures for effects assessed by other topics will be implemented effectively.

12.2.31. The limitations of the CCRA and ICCI assessments are as follows:

- The CCRA has not assessed the buildings (residential, education and commercial) resilience to climate change as there is currently not enough design information at this stage. This is considered a significant risk and will be considered during detailed building design.
- As this is an outline application the ICCI assessments has only been completed based on topics with available information and should be updated as more information becomes available as part of reserved matters. Climate specialists explored the potential for climate change to affect each EIA topic in discussion with the relevant topic specialist. Impacts from climate change were considered negligible for the following topics and were therefore scoped out from further consideration:

⁷ Adapted by Arup from IEMA Guidance, showing items considered Medium or above to be a significant risk. The IEMA guidance has been adapted to mirror terminology used in the wider CCRA assessment to show a scale of very low to very high.

- Noise
- Air quality
- Without detailed design information and topic specific details the impacts foreseen by the ICCI assessment are based on professional judgement and therefore a series of further strategies are suggested to mitigate climate change as far as responsibly possible at this stage. These are outlined in Section 12.8.
- There is limited methodological guidance on climate change resilience assessment in EIA from Government, and other institutions;
- Data on the climate baseline and future projections are based on freely available information from third parties, including the historical meteorological variables recorded by the Meteorological Office (Met Office) and the UK Climate Projections (UKCP18) developed by the Met Office⁸. In addition, the preliminary assessment has been informed by a selected range of existing climate change research and literature, available at the time of undertaking this assessment.
- Climate projections are not predictions or forecasts but simulations of potential scenarios of future climate, under a range of hypothetical emissions scenarios and assumptions. Therefore, the results from running the climate models cannot be treated as exact or factual, but projection options. They represent consistent representations of how the climate may evolve in response to a range of potential forcing scenarios, and their reliability varies between climate variables. Scenarios exclude outlying "surprise" or "disaster" scenarios in the literature, and any scenario includes, out of necessity, subjective elements and is open to various interpretations. In general, global projections are more certain than regional projections, and temperature projections are more certain than those for precipitation. Wind projections have the highest amount of uncertainty associated with them. Furthermore, the degree of uncertainty associated with all climate change projections increases for projections further into the future.

12.2.32. The preliminary CCRA has been informed by the following principle assumptions:

- the assessment has assumed that embedded mitigation measures relevant to different assets will be implemented effectively;
- the assessment is affected by assumptions associated with climate modelling and climate change projections, incorporated in UKCP18;
- the assessment assumes that disruption to the project resulting from any climate risk would cause, at worst, a regional level disruption as the Proposed Development does not include or affect any nationally significant infrastructure. Therefore, no risk is assessed to have greater than a large adverse consequence;

⁸ Meteorological Office UK Climate Projections (2018). Available online: <https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/index> [last accessed 03.08.21]

- the assessment is largely qualitative, with the exception of assessments relevant to drainage assets and flood risk, which have been informed by the Environment Agency climate change allowances for increases in peak river flow and rainfall intensity;
- there is inherent uncertainty in climate change projections. This study has been quantified using UKCP18, the latest set of probabilistic climate projections for the UK;
- there is often uncertainty in the relationship between changes in climate hazards and the respective response in terms of asset performance. This uncertainty has been assessed qualitatively; and
- the evidence relating to climate change impacts for some categories of assets and infrastructure is limited at this stage in the design. In these cases, the assessment has been informed by professional judgement.

12.3. Relevant Legislation, Policy & Guidance

- 12.3.1. The Kyoto Protocol is an international treaty which extends the United Nations Framework Convention on Climate Change (UNFCCC) and commits its parties by setting internationally binding emission reduction targets. Under Article 4 of the Kyoto Protocol, the EU created an Effort Sharing Regulation that requires the setting of individual binding GHG emission reduction targets for each of its Member States.
- 12.3.2. The Paris Agreement is an international climate agreement aiming to limit global temperature increase this century to less than 1.5 degrees Celsius above pre-industrial levels. It was adopted into UK law in 2015 and was enforceable as of November 2016. Additionally, it is to establish a goal on enhancing adaptive capacity⁹, strengthening resilience and reducing vulnerability to climate change. The guidelines for implementing the Paris Agreement were adopted at the 24th Conference of the Parties (COP24), in Katowice, Poland.
- 12.3.3. The UK is no longer a member of the European Union. Some aspects of EU legislation as it was applied to the UK on 31st December 2020 are now a part of UK domestic legislation, under the control of the UK's Parliaments and Assemblies.
- 12.3.4. The European Union (Withdrawal) Act 2018 introduced "retained EU law" which provides that EU-derived domestic legislation continues to have effect after 31st December 2020.
- 12.3.5. The EIA Directive (85/337/EEC) states that EIAs shall identify, describe and assess the direct and indirect significant effects of climate change relevant to a project. The Regulations implementing this directive were transposed into The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017.

⁹ Adaptive capacity relates to the capacity of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.

National

- 12.3.6. The Climate Change Act 2008¹⁰ committed the UK to its first statutory carbon reduction target to reduce carbon emissions by at least 80% from 1990 levels by 2050.
- 12.3.7. In June 2019, following the recommendation made by the UK Committee on Climate Change (UK CCC), the Climate Change Act 2008 (2050 Target Amendment) Order 2019 amended the legislated target to reduce GHG emissions by 'at least 100% below the 1990 baseline year' by 2050. The 100% reduction is often referred to as 'net zero' Greenhouse Gas emissions by 2050.
- 12.3.8. The Climate Change Act 2008 requires that five-yearly Carbon Budgets are set and not exceeded. It also established a requirement to undertake a climate change risk assessment (CCRA) every five years and development of a programme for adaptation action in response to the risks identified. Adaptation actions involve the provision of better information, diversification of supply chain risks and building better capacity to manage, share and transfer risk. There is an important role for new technology and infrastructure.
- 12.3.9. In June 2021, the UK Government legislated the Sixth Carbon Budget for the period 2033-2037¹¹. It is the first Carbon Budget to set the UK on a net zero GHG emissions path, requiring the UK to cut emissions by 78% by 2035 to support meeting net zero GHG emissions by 2050.

Table 12.6 – UK carbon budgets, as legislated by the Climate Change Act 2008¹²

Carbon budget	5-year period	Carbon budget level (tonnes of carbon dioxide equivalent (tCO ₂ e))
Third	2018-2022	2,544,000,000
Fourth	2023-2027	1,950,000,000
Fifth	2028-2032	1,725,000,000
Sixth	2033-2037	965,000,000

- 12.3.10. The Independent Assessment used to help inform the third UK Climate Change Risk Assessment (CCRA3) assesses 61 risks and opportunities from climate change to Wales, including to business, infrastructure, housing, the natural environment, our health and risks from the impacts of climate change internationally. It also recognises that more action is needed to encourage information sharing between infrastructure operators to improve overall risk management. The UK's Third CCRA was published in June 2021¹³.

¹⁰ UK Government, Climate Change Act 2008. Statute Law Database, 2008

¹¹ UK Government (2021) The Carbon Budget Order. Available at: <https://www.legislation.gov.uk/uksi/2021/750/introduction/made> [last access 03.08.21]

¹² Set out in the Carbon Budgets Order 2009, the Carbon Budget Order 2011, the Carbon Budget Order 2016 and the Carbon Budget Order 2021.

¹³ UK CCC. 2021. UK CCRA3. Available online at: <https://www.ukclimaterisk.org/> [last accessed 28.06.2021]

- 12.3.11. The Environment (Wales) Act 2016 requires Welsh Ministers to meet greenhouse gas reduction targets for Wales and establishes a 2050 emission target of 80% reduction in net emissions from the baseline year (1990 or 1995 depending in the specific greenhouse gas). Progress to this target is supported by interim emissions targets set for every ten years until 2050 and carbon budgets established for five-yearly periods. In June 2019, Welsh Government committed to adopting the Committee on Climate Change's recommendation to change the emissions reduction target to 95% by 2050, with an ambition to reach net zero emissions by 2050. In March 2021 Senedd Cymru approved a net zero target for 2050. Net zero means balancing the greenhouse gas emissions with the amount of gases we're removing from the atmosphere.
- 12.3.12. The Well-being of Future Generations (Wales) Act 2015 requires public bodies to carry out sustainable development, which is the process of improving the economic, social, environmental and cultural well-being of Wales by taking action aimed at achieving the well-being goals. The Act establishes seven well-being goals, which specifically reference acting on climate change. As such, the Act requires all public bodies to embed climate change into their decision-making.
- 12.3.13. The Planning (Wales) Act 2015 emphasises that national, strategic and local planning must be carried out in accordance with the sustainable development definition and principle as per the Well-being of Future Generations (Wales) Act 2015.

Policy context

International

- 12.3.14. Published in 2015, the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report provides evidence that human influence on climate change is clear and growing. Climate change is the largest inter-related cumulative environmental effect which has the potential to lead to significant environmental effects on a wide range of areas. This report outlines potential impacts of climate change in various geographical areas.
- 12.3.15. In 2018, the IPCC published a Special Report¹⁴ on limiting global temperature increases to 1.5°C above pre-industrial levels. It identifies the need for systems transitions in all sectors to limit global warming to 1.5°C and avoid the climate-related risks associated with warming of 2°C or more.

National - UK

- 12.3.16. The Climate Change: second national adaptation programme (2018 – 2023) (NAP) was produced by the Department for Environment, Food and Rural Affairs (DEFRA) and launched in 2018. The plan sets out the government's response to the second CCRA. It forms part of the five-yearly cycle of requirements laid down by the Climate Change Act, with the aim of driving a dynamic and adaptive approach to building the nation's resilience to climate change.
- 12.3.17. The UK Clean Growth Strategy is part of the wider Industrial Strategy. It sets out the Government's policies for delivering economic growth that delivers on the UK's legal requirements for reducing carbon emissions. This includes measures that will support green finance, that support businesses to reduce

¹⁴ IPCC (2018) Global warming of 1.5oC. Available at: <https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments/>

energy consumption by 20% by 2030, increase the energy efficiency of homes, supporting the shift to low-carbon transport, developing flexible energy networks and making better use of natural resources.

- 12.3.18. In March 2021 Senedd Cymru approved a net zero target for 2050. Net zero means balancing the greenhouse gas emissions with the amount of gases we're removing from the atmosphere¹⁵.

Table 12.7 – Wales' carbon budgets

Time period	Carbon budget/target
Carbon budget 2 (2021-2025)	Average of 33% reduction
2030 target	63% reduction
2040 target	89% reduction
2050 target	At least 100% reduction (net zero)

National - Wales

- 12.3.19. The 11th edition of Planning Policy Wales (PPW11) was published in February 2021. Together with Future Wales, the national development framework, it sets out land-use and planning policy for Wales. The new planning policy incorporates the sustainable development principles of the Well-being of Future Generations (Wales) Act 2015.
- 12.3.20. Prosperity for all: A low carbon Wales was published in March 2019. It sets out how Wales aims to meet the first carbon budget (2016-2020) and consequently the 2020 interim target through 100 policies and proposals across Ministerial portfolios.
- 12.3.21. Prosperity for all: A Climate Conscious Wales (2019) to influence partners in Wales to take action. The document aims to raise awareness of climate adaptation and offers knowledge and best practice to improve climate resilience.
- 12.3.22. Technical Advice Note 12: Design sets out the Welsh Government's land use planning policy in respect of 'Promoting sustainability through good design' and 'Planning for sustainable buildings', which includes the role of local planning authorities in delivering good sustainable design

¹⁵ <https://gov.wales/climate-change-targets-and-carbon-budgets>

Local

- 12.3.23. The Neath Port Talbot County Borough Council (NPTCBC) Local Development Plan (2011-2026)¹⁶, Strategic Policy SP1 Climate Change addresses climate change by implementing the following measures:
- The efficiency and sustainability of the County Borough's settlements will be enhanced through developing more cohesive and efficient settlements and settlement patterns, and consequently more sustainable travel patterns;
 - Greenhouse gas emissions from transport will be minimised through encouraging freight / commercial transport by alternatives to road (e.g. rail or sea);
 - Dependence on the private car and the need to travel in general will be reduced through promoting alternative means of transport and more efficient use of existing facilities, co-location and joint use of facilities; and
 - Provision will be made for the County Borough's appropriate contribution to renewable and low carbon energy generation.
- 12.3.24. In relation to the consequences of climate change:
- Likely increased food risk will be taken into account and addressed by ensuring that there is greater resilience by avoiding development on land that is at risk from flooding in the first instance in accordance with the sequential approach set out in national guidance or in locations that could increase the risk of flooding elsewhere; and
 - The fragmentation of habitats will be minimised and opportunities made for habitat and species change and migration where possible.
- 12.3.25. NPTCBC Local Flood Risk Management Strategy¹⁷ recognises the impacts of climate change on flooding. This is likely to result in more precipitation and flood events during the winter. It is suggested that schemes maximise the benefits gained from SuDS providing opportunities to create 'green infrastructure' and 'blue corridors' that provide multiple benefits.
- 12.3.26. NPTCBC Decarbonisation and Renewable Energy Strategy (2020)¹⁸ outlines the Council's overarching vision and objectives to introduce a series of interventions and improvement measures across the County Borough to maximise the economic, social and environmental benefits and opportunities that the decarbonisation agenda provides. It also sets out what the Council has already achieved and identifies the potential future opportunities that exist. The document outlines the overall sustainability

¹⁶ Available at: <https://www.npt.gov.uk/7328>.

¹⁷ Available at: <https://www.npt.gov.uk/4520>.

¹⁸ Available at: <https://www.npt.gov.uk/23524>.

drive and the associated action plan framework that will assist the Council in meeting its carbon footprint reduction aspirations.

- 12.3.27. Where appropriate, development applications will need to be accompanied by an 'Energy Assessment' which should investigate the potential to incorporate on-site zero and low carbon equipment and establish connections to existing sources of renewable energy. Opportunities for linking with district heating networks and where appropriate sharing renewable energy with the wider community will also need to be explored.

Relevant guidance

- 12.3.28. The following best practice guidance has been used to assess the impact of GHG emissions and vulnerability to climate change from the Proposed Development in this EIA:

- Institute of Environmental Management and Assessment (IEMA) (2017) Environmental Impact Assessment Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance. The Guide outlines the best practice process for undertaking the GHG emissions assessment as it relates to the EIA stages;
- The British Standard BS EN 15978:2011 sets out the overall principles of embodied and whole life carbon measurement in the built environment.
- The British Standard BS EN 15978 covers the assessment of the environmental performance of buildings, while the associated BS EN 15804 covers the environmental performance of individual products.
- The Publicly Available Specification 2080 (PAS 2080:2016)¹⁹ on carbon management in infrastructure. PAS 2080 was designed to specifically address the management of carbon in infrastructure. It looks at the whole life cycle of the carbon used on projects and promotes reduced carbon, reduced cost infrastructure delivery and a culture of challenge in the infrastructure value chain where innovation can be fostered; and
- RICS (2017) Whole life carbon assessment for the built environment. This document provides requirements and supporting guidance for conducting whole life carbon assessments for construction projects.
- Institute of Environmental Management and Assessment (IEMA) (2020) Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation. This publication is an essential reference point and guidance for considering climate change resilience and adaptation in EIA, for professionals coordinating EIA's or supporting significant assessments for climate change. It also draws from the relevant aspects of the EIA Regulations.
- NPTCBC Supplementary Planning Guidance: Renewable & Low Carbon Energy (2017) gives information about the planning approach to renewable and low carbon energy in Neath Port Talbot

¹⁹ British Standards Institution (2016) "PAS 2080:2016 Carbon Management in Infrastructure".

and sets out the relevant matters that will need to be taken into consideration when developments are being planned in the County Borough.

12.4. Baseline environment

GHG historic baseline

12.4.1. The UK's most recent final GHG emissions national statistics (for 2019)²⁰, set out the total UK GHG emissions for 2019 at 454.8 million tonnes of carbon dioxide equivalents (MtCO₂e). UK total emissions are showing a general downward trend, with 2019 UK total GHG emissions down 2.8% from 468.1 MtCO₂e in 2018. In 2019, the largest emitting sector was transport, accounting for 27% of the UK GHG emissions.

12.4.2. At a Welsh region level, in 2019, emissions in Wales were 38,489 ktCO₂e²¹.

CCRA historic baseline

12.4.3. The Met Office generates climatologies for different areas of the UK, known as climate districts, including historical regional climate information. The Proposed Development is with the Welsh region²². The historical observed weather therefore varies across the region due to the changing topography and atmospheric conditions. Table 12.7 describes the historical observed weather for the Welsh region.

Table 12.7 High level historical climate observations for the Welsh regional climate zone

Climate Parameter	Wales Region - Historical Weather Observations
Temperature	The mean annual temperature at low altitudes in Wales varies from about 9.5 °C to 11 °C, with the higher values occurring around or near to the coasts.
Precipitation	Annual precipitation in region has an average of 1000mm per year.
Wind	The region experiences 15 gales in an average year.
Sunshine	On the south-western coast the average annual sunshine total of over 1700 hours.
Ground frost	In the region ground frost averages of 40 days a year.
Snowfall	The region's average number of days each year when sleet or snow falls varies from 10 days or less per year.

²⁰ UK Government (2020) National Statistics for carbon emissions. Available at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/957887/2019_Final_greenhouse_gas_emissions_statistical_release.pdf [last accessed 31.08.21]

²¹ Welsh Government (2021) Emissions of Greenhouse Gases by Year. Available at: <https://statswales.gov.wales/Catalogue/Environment-and-Countryside/Greenhouse-Gas/emissionsofgreenhousegases-by-year>. [last accessed 31/08/21].

²² Met Office. UK Regional Climates. Available at: <https://www.metoffice.gov.uk/research/climate/maps-and-data/regional-climates/index>. [last accessed 31/08/21].

Future baseline

- 12.4.4. This section presents future projected climate conditions and extreme weather events for the area encompassing the Proposed Development for the 2050s and 2070s. These time periods cover the construction period, commencing in 2022, and a 60-year operational life, 2026-2086.
- 12.4.5. The description of future climate conditions and extreme weather events are based upon climate change projection data from the United Kingdom Climate Projections 2018 (UKCP18)²³. UKCP18 data is the most comprehensive and widely used data set of climate projections covering the UK.
- 12.4.6. Using the historical baseline data, two methods were implemented to establish the future climate baseline:
- The changes in average climate conditions were obtained from the UKCP18 probabilistic projections of climate change available at a spatial resolution of 25km²³; and
 - The changes in extreme weather events were obtained using UKCP18 regional projections available at a spatial resolution of 12km.
- 12.4.7. Climate change projections for a range of meteorological parameters are presented for different probability levels within the Representative Concentration Pathway 8.5 (RCP8.5) high emission scenario²⁴ for the near-term and long-term future time periods. This is consistent with industry best practice in considering vulnerability to climate change. Table 12.8 presents changes in extreme weather events for the 2050s and 2070s, such as number of heavy rainy days and presents expected changes in climate conditions, such as mean temperature and precipitation for the 2050s and 2070s.
- 12.4.8. Temperatures are projected to increase both in winter and summer. The largest increase in temperature is projected to be in the mean daily maximum temperature in summer, which is expected to increase by 4oC to 23.9oC in the 2070s, relative to the baseline in the high emissions scenario.
- 12.4.9. Mean precipitation rates for the winter are anticipated to change, increasing by 15.5% in the 2050s and to 22.9% in the 2070s. In the summer precipitation rate is anticipated to decrease by 20.5% in the 2050s and 30.7% in the 2070s.
- 12.4.10. The mean number of hot days, when the maximum temperature is above 25°C, is anticipated to increase from 8.3 days to 45.9 days per year in the 2070s for the high emissions scenario. The average number

²³ Meteorological Office UK Climate Projections 2018. Available online: <https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/index> [last accessed 03.08.21]

²⁴ The RCP8.5 global warming scenario represents a very high baseline emission scenario, representing the 90th percentile of no-policy baseline scenarios available at the time. '8.5' represents 8.5 watts per metre squared, which is a measure of the end-of-century radiative forcing increase relative to pre-industrial conditions. The four RCP scenarios include "one mitigation scenario leading to a very low forcing level (RCP2.6), two medium stabilisation scenarios (RCP4.5/RCP6.0) and one very high baseline emission scenarios (RCP8.5)". The high emissions baseline scenario is chosen to represent a potential worst-case outcome, allowing sensitivity testing of critical features of the Proposed Development. This is also representative of the trajectory that global emissions have been on. Additionally, the future climate baseline forms part of other EIA topics' respective future baselines for assessment. Use of the high emissions scenario ensures that any very vulnerable, high-value receptors are considered. These datasets are available at: www.metoffice.gov.uk [last accessed 03.08.21]

of days in a given year when the mean daily temperature is below 0°C is anticipated to decrease from 27.4 days to 1 day in the 2070s under the RCP 8.5 high emissions scenario.

- 12.4.11. In the case of extreme precipitation, the number of days with heavy rain (precipitation greater than 25mm/day) in a given year is expected to increase from 9.7 days in the baseline period to 14.3 days in the 2070s. Similarly, the average annual number of dry spells (periods of at least ten consecutive days with no precipitation) is projected to increase from 4.1 days in the baseline period to 5.4 days for the 2070s under the RCP 8.5 high emission scenario.

Table 12.8 UKCP18 climate change projections for extreme weather events for the Proposed Development area²⁵

Parameter		Observed baseline (1981-2000)	2040-2059			2060-2079		
			Min.	Mean	Max.	Min.	Mean	Max. ²⁶
Temperature	Number of frost days (daily minimum temperature equal or lower than 0°C)	27.4	17.9	7.8	1.0	12.4	0.9	-12.4
	Heatwaves (2 days with maximum temperature higher than 29°C and minimum temperature higher than 15°C)	1.4	3.4	6.1	12.3	4.5	11.3	16.7
	Number of hot days (daily maximum temperature higher than 25°C)	8.3	19.4	27.6	47.8	22.0	45.9	65.1
Precipitation	Dry spells (10 days or more with no precipitation)	4.1	4.2	4.8	5.4	4.7	5.4	6.7
	Annual number of days per year when precipitation is greater than 25mm per day (Met Office definition of 'heavy rain')	9.7	10.2	12.7	15.8	10.7	14.3	17.3

²⁵ Data based on 12km grid square, 437500, 112500 for the 2020s and 2050s (under the RCP 8.5 high emissions scenario, Available at: https://catalogue.ceda.ac.uk/?q=ukcp18&sort_by= [last accessed 03.08.21]

²⁶ 12 regional models are used in UKCP18 to project the variables for extreme weather events. The min. (minimum) and max. (maximum) values shown here are the minimum projection from the 12 models and maximum projection from the 12 models for the given parameter.

Table 12.9 UKCP18 climate change projections for average climate variables for the Proposed Development area²⁷

Parameter		Observed baseline (1981-2000)	Anomalies from baseline for 2050 (2040-2059)			Anomalies from baseline for 2070 (2060-2079)		
			10 th percentile	50 th percentile	90 th percentile	10 th percentile	50 th percentile	90 th percentile
Temperature (°C) (change from baseline)	Mean winter daily temperature	5.53	5.97	7.14	8.4	6.23	7.95	9.68
	Mean summer daily temperature	15.96	16.6	18.14	19.73	16.86	19.38	22.13
	Mean daily winter minimum temperature	2.96	3.32	4.56	6	3.62	5.37	7.3
	Mean daily summer maximum temperature	19.9	20.67	22.5	24.44	21	23.86	26.81
Precipitation (mm)	Winter mean precipitation mm/day	4.38mm	4.28	5.04	5.89	4.36	5.38	6.58
	Summer mean precipitation mm/day	2.94mm	1.69	2.34	2.98	1.21	2.04	2.86

12.5. Inherent design mitigation

GHG design mitigation

- 12.5.1. The benchmarks used to undertake the GHG emissions assessment are assumed to reflect a development built and operated according to standard practice.

²⁷ Data based on 25km grid square, 271728, 196091 for the 2050s and 2070s (under RCP 8.5 high emissions scenario), Available at: https://catalogue.ceda.ac.uk/?q=ukcp18&sort_by= [last accessed 03.08.21]

- 12.5.2. The PAS2080 carbon management hierarchy will be used to influence the detailed design stage of the Proposed Development. A carbon management hierarchy outlines broad categories of mitigation strategies that are more favourable than others:
- Build nothing: assess the basic need for development and consider alternative approaches to achieve the desired outcomes;
 - Build less: evaluate the potential for re-using and/or refurbishing existing assets to reduce the extent of new construction required;
 - Build clever: consider the use of low carbon solutions (including technologies materials and products) to minimise resource consumption during the construction and operation; and
 - Build efficiently: use techniques (e.g. construction, operational) that reduce resource consumption during the construction and operation phases of an asset or programme of work.
- 12.5.3. The carbon management hierarchy above has and should continue to be applied through every stage of design. The following measures are inherent mitigation to minimise the GHG emissions from the operation of the Proposed Development:
- Taking a fabric first approach and building to Part L Future Homes Standard 2025 standards, energy consumption will be reduced by 30% compared to current Part L from the building fabric alone.
 - St. Modwen aims to reduce construction waste by a third and increase its recycling rate to 99% by 2025. The use of Modern Methods of Construction (MMC) (such as offsite pre-manufacturing) will support achievement of these targets, and the proposed development has a minimum target 30% of homes to be constructed through the application of MMC in line with St. Modwen's own corporate target. This will reduce emissions through modular offsite construction and deliver higher energy efficiency in the buildings.
 - All buildings will incorporate solar PV generation and will be orientated to maximise this benefit.
 - Encouraging the use of low carbon transport modes, including active and public transport, in order to reduce emissions from transport by:
 - Equipping each residential dwelling with a connection for electric vehicle charging.
 - Segregated infrastructure for walking and cycling has been included throughout the Site.
 - Heat pumps will be connected to every individual building prioritising ground source heat pumps where feasible.
- 12.5.4. Overall, this will reduce the energy demand from the electricity grid from 19,916,000kWh (business as usual – high) to 1,256,000kWh per year. This equates to a reduction in GHG emissions from buildings from 84,085 tCO₂e to 5,303 tCO₂e over the operational lifespan of the Proposed Development.

Climate change resilience inherent mitigation

- 12.5.5. The embedded mitigation measures associated with each identified climate change risk have been considered in the CCRA, see Appendix 12.2. The embedded mitigation for each climate hazard is described in Table 12.10.

Table 12.10 Embedded mitigation for each climate hazard.

Climate Hazard	Existing or embedded mitigation
High temperatures	Road construction to current standards which take into consideration future climate baselines. All assets onsite will be monitored as per standard maintenance procedures.
High temperatures	Buildings and pavement construction to current standards, monitored as per standard maintenance procedures.
High precipitation	Masterplan design is based on detailed flood risk assessment which incorporates projected climate change, outlined in Chapter 9 Water environment. A drainage strategy is also being submitted and outlines mitigation for increased precipitation and flood risk.
Low precipitation	Landscape Management Plan includes procedures for irrigation during establishment and ongoing maintenance.
High winds	Current building regulations include sufficient allowance for changes in wind patterns.

12.6. Likely Environmental Impacts & Effects

GHG assessment

Table 12.11 Total Construction Phase GHG Emissions

Emissions source	Emissions over the construction period (tCO ₂ e)
Construction phase (2022 to 2026)	
Materials (A1 to A3)	234,957
Habitat loss (A5)	11,187
Traffic (A4)	182
Construction / Installation process (A5)	150
Total construction phase emissions	246,476

Contextualisation of construction phase effects

- 12.6.1. The construction phase of the development associated with stages A1-A3 will result in additional emissions of 246,476 tCO₂e or 20,540 tCO₂e per year over the 12-year construction period.
- 12.6.2. To contextualise emissions, in accordance with the relevant IEMA guidance, the construction phase emissions have been compared against local, regional and national emissions information.
- 12.6.3. The available Carbon Budgets for the construction phase of the proposed development are the Fourth (2023 to 2027), Fifth (2028 to 2032) and the Sixth Carbon Budgets (2033-2037). As construction begins in 2024, a combination of the carbon budgets that cover 2024 to 2036 have been used to give context to the construction emissions ($\frac{3}{4}$ of the Fourth Carbon budget was used as this spans 2023-2027 and $\frac{3}{4}$ of the Sixth Carbon budget as this spans 2033-2037). The Welsh Government has set a target of 5,241 tCO₂e by 2030.
- 12.6.4. At a local level, carbon budgets have not been set or are not publicly available. Therefore, emissions have been compared to the latest emissions data (2019) for the local area to consider what proportion of regional / local emissions construction may constitute.
- 12.6.5. Therefore, the construction emissions represent 0.0005% of the UK's carbon budgets per annum and 0.07% of the Welsh Government's target per annum for which the construction phase currently spans and which have been set.
- 12.6.6. In 2019, emissions in the area of Neath Port Talbot were 7,165,000 tCO₂e. Therefore, the construction phase emissions would represent 0.29% per annum of Neath Port Talbot's total annual emissions in 2019.

Assessment of construction phase effects

- 12.6.7. The assessment has concluded there would be emissions associated with the construction phase of the development. As the IEMA guidance states that any GHG emissions are significant, it is concluded that there will be a significant effect due to these increases in GHG emissions. However, these emissions are unlikely to impact the UK Government or Welsh Government's ability to adhere to the carbon budgets or targets for the construction's time period.
- 12.6.8. Based on guidance all emissions are deemed significant as increasing emissions is contradictory to the path to zero carbon set out in the Climate Change Act. However, emissions from the Proposed Development are reduced to a scale that makes up a small proportion of overall UK and Welsh carbon budgets, and there is scope for this to be further reduced through carbon management during construction.
- 12.6.9. Further detail on the quantification of emissions and the emissions breakdown per emission source are included in the GHG assessment, see Appendix 12.1.

Table 12.12 Total Operational Phase GHG Emissions

Emissions source Error! Bookmark not defined.	Emissions over appraisal period (Proposed Development) (tCO₂e) (2026 to 2086)
Traffic (B1)	30,668
Public Realm (B1)	1,638
Buildings – maintenance and refurbishment (B2 to B5)	54,381
Operational energy use (B6)	5,303
Operational water use (B7)	489
Total additional emissions	92,478

GHG assessment - contextualisation of operational phase effects

- 12.6.10. The operational phase of the development will result in additional emissions of 92,478 tCO₂e or 1,541 tCO₂e over the 60-year appraisal period.
- 12.6.11. The available Carbon Budgets for the operational phase of the proposed development are the Fourth (2023 to 2027), Fifth (2028 to 2032) and the Sixth Carbon Budgets (2033-2037). As operation begins in 2026, a combination of the carbon budgets that cover 2026 to 2037 have been used to give context to the operational emissions (1/4 of the Fourth Carbon budget was used as this spans 2023-2027). This equates to 3.2MtCO₂e. The Welsh Government has set a target of 5,241 tCO₂e by 2040.
- 12.6.12. Therefore, the operational emissions represent 0.001% of the UK's carbon budgets per annum and 0.029% of the Welsh Government's target per annum for which the operational phase currently spans and which have been set.
- 12.6.13. At a local level, carbon budgets have not been set or are not publicly available, therefore emissions have been compared to the latest emissions data (2019) for the region, to consider what proportion of regional / local emissions operation may constitute.
- 12.6.14. In 2019, emissions in the area of Neath Port Talbot were 7,165,000 tCO₂e. Therefore without mitigation, the operational phase emissions would therefore represent 0.022% of Neath Port Talbot's total annual emissions in 2019.

Assessment of operational phase effects

- 12.6.15. The assessment has concluded there would be emissions associated with the operational phase of the development. As the IEMA guidance states that any GHG emissions are significant, it is concluded that there will be a significant effect due to these increases in GHG emissions. However, these emissions are unlikely to impact the UK Government or Welsh Government's ability to adhere to the carbon budgets or targets for the operational time period.

12.6.16. Based on guidance all emissions are deemed significant as increasing emissions is contradictory to the path to zero carbon. However, emissions from the Proposed Development are reduced to a scale that makes up a small proportion of overall UK and Welsh carbon budgets, and there is scope for this to be further reduced through carbon management at the detailed design stage.

12.6.17. Further detail on the quantification of emissions and the emissions breakdown per asset are included in the GHG assessment, see Appendix 12.1.

CCRA and ICCI

Assessment of construction phase effects

12.6.18. The construction works will take place at different times per plot, between 2024 and 2036, depending on the phasing plans and detailed design. As such, potential climate change risks and in-combination climate impacts for construction will be dependent on these factors and will be considered at a later stage of design within a detailed CEMP.

Assessment of operational phase effects

12.6.19. As set out above, the CP18 2050s and CP18 2070s climate predictions have been used to assess the operational phase of the Proposed Development.

12.6.20. Nineteen climate change risks were identified for the development. These include risks associated with higher temperatures relating to transport, utilities and public realm and risks associated with high and low precipitation and extreme winds. Through a qualitative, professional judgement exercise carried out with designers and the EIA assessment team, all risks were considered to be low or very low and therefore not significant. The detailed CCRA can be seen in Appendix 12.2.

12.6.21. With regards to the ICCI assessment there is not enough design information to assess the in-combination climate change risks for the Proposed Development. Current constraints and mitigation have been assessed from the perspective of the future climate baseline and as such recommended mitigation has been described in Section 12.8. This recommended mitigation will involve collection of data and design information that will allow in-combination climate change risks to be assessed and mitigated. These will be documented through reserved matters applications.

12.7. Additional mitigation, compensation & enhancement measures

12.7.1. The GHG emissions assessment provides an indication of the emissions associated with the construction and operational phases of the Proposed Development. As all emissions from the development are considered significant under the definition in Section 12.3.28 mitigation actions should be implemented to minimise GHG emissions from the development.

12.7.2. PAS 2080 provides a framework for the management of carbon in projects in the built environment. The use of PAS 2080 to guide the approach to reducing GHG emissions associated with the Proposed Development will be adopted in the detailed design and demonstrated through submission of reserved matters.

Mitigation of effects from construction

12.7.3. The following measures are proposed to mitigate the impact of GHG emissions from the construction of the Proposed Development:

- Set targets for carbon reduction, continue to improve baseline understanding over the lifecycle of the project, set and pass targets through the supply chain. This should include a clear plan as to how targets will be passed to developers of individual plots over time (this could e.g. be a plot guide).
- The excess sandstone bedrock produced from the Proposed Development should be re-used onsite, re-used offsite or recycled in that order. HGV movements have not been calculated in the scenario of off-site re-use as the site for re-use is currently unknown. A strategy should be produced to ensure local re-use, reducing the amount of carbon from HGV movements.
- Identify highest impact materials (concrete, steel, plastic and glass) and seek ways to reduce these specifically.
- BREEAM assessments will be undertaken for non-residential buildings proposed as part of the development, including education facilities, office, employment and retail spaces. These buildings will be designed to target a minimum of BREEAM 'Excellent' ratings. If the BREEAM requirements fall short of St Modwen's own target of reducing energy consumption by 30% compared to current Part L Future Homes Standard 2025, then this will become the minimum target for non-residential buildings.
- Reduce the quantity of materials required through efficient design.
- Implement the principles of designing out waste to reduce the embodied emissions used to manufacture materials that are subsequently wasted. This might for example include off-site manufacturing and modular construction.
- Target best in class for key materials and deliver this through the procurement process; select alternative materials that have a lower emissions intensity e.g. recycled material, cement substitutes and best Energy Performance Certificates (EPD) ratings.
- Ensure use of temporary solar panels and batteries, followed by a grid connection instead of using generators and using alternative fuels for plant were applicable.
- Ensuring a green tariff for energy supplied to the site from the grid.
- Low carbon logistics and green travel plans.
- Select local material suppliers to reduce the transport distances and associated emissions from freight.

Mitigation of effects from operation

12.7.4. Additional mitigation that should be considered at the detailed design stage should include:

- Detailed design and reserved matter applications will need to demonstrate achievement of embedded emissions targets as set out in this chapter, the Energy Strategy and the Sustainability Strategy, submitted with this application.
- BREEAM assessments will be undertaken for non-residential buildings proposed as part of the development, including education facilities, office, employment and retail spaces. These buildings will be designed to target a minimum of BREEAM 'Excellent' ratings. If the BREEAM requirements fall short of St Modwen's own target of reducing energy consumption by 30% compared to current Part L Future Homes Standard 2025, then this will become the minimum target for non-residential buildings.
- Set an appropriate minimum standard for sustainability based on good industry practice.
- Consider opportunities for meanwhile uses on the site in terms of the site the programme for development (this could include e.g. energy generation or food production).
- Develop a strategy to support building occupiers to develop a circular economy, reducing consumption and waste.
- Design for operation and deconstruction, consider service-based material and selection of durable materials with low requirements for maintenance and replacement over the operational life of the development, with consideration of appropriate selection of materials based on the design life of the asset.
- Any remaining impacts should be mitigated through land-based interventions, ideally on site, but with offsite options as secondary approach.

CCRA and ICCI

12.7.5. At this stage there is no further mitigation required. As this is an outline application sufficient detail on the building designs and construction methods are currently unavailable.

12.7.6. As such, the following are recommendations for the detailed design stage of the Proposed Development:

- As there is a significant amount of time proposed between phases of development there is the potential for climate change risks to occur during construction relating to high temperatures, high precipitation and extreme weather events. These should be considered within a CEMP at the detailed design stage when information becomes available.
- A Green Infrastructure Management Plan should be developed to incorporate the requirements of the landscaping, flood attenuation and ecological features. This plan should detail how these features can maximise the climate change resilience of the site and enhance each other. For example, as the summers become drier, effective management of the sustainable water systems of the site will aid the resilience of the ecological and landscape features. These will also improve the public realms offering of high temperature resilience to the residents of the site by providing shaded public areas.

- The Cut and Fill Strategy and Ground Investigation has been completed and the current understanding is that existing ground contamination is not currently a threat to the surrounding environment. There remains a risk that this contamination could be released to the local environment in the case of heavy and consistent precipitation, a scenario that will become more likely as climate changes. A detailed CEMP should be completed for each plot of land during detailed design and pre-construction, that considers the existing contamination and how to mitigate this risk for the existing occupants and Crymlyn Bog SAC and SSSI.
- A Drainage Strategy has been completed for the site, which shows water will be managed within a network of water features to reduce infiltration during operation. The management of water on the site could have a positive impact on the conditions of the Crymlyn Bog SAC and SSSI in the long term. For example, reduced precipitation in summers and increased chance of heatwaves could negatively impact the SAC and SSSI, therefore a slower, managed release of water from this site could increase climate resilience and should be considered further at the detailed design stage.
- As the residential dwellings have not been through detailed design at this stage, it is suggested that all residential dwellings consider the future climate baseline by designing them using the Royal Institute of British Architects Guidance (2017)²⁸, and that this takes into account potential for overheating through the application of thermal modelling.

12.8. Residual environment impacts & effects

12.8.1. The Proposed Development would result in an increase of GHG emissions during both the construction phase and operational phase. Emissions from construction are mostly associated with the embodied carbon within construction materials, and emissions from operation are for the most part are associated with traffic. It is considered that these emissions would result in a significant residual effect.

12.8.2. The CCRA has concluded that there is no residual risk to the outline Proposed Development however it is noted that the CCRA has not taken into consideration the residential development part of this application as there is currently no design detail available.

12.9. Cumulative effects

12.9.1. Based upon the available detail within this outline application, there will be no residual in-combination climate change impacts associated with vulnerability to climate change should the mitigation suggested in Section 12.8.2 be completed at the detailed design stage.

12.10. Assessment summary

Topic	Mitigation measures	Designed into the Proposed Development	Delivery via condition (outline/RM)	Delivery via legal obligation	Paragraph reference in the ES	Proposed Monitoring Arrangement
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²⁸ RIBA (2017) Whole Life Carbon Guidance. Available at: <https://www.architecture.com/-/media/gathercontent/whole-life-carbon-assessment-for-architects/additional-documents/11241wholelifecarbonguidancev7pdf.pdf>

Environmental Statement

Coed Darcy



GHG emissions	Building energy consumption reduction	Yes	RM	N/A	Section 12.7	N/A
GHG emissions	Suggested recommendations for reducing GHG emissions from construction	Not currently	RM	N/A	Section 12.7	N/A
GHG emissions	Suggested recommendations for reducing GHG emissions from operation	Not currently	RM	N/A	Section 12.7	N/A
CCRA and ICCI	Completion of a detailed CEMP with climate change considerations and consideration of heavy rainfall impacting contaminated land	Not currently	RM	N/A	Section 12.8	N/A
CCRA and ICCI	A Green Infrastructure Management Plan	Not currently	RM	N/A	Section 12.8	N/A