Environmental Impact Assessment Report
Volume 1, Chapter 28: Climate Resilience

MarramWind Offshore Wind Farm

December 2025

MarramWind

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28. Climate Resilience

28.1 Introduction

28.1.1.1 This climate resilience Chapter of the Environmental Impact Assessment (EIA) Report presents the results of the assessment of climate-related impacts and the potential for likely significant effects on the onshore and offshore Project elements that may arise during the construction, operation and maintenance (O&M) and decommissioning of the Project. It should be read in conjunction with the project description provided in **Chapter 4: Project Description** and the relevant parts of the following chapters and appendices:

- **Chapter 5: Approach to EIA** considers the vulnerability of the Project to major accidents and / or disasters.
- **Chapter 6: Marine Geology Oceanography and Physical Processes** will assess in detail the effects of coastal and physical marine processes on the environment, which will be used to support the offshore climate-related sea level and coastal erosions impacts assessed within this Chapter.
- **Chapter 20: Water Resources and Flood Risk** will present a detailed assessment of flood risk and be used to support the onshore climate-related flood impacts considered within this Chapter.
- **Chapter 23: Terrestrial Ecology and Ornithology** provides additional information in relation to scoping opinion and consultation responses.

28.1.1.2 In addition, **Chapter 10: Marine Mammals** has used climate information from this Chapter to inform how climate may affect marine mammal receptors, their prey species and habitats.

28.1.1.3 The impact of the Project on climate change is assessed in **Chapter 29: Greenhouse Gases**.

28.1.1.4 This Chapter describes:

- the legislation, planning policy, guidance and other documentation that has informed the assessment (**Section 28.2: Relevant legislative and policy context**);
- the outcome of consultation and engagement that has been undertaken to date, including how matters relating to climate resilience have been addressed (**Section 28.3: Consultation and engagement**);
- the scope of the assessment for climate resilience (**Section 28.4: Scope of the assessment**);
- the data sources and methods used for gathering baseline data including surveys where appropriate (**Section 28.5: Methodology for baseline data gathering**);
- the overall environmental baseline (**Section 28.6: Baseline conditions**);
- the basis for the EIA Report (**Section 28.7: Basis for the EIA Report**);
- methodology for the EIA Report (**Section 28.8: Methodology for the EIA Report**);
- the assessment of climate-related impacts and likely significant effects (**Section 28.9: Assessment of effects: Construction**; **Section 28.10: Assessment of effects: Operation and maintenance**; **Section 28.11: Assessment of effects: Decommissioning**);
- the summary of residual effects (**Section 28.12: Summary of residual effects**);

- consideration of transboundary effects (**Section 28.13: Transboundary effects**);
- consideration of inter-related effects and cumulative effects (**Section 28.14: Inter-related effects and Section 28.15: Cumulative effects assessment**);
- a summary of residual climate-related impacts (**Section 28.16: Summary of residual likely significant effects**);
- a reference list is provided (**Section 28.17: References**); and
- a glossary of terms and abbreviations is provided (**Section 28.18: Glossary and Abbreviations**).

28.2 Relevant legislative and policy context and technical guidance

28.2.1 Legislative and policy context

28.2.1.1 This Section identifies the relevant legislation and policy context that has informed the scope of the climate resilience assessment. Further information on policies relevant to the EIA and their status is set out in **Chapter 2: Legislative and Policy Context**, which provides an overview of the relevant legislative and policy context for the Project. **Chapter 2: Legislative and Policy Context** is supported by **Volume 3, Appendix 2.1: Planning Policy Framework**, which provides a detailed summary of international, national, marine and local planning policies of relevance to the EIA.

28.2.1.2 Individual policies of specific relevance to this assessment and associated appendices have been taken into account.

28.2.1.3 This summary provides a foundation for understanding the specific requirements that this Chapter must address in terms of assessing and mitigating impacts on receptors and relevant environmental issues.

28.2.1.4 The legislation relevant to climate resilience includes:

- The Climate Change (Scotland) Act 2009; and
- Climate Change Act 2008; and
- Energy Act 2004.

28.2.1.5 The policies relevant to climate resilience includes:

- Draft Updated Sectoral Marine Plan for Offshore Wind Energy (Scottish Government, 2025)
- NPF4 Planning Guidance Policy 2 – Climate Mitigation and Adaptation (2025) (Scottish Government 2025a);
- United Nations Climate Change Conference (COP29) 2024 (United Nations, 2024);
- Progress Report 2024 (Scottish Government, 2024a);
- Department for Energy Security & Net Zero, National Policy Statement for Renewable Energy Infrastructure (EN-3) 2023 (Department for Energy Security & Net Zero, 2023a);
- Department for Energy Security & Net Zero, Overarching National Policy Statement (NPS) for Energy (EN-1) 2023 (Department for Energy Security & Net Zero, 2023b);
- Aberdeenshire Local Development Plan 2023 (Aberdeenshire Council, 2023a);

- National Planning Framework 4 (NPF4) 2023 (Scottish Government, 2023);
- United Nations Climate Change Conference (COP28) 2023 (United Nations, 2023);
- Carbon Budget Delivery Plan 2023 (HM Government, 2023);
- Clean Power 2030 Action Plan: A new era of clean electricity 2024 (UK Government, 2023);
- UK Climate Change Strategy 2021- 2024 (Export Finance, 2021);
- UNFCCC Glasgow Climate Pact 2021 (United Nation, 2021);
- UK Net Zero Strategy: Build Back Greener 2021 (HM Government, 2021).
- Energy white paper: Powering our net zero future 2020 (HM Government, 2020);
- The Environment Strategy for Scotland 2020 (Scottish Government, 2020b);
- Sectoral Marine Plan for Offshore Wind 2020 (Scottish Government, 2020c);
- The Climate Change Plan, Third Report on Proposals and Policies (2018-2032), Updated 2020 (Scottish Government, 2018);
- Scotland's National Marine Plan (2015) (Scottish Government, 2015);
- United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement 2015 (UNFCCC, 2015); and
- UK Marine Policy Statement 2011 (HM Government, 2011).

28.2.2 Relevant technical guidance

28.2.2.1 Other information and technical guidance relevant to the assessment undertaken for climate resilience include:

- Climate Change: Scottish National Adaptation Plan 2024-2029 (Scottish Government, 2024b);
- Department for Environment, Food and Rural Affairs (DEFRA), UK Climate Risk Independent Assessment 2021 (Betts and Brown, 2021) and UK Climate Change Risk Assessment (CCRA) 2022 (DEFRA, 2022);
- UK Climate Projections 2018 (UKCP18) (Met Office, 2021a);
- UKCP18 Factsheets (Met Office, 2019a) (Met Office, 2019b) (Met Office, 2021b);
- European Commission (EC) Notice – Technical guidance on the climate proofing of infrastructure in the period 2021 – 2027 (EC, 2021);
- Infrastructure In: The Third UK CCRA Technical Report. (Jaroszweski, D., *et al.,* 2021);
- International Organization for Standardization (ISO) 14091:2021 Adaptation to climate change – Guidelines on vulnerability, impacts and risk assessment (ISO, 2021);
- Institute of Environmental Management and Assessment (IEMA), EIA Guide to: Climate Change Resilience and Adaptation 2020 (IEMA, 2020);
- Science Overview Report (Met Office, 2018a);
- UKCP18 Land Projections: Science Report (Met Office, 2018b); and
- UKCP18 Marine Report (Met Office, 2018c).

28.3 Consultation and engagement

28.3.1 Overview

28.3.1.1 This Section describes the consultation and stakeholder engagement undertaken on the Project in relation to climate resilience. This includes early engagement, the outcome of and response to the Scoping Opinions: Onshore Scoping Opinion (Aberdeenshire Council, 2023b) and Offshore Scoping Opinion (Scottish Government, 2023b) in relation to the climate resilience assessment, non-statutory consultation, and the findings of the Project's Statutory Consultation. An overview of engagement undertaken for the Project as a whole can be found in Section 5.5 of **Chapter 5: Approach to the EIA**.

28.3.2 Key issues

28.3.2.1 A summary of the key issues raised during statutory and non-statutory consultation, specific to climate resilience, is outlined below in **Table 28.1**, together with how these issues have been considered in the production of this EIA Report.

Table 28.1 Stakeholder issues responses – climate resilience

Stakeholder	Stakeholder issue ID	Date, document, forum	Stakeholder comment	How is this addressed in the EIA Report
NatureScot	125	Aberdeenshire Council's Scoping Opinion Representation (Aberdeenshire Council, 2023b).	*"The potential for climate change and accelerating sea-level rise on landfall(s) and onshore grid connection infrastructure should be considered. We advise that natural re-exposure of a trenched landfall cable(s) should be scoped in as any demand for protective measures could interrupt coastal processes. The impacts of changes to sediment transfer and coastal processes should be considered in relation to the protected features of designated sites, including the Loch of Strathbeg Site of Special Scientific Interest / Special Protection Area / Ramsar."*	This climate resilience assessment has scoped in impacts related to sea level rise and the risk to infrastructure from coastal flooding and erosion. Further information can also be found within the **Volume 3, Appendix 6.3 Marine Geology Oceanography and Physical Processes Baseline**. In addition, mitigation for scour protection is also included in **Volume 4: Outline Scour Protection Plan.**
Aberdeenshire Council	165	Aberdeenshire Council's Scoping Opinion Representation (Aberdeenshire Council, 2023b).	*"Proposals for life extension, repowering and / or decommissioning must demonstrate accordance with Scottish Environment Protection Agency (SEPA) Guidance on the life extension and decommissioning of onshore wind farms. Table 1 of the guidance provides a hierarchical framework of environmental impact based upon the principles of sustainable resource use, effective mitigation of environmental risk (including climate change) and optimisation of long term ecological restoration. The submission must demonstrate how the hierarchy of environmental impact has been applied, within the context of latest knowledge and best practice, including justification for not selecting lower impact options when life extension is not proposed."*	This climate resilience assessment considers the impact of climate change on the Project assets and uses future climate projections for the 2020 to 2039 (2030s), 2040 to 2059 (2050s), and 2060 to 2079 (2070s) to assess the O&M stage and 2080 to 2099 (2090s) to assess the decommissioning stage for the in-scope receptors and climate hazards. Further information can also be found within **Chapter 23: Terrestrial Ecology and Ornithology**. The interface with climate resilience and the other EIA aspects is captured in the In-Combination Climate Impacts (ICCI) assessment. This is an assessment of how the impacts of climate change could exacerbate or ameliorate potential environmental effects or affect the efficacy of the proposed environmental measures in the future.

Stakeholder	Stakeholder issue ID	Date, document, forum	Stakeholder comment	How is this addressed in the EIA Report
NatureScot	220	29 September 2022 Meeting	*"Nature Scot suggestion that any coastal infrastructure should take future climate change into consideration through dynamic coast study."*	The climate resilience assessment has scoped in impacts related to sea level rise and the risk to infrastructure from coastal flooding and erosion. Further information can also be found within **Chapter 6: Marine Geology, Oceanography and Physical Processes**
NatureScot	221	29 September 2022 Meeting	*"What are the implications of climate change on anchoring system?"*	This climate resilience assessment has considered the destabilisation or degradation of wind turbine generator (WTG) mechanical systems and structures. This included mooring systems.
Marine Directorate - Licencing Operations Team (MD-LOT)	376	12 May 2023 MD-LOT Scoping Opinion (Scottish Government, 2023b).	*"The Scottish Ministers advise in line with the NatureScot representation that the impact of climate change effects should be considered, both in futureproofing the project design and how certain climate stressors may work in combination with potential effects from the Proposed Development. The Scottish Ministers also highlight the comments from NatureScot concerning the consideration of Positive Effects for Biodiversity / Biodiversity gain as well as nature-inclusive design aspects at an early stage of the project's design."*	The impact of climate change on the Project is considered within this climate resilience assessment. This considers how future climate-related impacts may affect the Project, and how environmental measures (either embedded or additional) will build resilience to climate change. Further information can also be found within the **Nature Positive Plan**.
NatureScot	447	12 May 2023 MD-LOT Scoping Opinion Appendix 1: Consultation Responses & Advice (Scottish Government, 2023b).	*"The impact of climate change effects should be considered, both in futureproofing the project design and how certain climate stressors may work in combination with potential effects from the proposed wind farm. The EIA Report should also consider the carbon cost of the wind farm (including supply chain) and to what extent this is offset through the production of green energy."*	The impact of climate change on the Project is considered within this climate resilience assessment. This considers how future climate-related impacts may affect the Project, and how environmental measures (either embedded or additional) will build resilience to climate change. The interface with climate resilience and the other EIA aspects is captured in the ICCI assessment. This is an assessment of how the

Stakeholder	Stakeholder issue ID	Date, document, forum	Stakeholder comment	How is this addressed in the EIA Report
				impacts of climate change could exacerbate or ameliorate potential environmental effects or affect the efficacy of the proposed environmental measures in the future. The EIA Report has considered the carbon cost of the wind farm in **Chapter 29: Greenhouse Gases.**

28.4 Scope of the assessment

28.4.1 Overview

28.4.1.1 This Section sets out the scope of the EIA for climate resilience. This scope has been developed as the Project's design has evolved and responds to stakeholder feedback received to-date, as set out in **Section 28.3**.

28.4.2 Spatial scope and study area

28.4.2.1 The spatial scope of the climate resilience assessment is defined by the spatial extent of the Project denoted by the Red Line Boundary and has formed the basis of the study area described in this Section. Reference to the Red Line Boundary refers to the combined Onshore and Offshore Red Line Boundary. Where used in the context of only the Onshore or Offshore study area, the term Onshore Red Line Boundary or Offshore Red Line Boundary are used as appropriate.

28.4.2.2 The climate resilience assessment considers the Project receptors within the Red Line Boundary as defined below in **Table 28.2**. However, the resilience of the Project is also assessed by its interdependencies with external infrastructure beyond the spatial scope of the Red Line Boundary. For example, the resilience of telecommunication networks operated by a third party.

28.4.3 Temporal scope

28.4.3.1 The temporal scope of the assessment of climate resilience is the entire lifetime of the Project, which therefore covers the construction, O&M, and decommissioning stages.

28.4.3.2 It is anticipated that the construction of the Project will commence in 2030, with the first phase becoming fully operational by 2037. It is anticipated that the second phase of the Project would become fully operational by 2040 and the third phase by 2043. The operational lifetime of the Project for each phase is expected to be 35 years.

28.4.3.3 Climate projection data used to inform the assessment uses 20-year time periods. To assess the construction stage (anticipated to commence in 2030), climate projection data for 2020 to 2039 (2030s) has been used, with consideration of the climate trends extending into the 2040 to 2059 (2050s).

28.4.3.4 The O&M stage has been assessed using climate data for the 2030s, 2050s and into 2060 to 2079 (2070s).

28.4.3.5 The decommissioning stage has been assessed using climate projection data for the timeframe 2080 to 2099 (2090s) aligning with the precautionary principle should the anticipated 35 year operational lifetime be extended.

28.4.4 Identified receptors

28.4.4.1 The spatial scope of the assessment enables the identification of receptors that may experience impacts as a result of climate change. The temporal scope enables the future climate projections to be considered in the climate resilience assessment. The receptors identified that may experience likely significantly effects for climate resilience are outlined in **Table 28.2** .

Table 28.2 Identified receptors requiring assessment for climate resilience

Receptor group	Receptors included within group
Building and infrastructure receptors	Project assets, both temporary and permanent, throughout the lifecycle of the Project. The climate resilience assessment includes for all optionality and scenarios, as described in **Chapter 4: Project Description.** Offshore assets: • WTGs, including floating units (platforms and station keeping system); • array cables; • subsea distribution centres; • subsea substations; • offshore substations; • reactive compensation platform(s) (RCPs) (if required); and • offshore export cables to connect the offshore infrastructure to the landfall(s). Onshore Assets • landfall(s) – the infrastructure associated with landfall(s) located above mean low water springs; • underground onshore export cables running from the landfall(s) to the onshore substations; • onshore substations; • underground grid connection cables (connecting the onshore substations to the grid connection point at Scottish and Southern Electricity Networks (SSEN) Netherton Hub); and • tie-in to grid connection point (SSEN Netherton Hub, which is a separate project and does not form part of the consenting applications that this EIA relates to).
Human health receptors	Construction and decommissioning workers, maintenance staff.
The natural environment	Habitats and species associated with any landscaping and biodiversity planting.

28.4.5 Potential climate-related impacts

28.4.5.1 Potential climate-related impacts on receptors that have been scoped in for assessment are summarised in **Table 28.3**.

Table 28.3 Potential climate-related impacts

Receptor	Climate hazard	Potential impact
Construction stage		
Human health (Offshore)	Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Increased heat stress or heat exhaustion experienced by the construction workforce.
Human health (Offshore)	Increased frequency and intensity of storm events and wave heights.	Extreme storminess leading to increased occurrences of unsafe working

Receptor	Climate hazard	Potential impact
		environments and delays to construction programme.
Building and infrastructure (Offshore)	Increased frequency and intensity of storm events and wave heights.	There is an increased risk of disruption to construction work, such as cranes / barges / rigs / vessels / helicopters unable to operate in high winds.
Human health (Onshore)	Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Increased heat stress or heat exhaustion experienced by the construction workforce.
Building and infrastructure (Onshore)	Increase in precipitation resulting in tidal, fluvial or pluvial flooding.	Flooding of construction site access roads causing delays to construction programme.
Building and infrastructure (Onshore)	Increase in precipitation resulting in tidal, fluvial or pluvial flooding.	Water ingress to equipment or machinery related to construction activities or permanent assets in place during construction, leading to equipment failures or damage.
Building and infrastructure (Onshore)	Increase in precipitation resulting in tidal, fluvial or pluvial flooding.	Overwhelming of the construction site drainage system causing flooding across the site.
Building and infrastructure (Onshore)	Increase in frequency and intensity of storm events.	There is an increased risk of disruption to construction work, such as cranes unable to operate in high winds.
O&M stage		
Building and infrastructure (Offshore)	Increased frequency and intensity of storm events and wave heights.	Destabilisation or degradation of WTG / floater mechanical systems and structures.
Building and infrastructure (Offshore)	Increased frequency and intensity of storm events and wave heights.	Loading and sediment transport across seabed leading to loss of integrity of foundations from scour and exposure.
Building and infrastructure (Offshore)	Increased frequency and intensity of storm events and wave heights.	Loading and sediment transport across seabed leading to loss of integrity of cabling systems from scour and exposure.
Building and infrastructure (Offshore)	Increased frequency and intensity of storm events and wave heights.	Impeded access for maintenance and inspection.
Building and infrastructure (Offshore)	Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Overheating of mechanical and electrical (M&E) assets such as offshore substations, leading to a decrease in asset performance and rating and / or requiring additional electricity demand for mechanical cooling units.

Receptor	Climate hazard	Potential impact
Building and infrastructure (Offshore)	Occurrence of intense low temperatures and cold snaps.	Cold weather leading to ice accretion affecting the efficiency and performance of WTGs.
Building and infrastructure (Offshore)	Increase sea surface temperatures and ocean acidification.	Increased corrosion of the structures.
Building and infrastructure (Onshore)	Sea level rise.	Risk to the onshore infrastructure, such as substations and trenched landfall cables, from coastal flooding and erosion.
Building and infrastructure (Onshore)	Increase in precipitation resulting in tidal, fluvial or pluvial flooding.	Risk to the onshore infrastructure, such as substations, from river, surface water and groundwater flooding.
Building and infrastructure (Onshore)	Increase in precipitation resulting in tidal, fluvial or pluvial flooding.	Restriction of access during flood events, preventing maintenance activities.
Building and infrastructure (Onshore)	Fluctuations in mean rainfall across the year, coupled with an increase in mean temperatures, resulting in changes to soil moisture.	Risk to subterranean and surface infrastructure from subsidence, such as onshore export cables and onshore substations.
Building and infrastructure (Onshore)	Decrease in summer precipitation, leading to drought conditions.	Changes in water content of soil has an adverse effect on soil resistivity leading to a reduction in cable ratings and the effectiveness of earthing systems at the onshore substations.
Building and infrastructure (Onshore)	Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Reduction in the amount of power which can be transmitted and distributed.
Building and infrastructure (Onshore)	Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Overheating of M&E assets such as onshore substations, leading to a decrease in asset performance and rating and / or requiring additional electricity demand for mechanical cooling units.
Human health (Onshore)	Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Increased heat stress or heat exhaustion experienced by the O&M workforce.
Building and infrastructure (Onshore)	Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Underground cable systems affected by the increase in ground temperatures, reducing cable ratings.
Building and infrastructure (Onshore)	Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Wildfire damaging electrical infrastructure.

Receptor	Climate hazard	Potential impact
Building and infrastructure (Onshore)	Occurrence of intense low temperatures and cold snaps.	Cold weather leading to ice accretion causing damage to the infrastructure.
Building and infrastructure (Onshore)	Increased frequency and intensity of storm events.	Lightning causing physical damage, fire, power surge, and shock wave at grid connection points.
Building and infrastructure (Onshore)	Increased frequency and intensity of storm events.	Increased wind loading on substation equipment and security fencing leading to damage.
Human health (Onshore)	Increased frequency and intensity of storm events.	Wind blown debris leading to risk to maintenance personnel.
Infrastructure interdependencies (Whole Project)	Increase in precipitation resulting in tidal, fluvial or pluvial flooding.	Interruption or temporary loss of key supply-chain / third party networks (such as telecommunication networks, grid connections).
Infrastructure interdependencies (Whole Project)	Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Interruption or temporary loss of key supply-chain / third party networks (such as telecommunication networks, grid connections).
Infrastructure interdependencies (Whole Project)	Increased frequency and intensity of storm events	Interruption or temporary loss of key supply-chain / third party networks (such as telecommunication networks, grid connections).
Decommissioning stage		
Human health (Offshore)	Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Increased heat stress or heat exhaustion experienced by the workforce associated with decommissioning.
Human health (Offshore)	Increased frequency and intensity of storm events and wave heights	Extreme storminess leading to increased occurrences of unsafe working environments and delays to decommissioning programme.
Building and infrastructure (Offshore)	Increased frequency and intensity of storm events and wave heights	There is an increased risk of disruption to decommissioning work, such as vessels, cranes and helicopters unable to operate in high winds.
Human health (Onshore)	Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Increased heat stress or heat exhaustion experienced by the workforce associated with decommissioning.
Human health (Onshore)	Increased annual mean temperatures and frequency and intensity of hot spells, coupled with decreased summer precipitation.	Increased dust creation from decommissioning activities, leading to impacts on the health of workers and the failure of machinery and equipment.

Receptor	Climate hazard	Potential impact
Human health (Onshore)	Increased annual mean temperatures and frequency and intensity of hot spells, coupled with decreased summer precipitation.	Risk of wildfires affecting the workforce.
The natural environment (Onshore)	Decrease in summer precipitation leading to drought conditions	Drought conditions impacting water available to use during decommissioning, e.g. for dust suppression.
Human health (Onshore)	Increase in precipitation resulting in tidal, fluvial or pluvial flooding.	Wet weather leading to increased possibility of slips, trips and falls.
Building and infrastructure (Onshore)	Increase in precipitation resulting in tidal, fluvial or pluvial flooding.	Flooding of the site access roads causing delays to decommissioning programme.
Building and infrastructure (Onshore)	Increase in precipitation resulting in tidal, fluvial or pluvial flooding.	Water ingress to equipment or machinery related to decommissioning activities, leading to equipment failures or damage.
Building and infrastructure (Onshore)	Increase in precipitation resulting in tidal, fluvial or pluvial flooding.	Overwhelming of the site drainage system causing flooding across the site.
Building and infrastructure assets (Onshore)	Increased in frequency and intensity of storm events.	There is an increased risk of disruption to decommissioning work, such as vessels, cranes and helicopters unable to operate in high winds.

28.4.6 Climate-related impacts scoped out of assessment

28.4.6.1 A number of potential climate-related impacts have been scoped out from further assessment, resulting from a conclusion of no likely significant effect. These conclusions have been made based on the climate resilience vulnerability assessment completed and presented in the Scoping Report (MarramWind Ltd., 2023) (MD-LOT, 2023), and subsequence Scoping Opinions as noted in **Table 28.1**. The vulnerability assessment considers the sensitivity and exposure of receptors to climate change, using knowledge of the baseline environment, the nature of planned works and the professional judgement on the potential for impact from such projects more widely. Each scoped out activity or impact is presented in **Table 28.4**.

Table 28.4 Climate-related impacts scoped out of assessment

Impact	Rational for scoping out
Impact of increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells at construction stage on Building	The minimal change in average summer temperatures in the 2030s from the baseline (0.77 Degrees Celsius (°C)) was also considered in the exposure assessment of certain construction activities during hot weather, such as pouring concrete.

Impact	Rational for scoping out
and Infrastructure Assets (Onshore and Offshore)	
Impact of increased annual mean temperatures and frequency and intensity of hot spells, coupled with decreased summer precipitation at construction stage on Human Health (Onshore)	The impact of increased dust creation from construction activities and the effect on the health of construction workers resulting from increasing temperatures has been scoped out due to the exposure on the construction workers assessed as being a minimal change in the 2030s from the baseline. This is based on the results of the future baseline, showing the minimal change in exposure, for instance the mean summer temperature is anticipated to increase by 0.77°C coupled with an anticipated 0.20% decrease in summer precipitation for the 50th percentile in the 2030s. The sensitivity of the receptor to changes in dust creation is also considered to be **low**. The sensitivity of the construction workforce to the risk of wildfire is assessed as **high** however, the exposure of this risk due to increasing temperatures and decreased summer precipitation is low. This results in a low vulnerability and is therefore scoped out of the assessment.
Impact of decrease in summer precipitation leading to drought conditions at: • **construction stage on the natural environment (Onshore); and** • **at operational stage on building and infrastructure (Onshore)**	The impact of drought conditions on the water available for use during construction is of low exposure in the 2030s (for instance the negligible 0.20% decrease in summer precipitation), in addition to the low sensitivity of the activity due to alternatives for sourcing water for dust suppression. Therefore, this has been scoped out. The sensitivity of buildings and infrastructure assets to drought conditions is **low**, and exposure during the 2030s and 2050s is also low. Although exposure increase to moderate in the 2070s, the overall vulnerability is low. Therefore, this has been scoped out.
Impact of increase in precipitation resulting in tidal, fluvial or pluvial flooding at: • **construction stage on Human health (Onshore); and** • **operational stage on building and infrastructure (Onshore)**	The increase in precipitation in winter resulting in an increased possibility of slips, trips and falls during construction has been scoped out due to the exposure being of minimal change from the baseline (12.98% increase in winter precipitation from the baseline) coupled with the sensitivity of increased precipitation on the possibility of on-site incidents is **low**. The exposure to changes in precipitation levels is increasing (22% increase in winter precipitation by 2070 and decreased summer precipitation by 12% by 2070), the sensitivity of mature vegetation to these gradual changes resulting in subsequent failure and damage to above ground equipment remains low resulting in the climate impact to be scoped out.
Impact of increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells at operational stage on building and infrastructure (Onshore)	The effect of vegetation growth resulting from longer growing seasons has been scoped out due to the low sensitivity of the assets, such as substations, to encroaching vegetation.

28.5 Methodology for baseline data gathering

28.5.1 Overview

28.5.1.1 Baseline data collection has been undertaken to obtain information over the study area described in **Section 28.4**. The current and future baseline conditions are presented in **Section 28.6.**

28.5.1.2 No site surveys were required to inform the climate resilience assessment.

28.5.2 Desk study

28.5.2.1 The data sources that have been collected and used to inform this climate resilience assessment are summarised in **Table 28.5**.

Table 28.5 Data sources used to inform the climate resilience chapter

Source	Date	Summary	Coverage of study area
Met Office Eastern Scotland: Climate. (Met Office, 2016)	Accessed July 2025.	This document describes the main features of the climate for the region over a 30-year average period of 1981 to 2010.	Full coverage of the Red Line Boundary.
Met Office UK Climate Averages, Fraserburgh climate station (Met Office 2022)	Accessed July 2025.	This data set provides the observed climate data from the nearest climate station to the Project.	Climate data representative of the Red Line Boundary.
UKCP18 Climate Projections (Met Office, 2021b)	Accessed July 2025.	This data source was used to obtain quantitative land projection data to inform future climate.	For the Onshore Red Line Boundary, data taken as an average of the full coverage of the study area**.** For the offshore elements, data taken from most appropriate grid square.
UKCP18 Land Projections: Science Report (Met Office, 2018b)	Accessed July 2025.	This data source was used to ascertain the future climate trends for the onshore elements.	Onshore Red Line Boundary.
UKCP18 Marine Report (Met Office, 2018c)	Accessed July 2025.	This data source was used to ascertain the future climate trends for the offshore elements.	Offshore Red Line Boundary.
UK CCRA 2021, Chapter 4: Infrastructure (Jaroszweski, D., *et al.,* 2021)	Accessed July 2025.	This Chapter provides an assessment of risks and opportunities associated with climate change on infrastructure, such as energy, and includes an assessment of offshore infrastructure.	Full coverage of the Red Line Boundary.

28.5.3 Data limitations

28.5.3.1 The UKCP18 projections (Met Office, 2021a) have been used to infer future changes in a range of climate variables that may affect the vulnerability of the Project to climate change. At the time of writing, these represent the most up-to-date representation of future climate in the UK.

28.5.3.2 There are inherent uncertainties associated with climate projections, and they are not predictions of the future. It is possible that future climate will differ from the future climate against which the Project has been assessed, depending on global emissions over the next century. A 'high' emissions scenario (Representative Concentration Pathways (RCP) 8.5) across a range of time frames relevant to the Project stages have been used to develop a baseline against which climate change risk has been assessed.

28.5.3.3 Any further research, analysis or decision-making in relation to the Project detailed design and operational management should take account of the accuracies and uncertainties associated with climate projections. It is also important to note that the analysis is based on selected observational data, the results of climate model ensembles and a selected range of existing climate change research and literature available at the time of assessment. Any future decision-making based on this analysis should consider the range of literature, evidence and research available at that time and any changes to this.

28.6 Baseline conditions

28.6.1.1 This Section sets out the current climatic conditions to inform the baseline, and a summary of the projected climate (future baseline) on which the climate resilience assessment has been based on.

28.6.2 Current baseline

28.6.2.1 The current baseline for the climate resilience assessment is the current climatic conditions representative of the Red Line Boundary. This is used to provide context of the climate change impacts throughout the construction, O&M and decommissioning of the Project.

28.6.2.2 The current baseline has been derived from the UK regional climate summary for 1981 to 2010 for Eastern Scotland (Met Office, 2016), within which the onshore elements are located.

28.6.2.3 Within Eastern Scotland, the mean annual temperature for this region varies between 6-9°C, whereas the rest of the UK averages 11°C. The average number of days with air frost varies from less than 40 a year on the coast of Fife to more than 90 a year over the higher ground of the Lammermuir Hills and Grampians.

28.6.2.4 Much of Eastern Scotland is sheltered from the rain-bearing westerly winds. This shelter reaches its greatest potential along the coasts and these areas receive less than 700 millimetres (mm) of rainfall in an average year. In contrast, the wettest area is the southern Grampians where the average annual rainfall is over 1500mm. The area of Fraserburgh, within the Red Line Boundary, experiences an average of 750mm of rain annually.

28.6.2.5 Eastern Scotland is one of the windier parts of the UK, being relatively close to the track of Atlantic depressions. The strongest winds are associated with the passage of deep areas of low pressure close to or across the UK. The frequency and strength of these depressions is greatest around the winter months, especially from December to February, and this is when mean speeds and gusts (short duration peak values) are high.

28.6.2.6 **Table 28.6** sets out the observed climate data from Fraserburgh climate station (the nearest Climate Station to the Project) (Met Office, 2022) for the period 1981 to 2010 and contextualises this against the regional data for Eastern Scotland and the country as a whole. The data presents the long term averages for the 30 year period 1981 to 2010 as this aligns with the modelled data used for future climate projections. Data provided in **Table 28.6** presents monthly average rainfall and wind speed values averaged across the 30 year period; the annual total days rainfall over 1mm and annual total days air frost across the 30 year period; the minimum and maximum annual average temperatures across the 30 year period.

Table 28.6 Baseline climate data 1981 to 2010

1981 to 2010	Nearest Climate Station - Fraserburgh	Regional: Eastern Scotland	Scotland
Monthly average rainfall (mm)	81.14	97.10	129.25
Annual total days of rainfall > 1mm (days)	146.43	160.59	188.18
Minimum annual average temperature (°C)	6.14	3.81	4.18
Maximum annual average temperature (°C)	11.40	10.86	10.80
Monthly average mean wind speed at 10 metres (m) (knots)	12.61	10.35	10.90
Annual total air frost (days)	27.63	84.80	75.33

28.6.3 Future baseline

28.6.3.1 UKCP18 (Met Office, 2021a) provides probabilistic data on projected climate variables for the UK for administrative regions. The data provides RCP projections until the end of the 21st century for different emissions scenarios.

28.6.3.2 RCP8.5 is considered a high emissions pathway and represents a potential future which is slow to transfer to low-carbon energy provision. With progress towards achieving National Determined Contributions, RCP8.5 is considered a possible, but conservative, emission scenario suitable for evaluating the Climate Change Resilience of long-lifetime projects.

28.6.3.3 In accordance with technical guidance (IEMA, 2020) the 10 percent, 50 percent and 90 percent probability levels will be considered in the climate resilience assessment as a minimum. Probabilistic climate projections, such as UKCP18, assign a probability to climate change outcomes based on a probability distribution function, which shows the possible range of climate change with the 50 percent probability level the median value. The climate projection values presented are indicative of the trends of climate change and should not be interpreted as absolute values of future climate change.

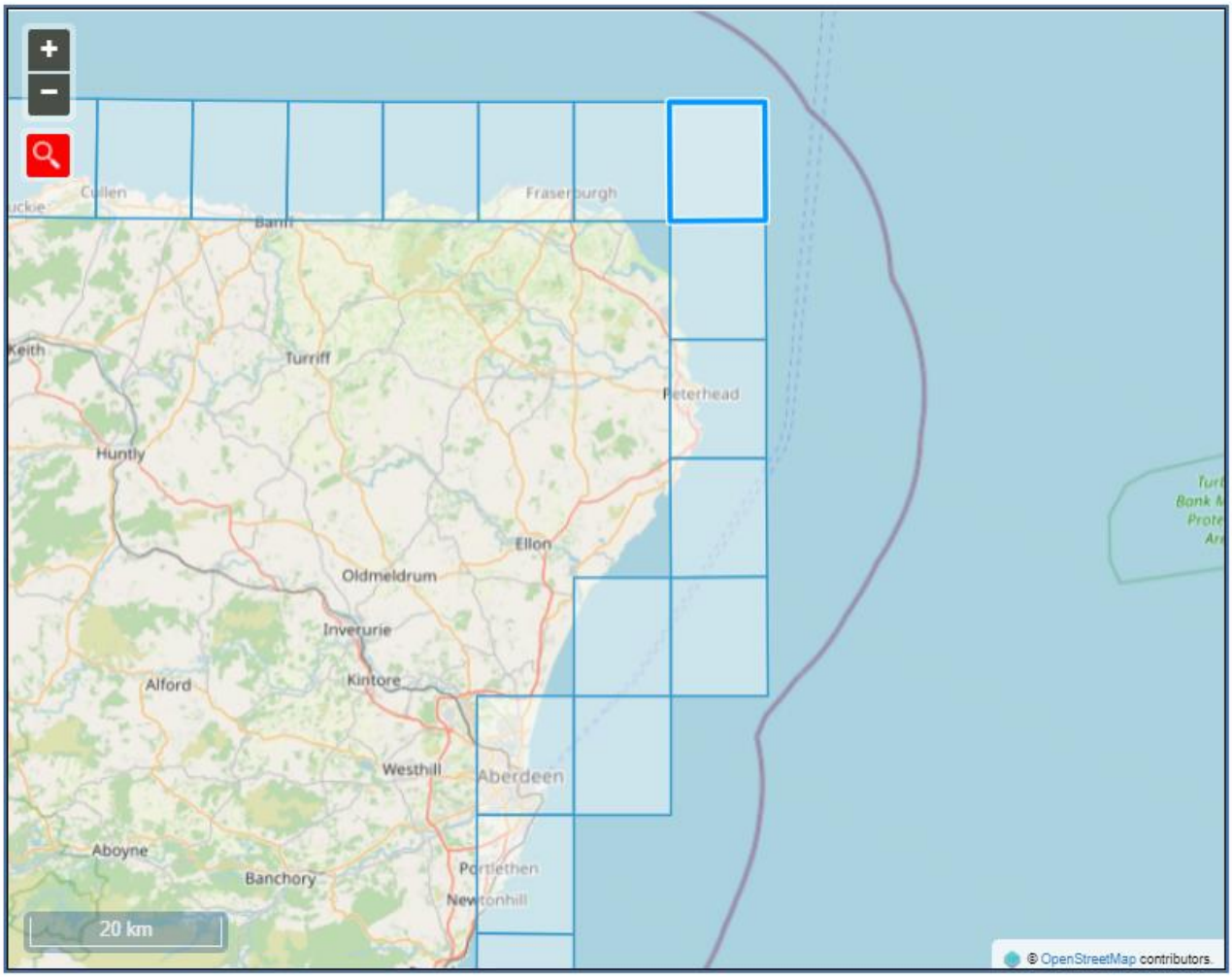
28.6.3.4 The future baseline is used to set out general climatic conditions that would be experienced over the project lifetime based on the following:

- the construction stage is anticipated to commence in 2030 and take up to 12 years for offshore infrastructure and nine years of onshore infrastructure;
- the operational stage will be phased commencing in 2037 through to 2043. Each phase is expected to have an operational lifetime of around 35 years; and
- decommissioning would take place at the end of the operational lifetime.

Offshore

28.6.3.5 Data from UKCP18 marine projections was extracted from the nearest grid cell shown in **Plate 28.1** and tabulated in **Table 28.7**

Plate 28.1 Study area for marine UKCP18 projections



Source: (Met Office, 2021a)

Table 28.7 Future climate projections for the study area from UKCP18 - offshore

Climate Variable	Time Slice and Projected Change					Trend
Time Period	**Percentile**	**2030**	**2050**	**2070**	**2090**	
Mean sea level (MSL) rise (m)	10% 50% 90%	0.07 0.10 0.14	0.15 0.21 0.29	0.24 0.35 0.49	0.35 0.52 0.73	↑ ↑ ↑

28.6.3.6 At the Offshore Red Line Boundary, a MSL rise of 0.52m could be experienced by 2090 (RCP8.5, 50 percent). Sea level rise over the considered time periods of the Project is expected to affect tidal characteristics substantially, however there is no evidence for significant changes in future storm surges, although confidence in this trend is low (Met Office, 2018c).

28.6.3.7 The marine projections also consider that there is no significant additional increase in the statistics of extreme water levels associated with atmospheric storminess only (Met Office, 2018c).

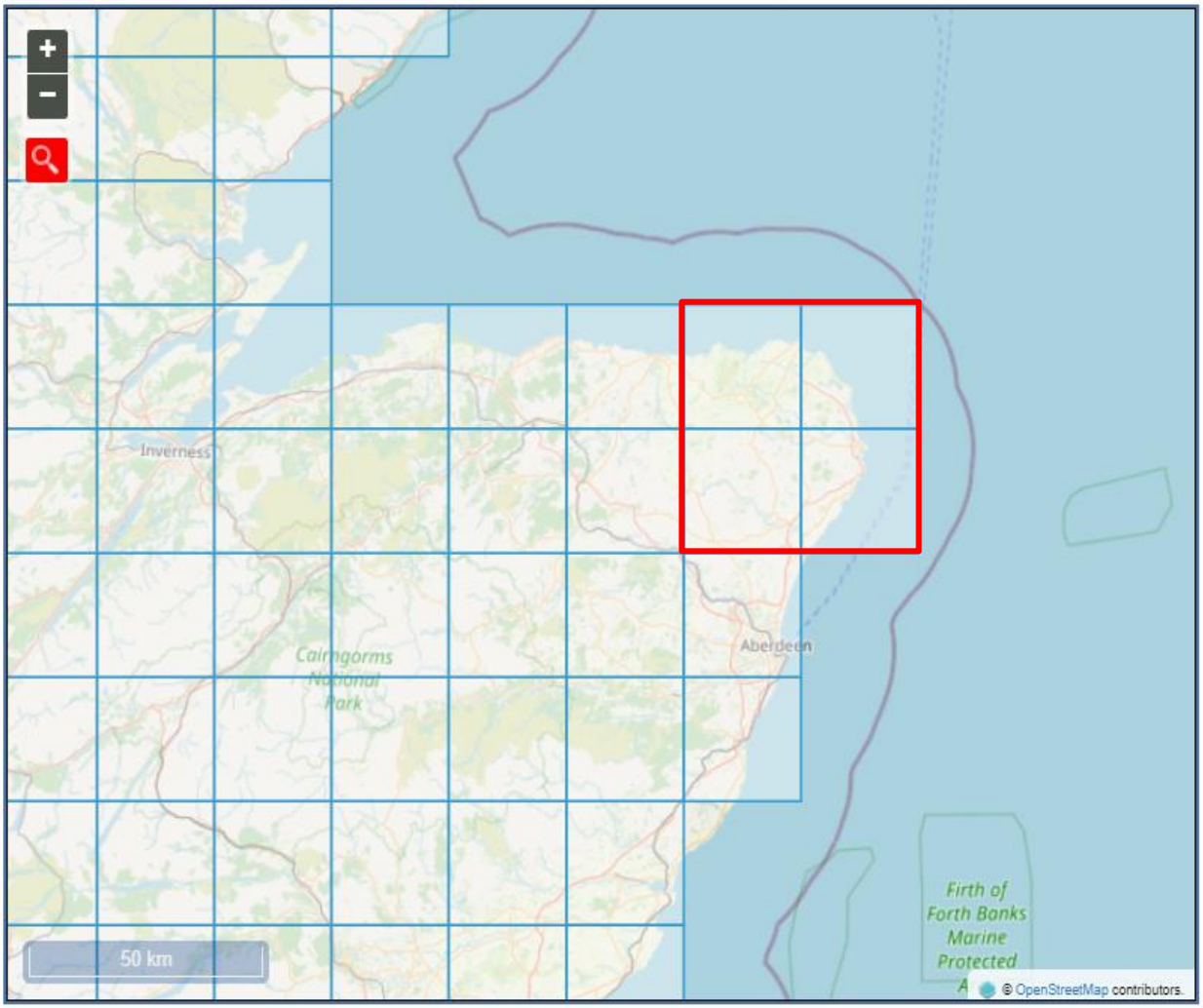
28.6.3.8 The projections for the 21st century suggest a general reduction in wave heights and extreme waves in the order of 10 per cent to 20 per cent; however, this is specific to the location and some coastal regions may remain dominated by local weather variability.

28.6.3.9 UKCP18 does not provide information on changes to coastal water properties, such as sea surface temperature and acidification (Met Office, 2018c). Professional knowledge and judgement has however been used to include impacts associated with these trends. UKCP18 data for temperature and wind is also not available for the marine environment. Land based projection data has been used to inform the assessment for these climate variables.

Onshore

28.6.3.10 **Plate 28.2** shows the study area for the onshore elements of the Project with each grid square representing 25 square kilometres (km^2) (Met Office, 2021a). The climate data was extracted from UKCP18 (Met Office, 2021a) and averaged over the study area. This data is tabulated in **Table 28.8**.

Plate 28.2 Study area for land based UKCP18 data extraction



Source: (Met Office, 2021a)

Table 28.8 Future climate projections for the study area from UKCP18 - onshore

Climate Variable	Time Period and Projected Change					Trend
	Percentile	2030s (2020-2039)	2050s (2040-2059)	2070s (2060-2079)	2090s (2080–2099)	
Mean temperature change (Summer) (°C)	10% 50% 90%	0.03 0.77 1.54	0.34 1.45 2.55	0.77 2.32 3.97	1.48 3.65 5.86	↑ ↑ ↑
Mean temperature change (Winter) (°C)	10% 50% 90%	-0.09 0.74 1.62	0.09 1.22 2.37	0.21 1.69 3.27	0.51 2.51 4.59	↑ ↑ ↑
Maximum temperature anomaly (Summer) (°C)	10% 50% 90%	-0.19 0.69 1.61	0.05 1.40 2.73	0.45 2.37 4.28	1.13 3.81 6.44	↑ ↑ ↑

Climate Variable	Time Period and Projected Change					Trend
	Percentile	2030s (2020-2039)	2050s (2040-2059)	2070s (2060-2079)	2090s (2080–2099)	
Mean precipitation change (Summer) (%)	10% 50% 90%	-12.48 -0.20 12.36	-23.45 -6.21 12.37	-32.19 -12.31 9.58	-45.55 -22.53 6.24	↓ ↓ ↓
Mean precipitation change (Winter) (%)	10% 50% 90%	-4.56 12.98 32.25	-0.63 19.43 42.78	-2.86 22.07 52.66	-0.65 32.92 73.68	↑ ↑ ↑
5-day total summer precipitation (mm)	10% 50% 90%	75.15 81.80 89.78	73.06 82.07 93.42	69.72 82.35 93.03	65.71 82.72 105.72	↓ ⇔ ↑
5-day total winter precipitation (mm)	10% 50% 90%	73.46 80.45 88.80	74.61 83.36 94.09	75.58 87.15 101.55	76.09 91.32 110.70	↑ ↑ ↑

28.6.3.11 **Table 28.8** shows the projected changes in future climate variables across the chosen time periods. Mean temperatures are increasing across all seasons but especially in the summer. The extremes are greater than the mean values, with extreme maximum temperatures increasing throughout the time periods. This could lead to frequent and prolonged hot spells. Hot spells are defined as maximum temperatures exceeding 30°C for two or more consecutive days. By the 2090s the frequency of hot spells is expected to increase (Met Office, 2021a).

28.6.3.12 Precipitation (rainfall) is anticipated to increase in the winter months, with a clear shift to drier summers across all time periods. This is also reflected in the 5-day winter precipitation events, with an increasing trend towards greater intensity and prolonged rainfall events. Despite an overall trend towards drier summers, summer rainfall events are still expected (Met Office, 2019a), however there is not a discernible trend within the 5-day summer precipitation event data to define this trend for the Red Line Boundary.

28.6.3.13 UKCP18 indicates an increase in surface wind speeds over the UK for the second half of the 21st century during the winter season, where more significant impacts of wind are experienced. The frequency of winter storms would increase, however the increase in wind speeds is modest (Met Office, 2018b).

28.6.3.14 The UKCP18 projections by the 2070s, show a decrease in lying winter snow of around 80-100 percent for the east of Scotland in both local (2.2km) and regional (12km) projections. Snowfall will also substantially decrease (Met Office, 2021b).

28.6.3.15 Coastal risk across the UK is anticipated to increase under all RCPs climate change scenarios throughout the century. This results in an increase in the frequency and magnitude of extreme water levels and coastal flood events (Met Office, 2021a), reflected in MSL rise data in **Table 28.7**.

28.7 Basis for the EIA Report

28.7.1 Maximum design scenario

28.7.1.1 The process of assessing using a parameter-based design envelope approach means that the assessment considers a maximum design scenario whilst allowing the flexibility to make improvements in the future in ways that cannot be predicted at the time of submission of the planning application, marine licences applications and Section 36 (s.36) consent.

28.7.1.2 The assessment of the maximum adverse scenario for each receptor establishes the maximum potential adverse effect and as a result effects of greater adverse significance would not arise should any other scenario (as described in **Chapter 4: Project Description**) to that assessed within this Chapter be taken forward in the final Project design.

28.7.1.3 The maximum design scenario parameters that have been identified to be relevant to climate resilience are outlined in **Table 28.9** and are in line with the Project design envelope (**Chapter 4: Project Description**).

28.7.1.4 In the context of climate resilience, the assessment considers the impact of climate change on the Project. Given that projected climatic changes are applied consistently across the Project location, factors which may vary, such as the construction methods, specific location of receptors, footprint or number of receptors, power generation figures, are assessed in the same way regardless of any optionality.

Table 28.9 Maximum design scenario for impacts on climate resilience

Impact / activity	Maximum design scenario parameter	Justification
Construction – onshore		
Impact C1: Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells **Increased heat stress or heat exhaustion experienced by the construction workforce**	• all options within the Onshore Red Line Boundary; and. • phased construction programme.	Impacts associated with increasing temperatures will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle[1] to inform the assessment of effects. Climate data for 2020 to 2039 (2030s) utilised to inform the assessment during construction stage.
Impact C2: Increase in precipitation resulting in tidal, fluvial or pluvial flooding **Flooding of construction site access roads causing delays to construction programme**	• all options within the Onshore Red Line Boundary; and • phased construction programme.	Impacts associated with increased precipitation resulting in flooding will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for 2020 to 2039 (2030s) utilised to inform the assessment during construction stage.
Impact C3: Increase in precipitation resulting in tidal, fluvial or pluvial flooding **Water ingress to equipment or machinery related to construction activities or permanent assets in place during construction, leading to equipment failures or damage**	• all options within the Onshore Red Line Boundary; and • phased construction programme.	Impacts associated with increased precipitation resulting in flooding will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for 2020 to 2039 (2030s) utilised to inform the assessment during construction stage.

[1] The precautionary principle is used to assist decision making where there is scientific uncertainty. There are inherent uncertainties associated with climate projections, and they are not predictions of the future. Applying a precautionary principle to the assessment allows for the climate trends inferred from the projection data to be applied to the assessment.

Impact / activity	Maximum design scenario parameter	Justification
Impact C4: Increase in precipitation resulting in tidal, fluvial or pluvial flooding **Overwhelming of the construction site drainage system causing flooding across the site**	• all options within the Onshore Red Line Boundary; and • phased construction programme.	Impacts associated with increased precipitation resulting in flooding will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for 2020 to 2039 (2030s) utilised to inform the assessment during construction stage.
Impact C5: Increased in frequency and intensity of storm events **There is an increased risk of disruption to construction work, such as cranes unable to operate in high winds**	• all options within the Onshore Red Line Boundary and • phased construction programme.	Impacts associated with increased storm events will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for 2020 to 2039 (2030s) utilised to inform the assessment during construction stage.
Construction – offshore		
Impact C6: Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells **Increased heat stress or heat exhaustion experienced by the construction workforce**	• all options within the Offshore Red Line Boundary; and • phased construction programme.	Impacts associated with increasing temperatures will be considered equally across the Offshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for 2020 to 2039 (2030s) utilised to inform the assessment during construction stage.
Impact C7: Increased frequency and intensity of storm events and wave heights **Extreme storminess leading to increased unsafe working environments and delays to construction programme**	• refer to Impact C6.	Impacts associated with increased storm events and wave heights will be considered equally across the Offshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for 2020 to 2039 (2030s) utilised to inform the assessment during construction stage.

Impact / activity	Maximum design scenario parameter	Justification
Impact C8: Increased frequency and intensity of storm events and wave heights **There is an increased risk of disruption to construction work, such as cranes / barges / rigs / vessels / helicopters unable to operate in high winds**	• refer to Impact C6.	Impacts associated with increased storm events and wave heights will be considered equally across the Offshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for 2020 to 2039 (2030s) utilised to inform the assessment during construction stage.
O&M - onshore		
Impact O1: Sea level rise **Risk to the onshore infrastructure, such as substations, from coastal flooding and erosion**	• all options within the Onshore Red Line Boundary where appropriate to coastal infrastructure; • indicative location of infrastructure and substations closets to the coast; • 35 year operational lifetime from commissioning of each phase. • one onshore substation comprising three substation blocks, one for each phase of operation. The onshore substation site is located approximately 2.3km to the east of the SSEN Netherton Hub site and approximately 2km to the west of Peterhead. The onshore substation site shown on **Volume 2, Figure 4.1: Onshore Red Line Boundary and Indicative Onshore Infrastructure.** All landfall(s) option locations considered: • option 1: Lunderton – all export cable circuits would make landfall(s) at Lunderton, based on the following scenarios:	Impacts associated with sea level rise and increased coastal flooding, and erosion will be considered equally across the Onshore Red Line Boundary coastal areas in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframes 2020 to 2039 (2030s), 2040 to 2059 (2050s), and 2060 to 2079 (2070s) utilised to inform the assessment for the O&M stage.

Impact / activity	Maximum design scenario parameter	Justification
	▸ Option 1a: all export cables circuits make landfall at Lunderton North (Option 1a); or ▸ Option 1b: all export cable circuits would make landfall at a combination of Lunderton North and Lunderton South. • option 2: Scotstown and Lunderton – export cables circuits would make landfall(s) at a combination of Lunderton (North and/or South) and Scotstown.	
Impact O2: Increase in precipitation resulting in tidal, fluvial or pluvial flooding **Risk to the onshore infrastructure, such as substations, from river, surface water and groundwater flooding**	• all options within the Onshore Red Line Boundary; • 35 year operational lifetime from commissioning of each phase; and • one onshore substation comprising three substation blocks, one for each phase of operation. The onshore substation site is located approximately 2.3km to the east of the SSEN Netherton Hub site and approximately 2km to the west of Peterhead. The onshore substation site shown on **Volume 2, Figure 4.1**.	Impacts associated with increased precipitation resulting in flooding will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframes 2020 to 2039 (2030s), 2040 to 2059 (2050s), and 2060 to 2079 (2070s) utilised to inform the assessment for the O&M stage.
Impact O3: Increase in precipitation resulting in tidal, fluvial or pluvial flooding **Restriction of access during flood events, preventing maintenance activities**	• all options within the Onshore Red Line Boundary; and • 35 year operational lifetime from commissioning of each phase.	Impacts associated with increased precipitation resulting in flooding will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects.

Impact / activity	Maximum design scenario parameter	Justification
		Climate data for the timeframes 2020 to 2039 (2030s), 2040 to 2059 (2050s), and 2060 to 2079 (2070s) utilised to inform the assessment for the O&M stage.
Impact O4: Fluctuations in mean rainfall across the year, coupled with an increase in mean temperatures, resulting in changes to soil moisture **Risk to subterranean and surface infrastructure from subsidence, such as cables and substations**	• all options within the Onshore Red Line Boundary; • 35 year operational lifetime from commissioning of each phase; and • trench depth up to 1.5m, minimum depth to top of buried infrastructure 0.9m to 1.2m.	Impacts associated with soil moisture changes will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframes 2020 to 2039 (2030s), 2040 to 2059 (2050s), and 2060 to 2079 (2070s) utilised to inform the assessment for the O&M stage.
Impact O5: Decrease in summer precipitation, leading to drought conditions **Changes in water content of soil has an adverse effect on soil resistivity leading to a reduction in cable ratings and the effectiveness of earthing systems at substations**	• all options within the Onshore Red Line Boundary; • 35 year operational lifetime from commissioning of each phase; and • trenched and trenchless installations.	Impacts associated with drought conditions will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframes 2020 to 2039 (2030s), 2040 to 2059 (2050s), and 2060 to 2079 (2070s) utilised to inform the assessment for the O&M stage.
Impact O6: Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells **Reduction in the amount of power which can be transmitted and distributed**	• all options within the Onshore Red Line Boundary; and • 35 year operational lifetime from commissioning of each phase.	Impacts associated with increasing temperatures will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframes 2020 to 2039 (2030s), 2040 to 2059 (2050s), and 2060 to 2079 (2070s) utilised to inform the assessment for the O&M stage.
Impact O7: Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells	• all options within the Onshore Red Line Boundary; and • 35 year operational lifetime from commissioning of each phase.	Impacts associated with increasing temperatures will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects.

Impact / activity	Maximum design scenario parameter	Justification
Overheating of M&E assets such as onshore substations, leading to a decrease in asset performance and rating and/or requiring additional electricity demand for mechanical cooling units		Climate data for the timeframes 2020 to 2039 (2030s), 2040 to 2059 (2050s), and 2060 to 2079 (2070s) utilised to inform the assessment for the O&M stage.
Impact O8: Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells **Increased heat stress or heat exhaustion experienced by the O&M workforce**	• all options within the Onshore Red Line Boundary; and • 35 year operational lifetime from commissioning of each phase.	Impacts associated with increasing temperatures will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframes 2020 to 2039 (2030s), 2040 to 2059 (2050s), and 2060 to 2079 (2070s) utilised to inform the assessment for the O&M stage.
Impact O9: Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells **Underground cable systems affected by the increase in ground temperatures, reducing cable ratings**	• all options within the Onshore Red Line Boundary; • 35 year operational lifetime from commissioning of each phase; and • trenched and trenchless installations.	Impacts associated with increasing temperatures will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframes 2020 to 2039 (2030s), 2040 to 2059 (2050s), and 2060 to 2079 (2070s) utilised to inform the assessment for the O&M stage.
Impact O10: Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells **Wildfire affecting electrical infrastructure**	• all options within the Onshore Red Line Boundary; and • 35 year operational lifetime from commissioning of each phase.	Impacts associated with wildfire will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframes 2020 to 2039 (2030s), 2040 to 2059 (2050s), and 2060 to 2079 (2070s) utilised to inform the assessment for the O&M stage.
Impact O11: Occurrence of intense low temperatures and cold snaps	• refer to Impact O10.	Impacts associated with cold temperatures will be considered equally across the Onshore Red Line Boundary

Impact / activity	Maximum design scenario parameter	Justification
Cold weather leading to ice accretion causing damage to the infrastructure		in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframes 2020 to 2039 (2030s), 2040 to 2059 (2050s), and 2060 to 2079 (2070s) utilised to inform the assessment for the O&M stage.
Impact O12: Increased frequency and intensity of storm events **Lightning causing physical damage, fire, power surge, and shock wave at grid connection points**	• refer to Impact O10.	Impacts associated with storms will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframes 2020 to 2039 (2030s), 2040 to 2059 (2050s), and 2060 to 2079 (2070s) utilised to inform the assessment for the O&M stage.
Impact O13: Increased frequency and intensity of storm events **Increased wind loading on substation equipment and security fencing leading to damage**	• refer to Impact O10.	Impacts associated with storms will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframes 2020 to 2039 (2030s), 2040 to 2059 (2050s), and 2060 to 2079 (2070s) utilised to inform the assessment for the O&M stage.
Impact O14: Increased frequency and intensity of storm events **Wind blown debris leading to risk to maintenance personnel**	• refer to Impact O10.	Impacts associated with storms will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframes 2020 to 2039 (2030s), 2040 to 2059 (2050s), and 2060 to 2079 (2070s) utilised to inform the assessment for the O&M stage.

Impact / activity	Maximum design scenario parameter	Justification
O&M - offshore		
Impact O15: Increased frequency and intensity of storm events and wave heights **Destabilisation or degradation of WTG / floater mechanical systems and structures**	• all options within the Offshore Red Line Boundary; • 50-year extreme wind speed – 48m/s; • 50-year extreme positive surge – 0.7m MSL; • long term mean significant wave height – 2.0m; • blade clearance above MSL 22m; • operational wind speed (rotor cut-out 28m/s); and • O&M methodology includes remote monitoring, preventative maintenance, corrective maintenance and replenishment of scour protection.	Impacts associated with storms will be considered equally across the Offshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframes 2020 to 2039 (2030s), 2040 to 2059 (2050s), and 2060 to 2079 (2070s) utilised to inform the assessment for the O&M stage.
Impact O16: Increased frequency and intensity of storm events and wave heights **Loading and sediment transport across seabed leading to loss of integrity of foundations from scour and exposure**	• all options within the Offshore Red Line Boundary; • offshore substations and RCPs jacket foundations secured with suction caisson, although offshore substation detailed design will be determined after geotechnical information; • driven piles 95m length. • rock placement - 500m^3 per offshore substation and RCP (irrespective of the number of legs); and • O&M Methodology includes remote monitoring, preventative maintenance, corrective maintenance and replenishment of scour protection.	Impacts associated with storms will be considered equally across the Offshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframes 2020 to 2039 (2030s), 2040 to 2059 (2050s), and 2060 to 2079 (2070s) utilised to inform the assessment for the O&M stage.
Impact O17: Increased frequency and intensity of storm events and wave heights	• all options within the Offshore Red Line Boundary;	Impacts associated with storms will be considered equally across the Offshore Red Line Boundary in line with the future

Impact / activity	Maximum design scenario parameter	Justification
Loading and sediment transport across seabed leading to loss of integrity of cabling systems from scour and exposure	• the cable laying vessel buries the cables typically 1 to 2m beneath the seabed wherever possible. Where cable protection cannot be achieved by cable burial, other alternative methods will be used to protect them; • rock placement cable protection; and • O&M Methodology includes remote monitoring, preventative maintenance, corrective maintenance and replenishment of scour protection.	climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframes 2020 to 2039 (2030s), 2040 to 2059 (2050s), and 2060 to 2079 (2070s) utilised to inform the assessment for the O&M stage.
Impact O18: Increased frequency and intensity of storm events and wave heights **Impeded access for maintenance and inspection**	• all options within the Offshore Red Line Boundary; and • O&M Methodology includes remote monitoring, preventative maintenance, corrective maintenance and replenishment of scour protection.	Impacts associated with storms will be considered equally across the Offshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframes 2020 to 2039 (2030s), 2040 to 2059 (2050s), and 2060 to 2079 (2070s) utilised to inform the assessment for the O&M stage.
Impact O19: Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells **Overheating of M&E assets such as offshore substations, leading to a decrease in asset performance and rating and/or requiring additional electricity demand for mechanical cooling units**	• refer to Impact O18.	Impacts associated with temperature increases will be considered equally across the Offshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframes 2020 to 2039 (2030s), 2040 to 2059 (2050s), and 2060 to 2079 (2070s) utilised to inform the assessment for the O&M stage.
Impact O20: Occurrence of intense low temperatures and cold snaps	• all options within the Offshore Red Line Boundary.	Impacts associated with cold temperatures will be considered equally across the Offshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects.

Impact / activity	Maximum design scenario parameter	Justification
Cold weather leading to ice accretion affecting the efficiency and performance of WTGs		Climate data for the timeframes 2020 to 2039 (2030s), 2040 to 2059 (2050s), and 2060 to 2079 (2070s) utilised to inform the assessment for the O&M stage.
Impact O21: Increase sea surface temperatures and ocean acidification **Increased corrosion of the structures**	• refer to Impact O18.	Impacts associated with sea temperature and ocean acidification will be considered equally across the Offshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframes 2020 to 2039 (2030s), 2040 to 2059 (2050s), and 2060 to 2079 (2070s) utilised to inform the assessment for the O&M stage.
Decommissioning - onshore		
Impact D1: Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells **Increased heat stress or heat exhaustion experienced by the workforce associated with decommissioning**	• all options within the Onshore Red Line Boundary; and • 35 year operational lifetime from commissioning of each phase.	Impacts associated with increasing temperatures will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframe 2080 to 2099 (2090s) utilised to inform the assessment for the decommissioning stage.
Impact D2: Increased annual mean temperatures and frequency and intensity of hot spells, coupled with decreased summer precipitation **Increased dust creation from decommissioning activities, leading to impacts on the health of workers and the failure of machinery and equipment**	• all options within the Onshore Red Line Boundary.	Impacts associated with increasing temperatures will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframe 2080 to 2099 (2090s) utilised to inform the assessment for the decommissioning stage.

Impact / activity	Maximum design scenario parameter	Justification
Impact D3: Increased annual mean temperatures and frequency and intensity of hot spells, coupled with decreased summer precipitation **Risk of wildfires affecting the workforce**	• refer to Impact D2.	Impacts associated with increasing temperatures will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframe 2080 to 2099 (2090s) utilised to inform the assessment for the decommissioning stage.
Impact D4: Decrease in summer precipitation leading to drought conditions **Drought conditions impacting water available to use during decommissioning, e.g. for dust suppression**	• refer to Impact D2.	Impacts associated with drought conditions will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframe 2080 to 2099 (2090s) utilised to inform the assessment for the decommissioning stage.
Impact D5: Increase in precipitation resulting in tidal, fluvial or pluvial flooding **Wet weather leading to increased possibility of slips, trips and falls**	• refer to Impact D2.	Impacts associated with increasing rainfall and associated flooding will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframe 2080 to 2099 (2090s) utilised to inform the assessment for the decommissioning stage.
Impact D6: Increase in precipitation resulting in tidal, fluvial or pluvial flooding **Flooding of the site access roads causing delays to decommissioning programme**	• refer to Impact D2.	Impacts associated with increasing rainfall and associated flooding will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframe 2080 to 2099 (2090s) utilised to inform the assessment for the decommissioning stage.
Impact D7: Increase in precipitation resulting in tidal, fluvial or pluvial flooding	• refer to Impact D2.	Impacts associated with increasing rainfall and associated flooding will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data,

Impact / activity	Maximum design scenario parameter	Justification
Water ingress to equipment or machinery related to decommissioning activities, leading to equipment failures or damage		using a precautionary principle to inform the assessment of effects. Climate data for the timeframe 2080 to 2099 (2090s) utilised to inform the assessment for the decommissioning stage.
Impact D8: Increase in precipitation resulting in tidal, fluvial or pluvial flooding **Overwhelming of the site drainage system causing flooding across the site**	• refer to Impact D2.	Impacts associated with increasing rainfall and associated flooding will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframe 2080 to 2099 (2090s) utilised to inform the assessment for the decommissioning stage.
Impact D9: Increased in frequency and intensity of storm events **There is an increased risk of disruption to decommissioning work, such as vessels, cranes and helicopters unable to operate in high winds**	• refer to Impact D2.	Impacts associated with storms will be considered equally across the Onshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframe 2080 to 2099 (2090s) utilised to inform the assessment for the decommissioning stage.
Decommissioning - offshore		
Impact D10: Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells **Increased heat stress or heat exhaustion experienced by the workforce associated with decommissioning**	• all options within the Offshore Red Line Boundary.	Impacts associated with increasing temperatures will be considered equally across the Offshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframe 2080 to 2099 (2090s) utilised to inform the assessment for the decommissioning stage.
Impact D11: Increased frequency and intensity of storm events and wave heights	• refer to Impact D10.	Impacts associated with storms will be considered equally across the Offshore Red Line Boundary in line with the future

Impact / activity	Maximum design scenario parameter	Justification
Extreme storminess leading to increased occurrences of unsafe working environments and delays to decommissioning programme		climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframe 2080 to 2099 (2090s) utilised to inform the assessment for the decommissioning stage.
Impact D12: Increased frequency and intensity of storm events and wave heights **There is an increased risk of disruption to decommissioning work, such as vessels, cranes and helicopters unable to operate in high winds**	• refer to Impact D10.	Impacts associated with storms will be considered equally across the Offshore Red Line Boundary in line with the future climate baseline data, using a precautionary principle to inform the assessment of effects. Climate data for the timeframe 2080 to 2099 (2090s) utilised to inform the assessment for the decommissioning stage.

28.7.2 Embedded environmental measures

28.7.2.1 As part of the Project design process, a number of embedded design and operational measures have been adopted to reduce the potential for adverse impacts on the Project from climate resilience. These embedded environmental measures have evolved over the development process as the EIA has progressed and in response to consultation.

28.7.2.2 These measures also include those that have been identified as good or standard practice and include actions that would be undertaken to meet existing legislation requirements. As there is a commitment to implementing these embedded environmental measures, and also to various standard sectoral practices and procedures, they are considered inherently part of the design of the Project and are set out in the EIA Report.

28.7.2.3 **Table 28.10** sets out the relevant embedded environmental measures within the design and how these affect the climate resilience assessment.

28.7.2.4 In relation to infrastructure interdependencies (where climate-related impacts are associated with the interruption of temporary loss of key supply-chain / third party networks (such as telecommunication networks, grid connections)), the assessment approach has made the assumption that climate-related risks and adaptation measures have been adopted by the third parties. This assumption is based on the suppliers operating in accordance with climate adaptation and industry specific requirements (such as the Climate Change Act 2008 which requires companies to report on their preparedness for climate change, under the Adaptation Reporting Power), which incorporate planning for and adapting to interruption or loss of services to clients.

Table 28.10 Relevant climate resilience embedded environmental measures

ID	Environmental measure proposed	Project stage measure introduced	Securing mechanism	Relevance to climate resilience assessment
M-001	Underground cables will be used to connect from the landfall transition joint bays to the Project onshore substations. An additional section of the onshore export cable corridor will run from the onshore substations to the onshore substations nominated by NETS grid connection point at SSEN Netherton Hub. Cables are typically installed in ducts in a standard buried trench arrangement with appropriate insulation, providing protection from temperature extremes and changes in soil moisture.	Scoping Amended at EIA Report	**Volume 4: Outline Construction Environmental Management Plan** (CEMP) and planning conditions.	Measures will offer protection from increases in ground temperature and changes in soil moisture which may reduce the rating of the cables or cause damage to cables.
M-016	In areas (or during periods of adverse weather) there may be the requirement to import aggregates to minimise erosion or transport of sediment from construction. Options such as bog-matting, geotextiles, floating roads will be considered by the principal contractor for sensitive sections of the onshore export cable corridor to reduce impact. The Outline CEMP will include a commitment to review and implement additional protective measures for soil stockpiles, if needed, to control sediment run-off due to heavy rainfall/flood conditions and maintain soils in a drier condition.	Scoping Amended at EIA Report	**Volume 4: Outline CEMP** and planning conditions.	Measure will mitigate the impacts of saturated ground and reduce potential for construction programme delays.
M-020	Emergency Response Plans (ERPs) for flood events will be prepared for all construction activities, working areas, access and egress routes in floodplain areas. These plans will be provided for both construction and O&M stages and will include evacuation procedures for personnel.	Scoping Amended at EIA Report	**Volume 4: Outline CEMP** and planning conditions.	ERPs will ensure control measures and management processes are in place in the event of a weather-related event.
M-028	**Volume 4: Outline Scour Protection Plan** has been submitted within this Application, and includes details of the need, type, quantity and installation methods for scour protection. A Final Scour Protection Plan will be completed	Scoping Amended at EIA Report	s.36 conditions and marine licences conditions.	Measure will aid the management of scour protection which may be adversely impacted by climate change.

ID	Environmental measure proposed	Project stage measure introduced	Securing mechanism	Relevance to climate resilience assessment
	prior to construction commencing and will include measures during the O&M stage such as periodic inspection and maintenance requirements and will be submitted to MD-LOT for approval.			
M-054	A detailed Cable Burial Risk Assessment (CBRA) will be undertaken to enable informed judgements about burial depth. This should reduce the risk of buried cables reemerging whilst also limiting the amount of sediment disturbance to that which is necessary. The array cables will typically be buried at a target burial depth between 1m to 2m below the seabed surface. The final depth of the cable will be dependent on the seabed mobility and CBRA. The CBRA will manage and mitigate risks from loading and sediment transport across the seabed. The CBRA will be included within the Final Cable Plan.	Scoping Amended at EIA Report	s.36 conditions and marine licences conditions.	Measure will aid the management of buried cables which may be adversely impacted by climate change.
M-063	A CEMP to be implemented by the contractor in accordance with **Volume 4: Outline Construction Environmental Management Plan**. The contractor will ensure that the relevant environmental measures within the CEMP and health and safety procedures are implemented. A CEMP will identify the project management structure roles and responsibilities with regard to managing and reporting on the environmental impact of the construction stage.	Scoping Amended at EIA Report	**Volume 4: Outline CEMP** and planning conditions.	The Outline CEMP will support the management of weather-related impacts which may occur.
M-080	Drainage design to manage and, if necessary, treat surface water run-off will be included in all elements of temporary construction sites and permanent operational infrastructure. A Controlled Activities Regulations licence will be required for all sites that exceed five hectares in area. Drainage design will follow the Sustainable Drainage Systems (SuDS) hierarchy principles including allowances for climate change and discharge at pre-development rates (as set out in the **Volume 4: Outline Operational Drainage Strategy**). Where the	Scoping Amended at EIA Report	**Volume 4: Outline CEMP** and planning conditions.	The inclusion of climate change within the drainage strategy will reduce the risk of overwhelmed drainage and flooding.

ID	Environmental measure proposed	Project stage measure introduced	Securing mechanism	Relevance to climate resilience assessment
	development intersects overland flow pathways or areas of known surface water flooding appropriate measures will be embedded into the design. All subsurface infrastructure will be designed to facilitate subsurface flow pathways to avoid any localised increases in groundwater flooding.			
M-081	Construction and permanent development in flood plains will be avoided. Where this is not possible mitigation will be developed to ensure the works are compliant with policy requirements.	Scoping Amended at EIA Report	**Volume 4: Outline CEMP** and planning conditions.	Avoidance for flood plains will reduce the risk of flooding.
M-097	Construction activities will be planned through use of a Risk Assessment Method Statement (RAMS) alongside safety bulletins as part of **Volume 4: Outline Construction Environmental Management Plan**. The RAMS will put in place procedures in the case of extreme weather (high temperatures, extreme winds, flooding, wildfire risk). This may include altering the construction programme to delaying affected activities, changing shift patterns, Personal Protective Equipment (PPE) and toolbox talks.	Scoping	**Volume 4: Outline CEMP** and planning conditions.	Measure will minimise risk of health and safety impacts.
M-106	The development of and adherence to a decommissioning Programme. The decommissioning Programme will outline measures for the decommissioning of the Project.	Scoping Amended at EIA Report.	Required under Sections 105 and 114 (Energy Act 2004) and marine licences consent conditions.	The consideration of climate and weather extremes at the decommissioning stage will reduce adverse effects to the decommissioning works, workers and programme.
M-119	A construction programme will be developed prior to construction commencing and submitted before construction commences for stage to MD-LOT for approval. The construction programme will include for weather related delays.	EIA Report	s.36 conditions and marine licences conditions.	The inclusion of weather-related delays within the construction programme will reduce potential of the construction stage overrunning.
M-158	Weather forecasts will be monitored to inform short to medium term planning of construction activities.	EIA Report	**Volume 4: Outline CEMP**.	Measure will support programming of construction activities to aid the

ID	Environmental measure proposed	Project stage measure introduced	Securing mechanism	Relevance to climate resilience assessment
				avoidance of delays and health and safety impacts.
M-159	Construction works will be programmed to avoid forecast heatwaves / extreme temperatures, high wind and storms (should they occur during construction stage).	EIA Report	**Volume 4: Outline CEMP**.	Measure will support programming of construction activities to aid the avoidance of delays and health and safety impacts.
M-160	Measures to mitigate and manage adverse weather and flooding will be provided within the Outline CEMP.	EIA Report	**Volume 4: Outline CEMP**.	Measure outlined in the Outline CEMP to manage adverse weather and flooding will reduce the consequence of such events should they occur.
M-161	Construction equipment, machinery or permanent assets with electrical components exposed to water ingress will have suitable Ingress Protection rating.	EIA Report	**Volume 4: Outline CEMP**.	Measure will build resilience to increasing occurrences and intensity of precipitation which may lead to water ingress, damage to equipment and delays to construction programme.
M-162	The Principal Contractor will ensure the construction equipment is well maintained, serviced and provide replacement equipment / machinery as necessary.	EIA Report	**Volume 4: Outline CEMP**.	Measure will aid the avoidance of delays and damage to construction equipment.
M-163	Flood prevention measures such as drainage strategy / coastal Flood Risk Assessment / raised height of critical infrastructure.	EIA Report	Drainage strategy, coastal Flood Risk Assessment and design specification.	Measure will reduce the risk of damage to infrastructure from flooding and standing water.
M-164	**Volume 4: Outline Operational Drainage Management Strategy** has been provided to provide the outline proposals for drainage required for the operation of the onshore substations. The outline strategy provides a feasible drainage strategy which would adequately control site runoff at the	EIA Report	Planning conditions.	Drainage arrangements will ensure heavy rain and standing water is cleared effectively, reducing the risk of damage and access concerns.

ID	Environmental measure proposed	Project stage measure introduced	Securing mechanism	Relevance to climate resilience assessment
	operational onshore substations which can be delivered within the Onshore Red Line Boundary for the onshore substations to meet policy requirements. The Outline operational drainage strategy has designed the SuDS to accommodate 1:200 year (0.5 percent Annual Exceedance Probability (AEP)) plus 37 percent climate change based on the SEPA guidance. The outline strategy retains flexibility in design for the detailed design of the onshore substations. A detailed Operational Drainage Management Strategy would be produced following consent and prior to the construction of the onshore substations. This would be produced in accordance with the Outline Operational Drainage Management Strategy and with further consultation with SEPA and Aberdeenshire Council.			
M-165	Operations and maintenance strategy include for emergency access arrangements.	EIA Report	Operations and maintenance strategy.	Emergency access arrangements will ensure control measures and management processes are in place in the event of a weather-related event.
M-166	Maintenance activities planned to avoid seasonal poor weather conditions and extreme weather events. Weather forecasts will be monitored to inform short to medium term planning of maintenance activities.	EIA Report	Operations and maintenance strategy.	Measure will support programming of maintenance activities to aid the avoidance of delays and health and safety impacts.
M-167	Ground investigation studies to inform foundation design and siting of critical infrastructure on level terrain.	EIA Report	Ground investigation and design specification.	Measure will ensure infrastructure is of suitable design and sited to reduce the impacts of climate-related changes in ground conditions.
M-168	Regular inspection and maintenance regime to monitor any indication of subsidence.	EIA Report	Operations and maintenance strategy.	Measure will aid the identification of defects which may be exacerbated by severe weather or climate change and support the timely replacement or

ID	Environmental measure proposed	Project stage measure introduced	Securing mechanism	Relevance to climate resilience assessment
				repair to minimise the extent of any potential damage.
M-169	Cable installation works will be in line with best practice UK and European standards as appropriate which will account for a range of long-term variations in soil resistivity.	EIA Report	Design specification.	Measure will ensure cable installations are appropriate to the site conditions, reducing the potential for reduced efficiency through changes in water content of soil as a result of climate change.
M-170	An inspection and maintenance regime will be in place to monitor any degradation and implement replacement if deemed necessary.	EIA Report	Operations and maintenance strategy.	Measure will aid the identification of defects which may be exacerbated by severe weather or climate change and support the timely replacement or repair to minimise the extent of any potential damage.
M-171	Minimum design temperatures for electrical assets will take account of climate change where necessary.	EIA Report	Design specification.	Measure will ensure infrastructure is designed to withstand anticipated temperatures to minimise damage. Measures will offer protection from increases in ground temperature which may reduce the rating of the cables.
M-172	Regular inspection and maintenance regime to monitor cooling needs and increase cooling input if required.	EIA Report	Operations and maintenance strategy.	Measure will allow for early adaptation should it be required.
M-173	Clearance of vegetation as part of operational and maintenance activities.	EIA Report	Operations and maintenance strategy.	Measure will reduce adverse impacts should a wildfire be present in the vicinity.
M-174	Fire protection measures in critical infrastructure.	EIA Report	Design specification	Measure will reduce adverse impacts of fire.

ID	Environmental measure proposed	Project stage measure introduced	Securing mechanism	Relevance to climate resilience assessment
M-175	Emergency plans include measures and actions for weather-related risks (such as wildfire, lightning strike) and access / egress contingency plans.	EIA Report	Operations and maintenance strategy.	Emergency Plans will ensure control measures and management processes are in place in the event of a weather-related event.
M-176	Design parameters / design standards allow for cold spells / snow and ice loading.	EIA Report	Design specification.	Measure will ensure infrastructure is designed to withstand anticipated cold temperatures to minimise damage.
M-177	Regular inspection and maintenance regime to monitor any degradation of infrastructure following cold spells.	EIA Report	Operations and maintenance strategy.	Measure will aid the identification of defects which may be exacerbated by severe weather or climate change and support the timely replacement or repair to minimise the extent of any potential damage.
M-178	Assets will be provided with earthing, grounding and surge protection measures.	EIA Report	Design specification.	Measure will protect against power surges from lightning strike.
M-179	Secondary or emergency power supply will be provided.	EIA Report	Design specification.	Measure will ensure continuity of critical services during a weather-related power outage.
M-180	Design parameters / design standards allow for sufficient wind loading.	EIA Report	Design specification.	Measure will ensure infrastructure is designed to withstand anticipated wind loads to minimise damage.
M-181	Regular inspection and maintenance regime to monitor and repair any damage from high winds as necessary, ensure good housekeeping and removal / repair of any loose materials.	EIA Report	Operations and maintenance strategy.	Measure will aid the identification of defects which may be exacerbated by severe weather or climate change and support the timely replacement or repair to minimise the extent of any potential damage.

ID	Environmental measure proposed	Project stage measure introduced	Securing mechanism	Relevance to climate resilience assessment
				Measure will minimise risk of health and safety impacts.
M-182	Project design will be based on the 50 year return period values for short term gust, peak wind speed and wave conditions.	EIA Report	Design specification.	Measure will ensure infrastructure is designed to withstand anticipated climatic conditions to minimise damage and reduction in operation.
M-188	Maintenance activities will be planned through use of a RAMS. The RAMS will put in place procedures in the case of extreme weather (high temperatures, extreme winds, flooding, wildfire risk). This may include altering the maintenance programme to delaying affected activities, changing shift patterns, PPE and toolbox talks.	EIA Report	Operations and maintenance strategy.	Measure will minimise risk of health and safety impacts.
M-189	WTG design considered a 50-year minimum air temperature at hub height of -2.8ºC. Absolute maxima and minima temperature ranges will be considered within the design.	EIA Report	Design specification.	Measure will ensure infrastructure is designed to withstand anticipated temperatures to minimise damage and performance.
M-190	Corrosion strategy to be developed to determine requirement for corrosion protection.	EIA Report	Operations and maintenance strategy.	Measure will support the management of corrosion effects.
M-191	Weather forecasts will be monitored to inform short to medium term planning of decommissioning activities.	EIA Report	Draft Decommissioning Environmental Management Plan.	Measure will support programming of decommissioning activities to aid the avoidance of delays and health and safety impacts.
M-192	Decommissioning works will be programmed to avoid forecast heatwaves / extreme temperatures / storm events.	EIA Report	Draft Decommissioning Environmental Management Plan.	Measure will support programming of decommissioning activities to aid the avoidance of delays and health and safety impacts.

ID	Environmental measure proposed	Project stage measure introduced	Securing mechanism	Relevance to climate resilience assessment
M-193	Decommissioning activities will be planned through use of a RAMS. The RAMS will put in place procedures in the case of extreme weather (high temperatures, extreme winds, flooding, wildfire risk). This may include altering the maintenance programme to delaying affected activities, changing shift patterns, PPE and toolbox talks.	EIA Report	Draft Decommissioning Environmental Management Plan.	Measure will minimise risk of health and safety impacts.
M-194	The Decommissioning Contractor will ensure the construction equipment is well maintained, serviced and provide replacement equipment / machinery as necessary.	EIA Report	Draft Decommissioning Environmental Management Plan.	Measure will aid the avoidance of delays.
M-195	Emergency plans include measures and actions for weather-related risks (such as wildfire) and access / egress contingency plans.	EIA Report	Draft Decommissioning Environmental Management Plan.	Emergency Plans will ensure control measures and management processes are in place in the event of a weather-related event.
M-196	The requirement for any abstraction activities would be assessed at the point of decommissioning. Programming of water intensive decommissioning works to avoid seasonal dry spells.	EIA Report	Draft Decommissioning Environmental Management Plan.	Measure will support the programming of decommissioning activities to aid the avoidance of delays and ensure water is available for dust suppression.
M-197	Drainage design will include allowance for climate change.	EIA Report	Draft Decommissioning Environmental Management Plan.	Measure will support the efficient discharge of rainfall and standing water.
M-198	Offshore infrastructure built to appropriate design standards that are suitable for the proposed location.	EIA Report	Design specification.	Measure will ensure infrastructure is designed to withstand anticipated conditions.
M-211	The Decommissioning Plan for the Project will include measures to minimise environmental impacts, whilst taking into	EIA Report	Required under Sections 105 and 114 (Energy Act	The consideration of climate and weather extremes at the decommissioning stage will reduce

ID	Environmental measure proposed	Project stage measure introduced	Securing mechanism	Relevance to climate resilience assessment
	account the climate and weather extremes anticipated at the time of decommissioning.		2004) and marine licences consent conditions.	adverse effects to the decommissioning works, workers and programme

28.7.2.5 Further detail on the embedded environmental measures in **Table 28.10** is provided in the **Volume 3, Appendix 5.2: Commitments Register**, which sets out how and where particular embedded environmental measures will be implemented and secured.

28.8 Methodology for the EIA Report

28.8.1 Introduction

28.8.1.1 The Project-wide approach to assessment is set out in **Chapter 5: Approach to EIA.** Whilst this has informed the approach that has been used in this climate resilience assessment, it is necessary to set out how this methodology has been applied, and adapted as appropriate, to address the specific needs of the climate resilience assessment.

28.8.1.2 The assessment methodology for climate resilience evaluates the likelihood of climate-related impacts occurring, and the consequence to the Project should they occur. The likelihood and consequence are considered using a five-by-five matrix to determine significance.

28.8.2 Significance evaluation methodology

Overview

28.8.2.1 The likelihood of the climate change impact on the receptor occurring takes into account the climate change trends and the anticipated exposure of the receptor to the trend. An indicative scale used for assessing the likelihood of the climate change impact on the receptor is contained in **Table 28.11**.

Table 28.11 Indicative scale for assessing the likelihood of a climate change impact on the receptor

Likelihood category	Description (probability and frequency of occurrence)
Very likely	The impact is almost certain to occur during the stage of the Project considered.
Likely	The impact is considered likely to occur during the stage of the Project considered.
Possible	The impact is as likely as not to occur during the stage of the Project considered.
Unlikely	The impact is unlikely to occur during the stage of the Project considered but still could occur at least once.
Very unlikely	The impact is high unlikely to occur during this stage of the Project considered and is considered rare.

28.8.2.2 The consequence if the climate change impact occurs is the magnitude of change felt by the receptor. An indicative scale used for assessing the consequence of the climate change impact on the receptor is contained within **Table 28.12**.

Table 28.12 Indicative scale for assessing the consequence (magnitude of change) of a climate change impact on the receptor

Consequence category	Consequence criteria
Catastrophic	The impact could lead to complete shutdown of operations, loss of the asset, or collapse. There could be single or multiple fatalities and significant harm to the environment with limited prospect of full recovery. Social implications could lead to community protests and high financial implications.
Major	The impact could lead to disruption to activities lasting more than one week. There could be major or multiple injuries which could be permanent. Environmental damage could be significant with recovery times over a year and non-compliance with regulations and consents. National and long-term social impacts could be endured. The impact would require extensive mitigation actions.
Moderate	The impact could lead to disruption to activities lasting more than one day but less than one week. There could be moderate environmental damage with wider effects and recovery of up to a year. Moderate cost and social implications which are localised yet long-term. This could lead to a serious injury requiring lost time. The impact would require emergency mitigation actions to be in place.
Minor	The impact could lead to disruption to activities lasting less than one day. There could be localised environmental impact within the Red Line Boundary, localised and temporary social or reputational impacts, and a minor cost implication. This could lead to a minor injury requiring medical treatment. The impact could be rectified through additional mitigation actions to be put in place.
Minimal	The impact could lead to disruption to an isolated section of activity with limited social, economic and environmental consequences. It could equate to a minor first aid case. The impact could be rectified through usual activity.

Significance evaluation

28.8.2.3 The level of the risk of the climate change impacts on the Project is concluded in this risk assessment as a function of the likelihood and magnitude. This will identify any significant potential risks and where further mitigation and adaptation measures will be required, shown as significant effects within the matrix in **Table 28.13**.

Table 28.13 Significance of effects

Likelihood	Magnitude				
	Minimal	Minor	Moderate	Major	Catastrophic
Very unlikely	Negligible (NS)	Negligible (NS)	Minor (NS)	Moderate (S)	Moderate (S)
Unlikely	Negligible (NS)	Minor (NS)	Minor (NS)	Moderate (S)	Major (S)
Possible	Minor (NS)	Minor (NS)	Moderate (S)	Major (S)	Major (S)
Likely	Moderate (S)	Moderate (S)	Major (S)	Major (S)	Major (S)
Very likely	Moderate (S)	Major (S)	Major (S)	Major (S)	Major (S)

Note: (S) denotes a significant or potentially significant effect, (NS) denotes a not significant effect.

28.9 Assessment of effects: construction stage

28.9.1 Introduction

28.9.1.1 This Section provides an assessment of climate-related impacts on the construction of the offshore and onshore elements of the Project. The assessment is presented in **Table 28.14**.

28.9.1.2 The assessment methodology set out in **Section 28.8** has been applied to assess climate-related impacts, using a likelihood and consequence assessment for the in-scope receptors and climate hazards, to determine significance. The maximum assessment scenario relevant to the climate resilience assessment (as presented in **Table 28.9**) and the embedded environmental measures outlined in **Table 28.10** have been taken into account for the assessment.

Table 28.14 Assessment of climate-related impacts: construction stage

Receptor	Climate hazard	Potential impacts	Likelihood	Consequence	Significance	Relevant embedded environmental measures ID (from Table 28.10)
Human health (Offshore)	Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Increased heat stress or heat exhaustion experienced by the construction workforce.	Very unlikely	Minor	**Negligible** (**Not Significant**).	M-097 M-158 M-159
Human health (Offshore)	Increased frequency and intensity of storm events and wave heights.	Extreme storminess leading to increased occurrences of unsafe working environments and delays to construction programme.	Possible	Minimal	**Minor** (**Not Significant**).	M-097 M-119 M-158 M-159 M-160
Building and infrastructure (Offshore)	Increased frequency and intensity of storm events and wave heights.	There is an increased risk of disruption or delay to construction work, such as cranes / barges / rigs / vessels / helicopters unable to operate in high winds.	Possible	Minimal	**Minor** (**Not Significant**).	M-097 M-119 M-158 M-159 M-160
Human health (Onshore)	Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Increased heat stress or heat exhaustion experienced by the construction workforce.	Very unlikely	Minor	**Negligible** (**Not Significant**).	M-097 M-158 M-159

Receptor	Climate hazard	Potential impacts	Likelihood	Consequence	Significance	Relevant embedded environmental measures ID (from Table 28.10)
Building and infrastructure (Onshore)	Increase in precipitation resulting in tidal, fluvial or pluvial flooding.	Flooding of construction site access roads causing delays to construction programme.	Unlikely	Minor	**Minor** (**Not Significant**).	M-016 M-020 M-063 M-080 M-081 M-119 M-160
Building and infrastructure (Onshore)	Increase in precipitation resulting in tidal, fluvial or pluvial flooding.	Water ingress to equipment or machinery related to construction activities or permanent assets in place during construction, leading to equipment failures or damage.	Very unlikely	Minor	**Negligible** (**Not Significant**).	M-161 M-162
Building and infrastructure (Onshore)	Increase in precipitation resulting in tidal, fluvial or pluvial flooding.	Overwhelming of the construction site drainage system causing flooding across the site.	Unlikely	Minor	**Minor** (**Not Significant**).	M-020 M-063 M-080 M-160
Building and infrastructure (Onshore)	Increased in frequency and intensity of storm events.	There is an increased risk of disruption to construction work, such as cranes unable to operate in high winds.	Possible	Minimal	**Minor** (**Not Significant**).	M-063 M-119 M-158 M-159

28.9.1.3 The climate resilience assessment for the construction stage has identified only minor and negligible effects which are **Not Significant**. The short timeframe of the construction stage (in comparison to climatic timescales) and the embedded environmental measures in place to manage the climate-related impacts are considered sufficient to ensure the likelihood and consequence of climate change related impacts are not significant.

28.10 Assessment of effects: O&M stage

28.10.1 Introduction

28.10.1.1 This Section provides an assessment of climate-related impacts on the O&M stage of the offshore and onshore elements of the Project. The assessment is presented in **Table 28.15**.

28.10.1.2 The assessment methodology set out in **Section 28.8** has been applied to assess climate-related impacts, using a likelihood and consequence assessment for the in-scope receptors and climate hazards, to determine significance. The maximum assessment scenario relevant to the climate resilience assessment (as presented in **Table 28.9**) and the embedded environmental measures outlined in **Table 28.10** have been taken into account for the assessment.

Table 28.15 Assessment of climate-related impacts: O&M stage

Receptor	Climate hazard	Potential impacts	Likelihood	Consequence	Significance	Relevant embedded environmental measures ID (from Table 28.10)
Building and infrastructure (Offshore)	Increased frequency and intensity of storm events and wave heights.	Destabilisation or degradation of WTG / floater mechanical systems and structures.	Possible	Minor	**Minor** (**Not Significant**).	M-181 M-182
Building and infrastructure (Offshore)	Increased frequency and intensity of storm events and wave heights.	Loading and sediment transport across seabed leading to loss of integrity of foundations from scour and exposure.	Unlikely	Moderate	**Minor** (**Not Significant**).	M-028 M-054 M-170
Building and infrastructure (Offshore)	Increased frequency and intensity of storm events and wave heights.	Loading and sediment transport across seabed leading to loss of integrity of cabling systems from scour and exposure.	Unlikely	Moderate	**Minor** (**Not Significant**).	M-028 M-054 M-170
Building and infrastructure (Offshore)	Increased frequency and intensity of storm events and wave heights.	Impeded access for maintenance and inspection.	Unlikely	Minor	**Minor** (**Not Significant**).	M-166 M-188
Building and infrastructure (Offshore)	Increased annual mean temperatures, especially in the summer months, and an increase in the frequency	Overheating of M&E assets such as offshore substations, leading to a decrease in asset performance and rating and / or requiring additional electricity	Unlikely	Moderate	**Minor** (**Not Significant**).	M-170 M-189 M-198

Receptor	Climate hazard	Potential impacts	Likelihood	Consequence	Significance	Relevant embedded environmental measures ID (from Table 28.10)
	and intensity of hot spells.	demand for mechanical cooling units.				
Building and infrastructure (Offshore)	Occurrence of intense low temperatures and cold snaps.	Cold weather leading to ice accretion affecting the efficiency and performance of WTGs.	Unlikely	Minor	**Minor** (**Not Significant**).	M-177 M-189 M-198
Building and infrastructure (Offshore)	Increase sea surface temperatures and ocean acidification.	Increased corrosion of the structures.	Unlikely	Minor	**Minor** (**Not Significant**).	M-190 M-198
Building and infrastructure (Onshore)	Sea level rise.	Risk to the onshore infrastructure, such as substations and trenched landfall cables, from coastal flooding and erosion.	Possible	Minor	**Minor** (**Not Significant**).	M-163 M-164
Building and infrastructure (Onshore)	Increase in precipitation resulting in tidal, fluvial or pluvial flooding.	Risk to the onshore infrastructure, such as substations, from river, surface water and groundwater flooding.	Possible	Minor	**Minor** (**Not Significant**).	M-081 M-163 M-164
Building and infrastructure (Onshore)	Increase in precipitation resulting in tidal, fluvial or pluvial flooding.	Restriction of access during flood events, preventing maintenance activities.	Possible	Minor	**Minor** (**Not Significant**).	M-081 M-165 M-166

Receptor	Climate hazard	Potential impacts	Likelihood	Consequence	Significance	Relevant embedded environmental measures ID (from Table 28.10)
Building and infrastructure (Onshore)	Fluctuations in mean rainfall across the year, coupled with an increase in mean temperatures, resulting in changes to soil moisture.	Risk to subterranean and surface infrastructure from subsidence, such as cables and substations.	Unlikely	Moderate	**Minor** (**Not Significant**).	M-167 M-168
Building and infrastructure (Onshore)	Decrease in summer precipitation, leading to drought conditions.	Changes in water content of soil has an adverse effect on soil resistivity leading to a reduction in cable ratings and the effectiveness of earthing systems at substations.	Very unlikely	Moderate	**Minor** (**Not Significant**).	M-001 M-169 M-171
Building and infrastructure (Onshore)	Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Reduction in the amount of power which can be transmitted and distributed.	Very unlikely	Moderate	**Minor** (**Not Significant**).	M-001 M-171
Building and infrastructure (Onshore)	Increased annual mean temperatures, especially in the summer months, and an increase in the frequency	Overheating of M&E assets such as onshore substations, leading to a decrease in asset performance and rating and / or requiring additional electricity	Unlikely	Moderate	**Minor** (**Not Significant**).	M-171 M-172

Receptor	Climate hazard	Potential impacts	Likelihood	Consequence	Significance	Relevant embedded environmental measures ID (from Table 28.10)
	and intensity of hot spells.	demand for mechanical cooling units.				
Human health (Onshore)	Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Increased heat stress or heat exhaustion experienced by the O&M workforce.	Unlikely	Minor	**Minor** (**Not Significant**).	M-166 M-188
Building and infrastructure (Onshore)	Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Underground cable systems affected by the increase in ground temperatures, reducing cable ratings.	Very unlikely	Moderate	**Minor** (**Not Significant**).	M-001 M-171
Building and infrastructure (Onshore)	Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Wildfire affecting electrical infrastructure.	Very unlikely	Moderate	**Minor** (**Not Significant**).	M-173 M-174 M-175

Receptor	Climate hazard	Potential impacts	Likelihood	Consequence	Significance	Relevant embedded environmental measures ID (from Table 28.10)
Building and infrastructure (Onshore)	Occurrence of intense low temperatures and cold snaps.	Cold weather leading to ice accretion causing damage to the infrastructure.	Unlikely	Minor	**Minor** (**Not Significant**).	M-176 M-177
Building and infrastructure (Onshore)	Increased frequency and intensity of storm events.	Lightning causing physical damage, fire, power surge, and shock wave at grid connection points.	Unlikely	Minor	**Minor** (**Not Significant**).	M-174 M-175 M-178 M-179
Building and infrastructure (Onshore)	Increased frequency and intensity of storm events.	Increased wind loading on substation equipment and security fencing leading to damage.	Possible	Minimal	**Minor** (**Not Significant**).	M-170 M-180 M-181
Human health (Onshore)	Increased frequency and intensity of storm events.	Wind blown debris leading to risk to maintenance personnel.	Possible	Minimal	**Minor** (**Not Significant**).	M-166 M-170 M-181 M-188
Infrastructure interdependencies (Whole Project)	Increase in precipitation resulting in tidal, fluvial or pluvial flooding.	Interruption or temporary loss of key supply-chain / third party networks (such as telecommunication networks, grid connections).	Unlikely	Moderate	**Minor** (**Not Significant**).	M-179
Infrastructure interdependencies (Whole Project)	Increased annual mean temperatures, especially in the summer months, and an increase in the frequency	Interruption or temporary loss of key supply-chain / third party networks (such as telecommunication networks, grid connections).	Unlikely	Moderate	**Minor** (**Not Significant**).	M-179

Receptor	Climate hazard	Potential impacts	Likelihood	Consequence	Significance	Relevant embedded environmental measures ID (from Table 28.10)
	and intensity of hot spells.					
Infrastructure interdependencies (Whole Project)	Increased frequency and intensity of storm events.	Interruption or temporary loss of key supply-chain / third party networks (such as telecommunication networks, grid connections).	Unlikely	Moderate	**Minor** (**Not Significant**).	M-179

28.10.1.3 The O&M stage climate-related impacts have sufficient embedded environmental measures in place which result in minor effects which are **Not Significant**.

28.11 Assessment of effects: decommissioning stage

28.11.1 Introduction

28.11.1.1 This Section provides an assessment of climate-related impacts on the decommissioning of the offshore and onshore elements of the Project. The assessment is presented in **Table 28.16.**

28.11.1.2 The assessment methodology set out in **Section 28.8** has been applied to assess climate-related impacts, using a likelihood and consequence assessment for the in-scope receptors and climate hazards, to determine significance. The maximum assessment scenario relevant to the climate resilience assessment (as presented in **Table 28.9**) and the embedded environmental measures outlined in **Table 28.10** have been taken into account for the assessment.

Table 28.16 Assessment of climate-related impacts: decommissioning stage

Receptor	Climate hazard	Potential impacts	Likelihood	Consequence	Significance	Relevant embedded environmental measures ID (from Table 28.10)
Human health (Offshore)	Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Increased heat stress or heat exhaustion experienced by the workforce associated with decommissioning.	Unlikely	Minor	**Minor** (**Not Significant**).	M-106 M-191 M-192 M-193 M-211
Human health (Offshore)	Increased frequency and intensity of storm events and wave heights.	Extreme storminess leading to increased occurrences of unsafe working environments and delays to decommissioning programme.	Possible	Minimal	**Minor** (**Not Significant**).	M-106 M-191 M-192 M-193 M-211
Building and infrastructure (Offshore)	Increased frequency and intensity of storm events and wave heights.	There is an increased risk of disruption to decommissioning work, such as vessels, cranes and helicopters unable to operate in high winds.	Possible	Minimal	**Minor** (**Not Significant**).	M-106 M-191 M-192 M-211
Human health (Onshore)	Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Increased heat stress or heat exhaustion experienced by the workforce associated with decommissioning.	Unlikely	Minor	**Minor** (**Not Significant**).	M-106 M-191 M-192 M-193 M-211
Human health (Onshore)	Increased annual mean temperatures and	Increased dust creation from decommissioning	Unlikely	Minor	**Minor** (**Not Significant**).	M-106 M-193

Receptor	Climate hazard	Potential impacts	Likelihood	Consequence	Significance	Relevant embedded environmental measures ID (from Table 28.10)
	frequency and intensity of hot spells, coupled with decreased summer precipitation.	activities, leading to impacts on the health of workers and the failure of machinery and equipment.				M-194 M-196 M-211
Human health (Onshore)	Increased annual mean temperatures and frequency and intensity of hot spells, coupled with decreased summer precipitation.	Risk of wildfires affecting the workforce.	Unlikely	Moderate	**Minor** (**Not Significant**).	M-106 M-193 M-195 M-211
The natural environment (Onshore)	Decrease in summer precipitation leading to drought conditions.	Drought conditions impacting water available to use during decommissioning, e.g. for dust suppression.	Unlikely	Minor	**Minor** (**Not Significant**).	M-106 M-196 M-211
Human health (Onshore)	Increase in precipitation resulting in tidal, fluvial or pluvial flooding.	Wet weather leading to increased possibility of slips, trips and falls.	Possible	Minor	**Minor** (**Not Significant**).	M-106 M-193 M-197 M-211
Building and infrastructure (Onshore)	Increase in precipitation resulting in tidal, fluvial or pluvial flooding.	Flooding of the site access roads causing delays to decommissioning programme.	Possible	Minor	**Minor** (**Not Significant**).	M-106 M-081 M-195 M-197 M-211
Building and infrastructure (Onshore)	Increase in precipitation resulting in tidal, fluvial or pluvial flooding.	Water ingress to equipment or machinery related to decommissioning activities, leading to	Unlikely	Minor	**Minor** (**Not Significant**).	M-106 M-194 M-211

Receptor	Climate hazard	Potential impacts	Likelihood	Consequence	Significance	Relevant embedded environmental measures ID (from Table 28.10)
		equipment failures or damage.				
Building and infrastructure (Onshore)	Increase in precipitation resulting in tidal, fluvial or pluvial flooding.	Overwhelming of the site drainage system causing flooding across the site.	Possible	Minor	**Minor** (**Not Significant**).	M-106 M-081 M-197 M-211
Building and infrastructure assets (Onshore)	Increase in frequency and intensity of storm events.	There is an increased risk of disruption to decommissioning work, such as cranes unable to operate in high winds	Possible	Minimal	**Minor** (**Not Significant**).	M-106 M-191 M-192 M-211

28.11.1.3 The climate resilience assessment for the decommissioning stage has identified only minor effects which are **Not Significant**. The embedded environmental measures in place to manage the climate-related impacts are considered sufficient to ensure the likelihood and consequence of climate change related impacts are not significant.

28.12 Summary of effects

28.12.1.1 A summary of the effects arising from the construction, O&M and decommissioning stages of the Project are provided in **Table 28.14**, **Table 28.15** and **Table 28.16.**

28.13 Transboundary effects

28.13.1.1 Transboundary effects arise when impacts from a development with one European Economic Area (EEA) State affects the environment of another EEA State(s). A screening of transboundary effects has been carried out and is presented in Appendix 4B of the Scoping Report (MarramWind Ltd., 2023).

28.13.1.2 The Climate Resilience assessment assesses the climate-related impacts on the Project. No transboundary effects are anticipated on the basis that climate-related impacts and embedded environmental measures are specific to the development and will not result in impacts to an adjacent state.

28.14 Inter-related effects

28.14.1.1 A description and assessment of the likely inter-related effects as a result of climate-related impacts to the Project is provided in **Chapter 32: Inter-Related Effects**.

28.15 Cumulative effects assessment

28.15.1.1 A description and assessment of the cumulative effects as a result of climate-related impacts to the Project is provided in **Chapter 33: Cumulative Effects Assessment**.

28.16 Summary of residual likely significant effects

28.16.1.1 There are no residual likely significant effects on climate resilience receptors assessed in this Chapter.

28.17 References

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28.18 Glossary of terms and Abbreviations

28.18.1 Abbreviations

Acronym	Definition
°C	Degrees Celsius
CCRA	Climate Change Risk Assessment
CBRA	Cable Burial Risk Assessment
CEMP	Construction Environmental Management Plan
DEFRA	Department for Environment, Food and Rural Affairs
EC	European Commission
EEA	European Economic Area
EIA	Environmental Impact Assessment
ERP	Emergency Response Plan
HM	His Majesty
ICCI	In-Combination Climate Impacts
IEMA	Institute of Environmental Management and Assessment
ISO	International Organization for Standardization
km	Kilometres
m	Metres
mm	Millimetres
M&E	Mechanical and electrical
MD-LOT	Marine Directorate - Licencing Operations Team
MSL	Mean Sea Level
O&M	Operation and Maintenance
PPE	Personal Protective Equipment
RAMS	Risk Assessment Method Statement
RCP8.5	Representative Concentration Pathways
RCP	Reactive compensation platform(s)
s.36	Section 36

Acronym	Definition
SEPA	Scottish Environment Protection Agency
SSEN	Scottish and Southern Electricity Networks
UK	United Kingdom
UKCP18	UK Climate Projections
WTG	Wind turbine generators

28.18.2 Glossary of terms

Term	Definition
Climate hazard	The potential occurrence of a natural or human-induced physical event or trend that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources.
Climate impact / Climate-related impact	Impact is used primarily to refer to the effects on natural and human systems of extreme weather and climate events and of climate change. Impacts generally refer to effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services and infrastructure due to the interaction of climate change or hazardous climate events occurring within a specific time-period and the vulnerability of an exposed society or system. Impacts are also referred to as consequences and outcomes.
Climate trend	Climate trends refer to the pattern of climate change over decades to understand how the climate is changing.
Resilience	The capacity of systems and its component to anticipate and cope with a hazardous event or trend or disturbance, and accommodate, or recover from the effects of a hazardous event or trend in a timely and efficient manner.
Vulnerability	Propensity or predisposition to be adversely affected.

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