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Environmental Statement – Volume 1 – Chapter 28 Carbon and Climate Change

The Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 – Regulation 5(2)(a)

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017

Document Ref: 6.1.28

PINS Ref.: EN020022

AQUIND Limited

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Environmental Statement – Volume 1 – Chapter 28 Carbon and Climate Change

PINS REF.: EN020022

DOCUMENT: 6.1.28

DATE: 14 NOVEMBER 2019

WSP

WSP House

70 Chancery Lane

London

WC2A 1AF

+44 20 7314 5000

www.wsp.com

DOCUMENT

Document	**6.1.28 Environmental Statement – Volume 1– Chapter 28 Carbon and Climate Change**
Revision	001
Document Owner	WSP UK Limited
Prepared By	H. Probert
Date	14 November 2019
Approved By	J. Peet
Date	14 November 2019

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28. CARBON AND CLIMATE CHANGE

28.1. SCOPE OF THE ASSESSMENT

28.1.1. INTRODUCTION

28.1.1.1. This chapter reports the outcome of the assessment of likely significant effects arising from the Proposed Development upon climate change, specifically greenhouse gas emissions ('GHG[1] emissions'), and the likely significant effects of climate change on the Proposed Development (Climate Resilience). The Proposed Development that forms the basis of this assessment is described in Chapter 3 (Description of the Proposed Development) of this Environmental Statement ('ES') Volume 1 (document reference 6.1.3).

28.1.1.2. The requirement to consider climate change is required following the 2014 amendment to the EIA Directive (2014/52) (European Parliament and Council, 2014). The Directive has been fully transposed into UK law in the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (EIA Regulations) and came into force in the UK on the 16 May 2017 (HM Government, 2017). The EIA Regulations require an environmental statement to include:

> "*A description of the factors specified in regulation 5(2) likely to be significantly affected by the development:… climate (for example greenhouse gas emissions, impacts relevant to adaptation)…..*"

28.1.1.3. There are two components to the climate assessment covered by this requirement of the EIA Regulations: GHG emissions and climate resilience. For ease of understanding, the chapter is structured as follows:

- Part A: GHG Emissions; and
- Part B: Climate Resilience.

28.1.2. GREENHOUSE GAS EMISSIONS

28.1.2.1. The GHG assessment (the impact of the Proposed Development on the environment in terms of climate change), is outlined in this chapter.

28.1.2.2. The climate change assessment has considered the potential impacts associated with the following activities:

[1] GHG, or Greenhouse Gases, are gasses that trap heat within the atmosphere (of which carbon dioxide is the most common). The build-up of these gasses within the atmosphere due to human activity is causing climate change. GHGs are also referred to in this report as 'carbon'.

- Carbon emissions resulting from the construction of the onshore and marine elements of the Proposed Development, including the extraction and manufacture of materials, deliveries to and from site, and on-site construction activities;
- Carbon emissions associated with the operation of the onshore and marine elements of the Proposed Development, including electricity consumption, fugitive gas emissions, maintenance and replacement; and
- Carbon emissions, or avoided emissions associated with the transfer of electricity between the United Kingdom and France.

28.1.3. CLIMATE RESILIENCE

28.1.3.1. The vulnerability of the Proposed Development to climate change is assessed in this chapter. As identified in the Scoping Report the Proposed Development would be vulnerable to changes in climate variables such as changes in seasonal temperature and rainfall, changes to extreme temperature and rainfall, changes to storminess and changes to soil moisture.

28.1.3.2. The Preliminary Environmental Information Report ('PEIR') undertook a vulnerability assessment to identify the climate variables which the Proposed Development is deemed to be vulnerable to. This ES chapter assesses the significance of the effects associated with changes in the climate variables.

28.1.3.3. The climate resilience assessment has considered the potential impacts of climate change on the following aspects of the Proposed Development:

- HVDC Marine Cables;
- HVDC underground Onshore Cables;
- Converter Station;
- Access Road to the Converter Station;
- HVAC cables; and
- Fibre Optic data transmission Cables ('FOC') and associated FOC Infrastructure (including the Telecommunications Building(s) and Optical Regeneration Station(s) ('ORS')).

28.1.4. STUDY AREA

GHG Emissions

28.1.4.1. The GHG assessment is not restricted by geographical area but instead includes any increase or decrease in emissions as a result of the Proposed Development, wherever that may be – for example if the emissions occur on the road network around the Proposed Development due to transport of materials.

Climate Resilience

28.1.4.2. The study area for the climate resilience assessment comprises the Proposed Development (as indicated by the Order Limits), as it is an assessment of the potential impacts of a changing climate on the Proposed Development itself. The assessment of resilience is informed by regional scale information on historic and projected change in climate variables.

28.1.4.3. The assessment is informed by climate projections for the UK at the administrative region scale. Projections at this scale provide sufficiently detailed information about the future climate that the Proposed Development will experience and allow a proportionate assessment to be undertaken. The Proposed Development falls within the South-East England region.

28.2. LEGISLATION, POLICY AND GUIDANCE

28.2.1.1. This assessment has taken into account the current legislation, policy and guidance relevant to climate change. These items, covering both GHG emissions and climate resilience, are detailed below.

28.2.2. LEGISLATION

United Nations Framework Convention on Climate Change

28.2.2.1. The UK is a member of the United Nations Framework Convention on Climate Change ('UNFCCC') which drives international action on climate change. The UK has pledged to reduce emissions under the 'Paris Agreement' in 2015, as a part of a joint pledge by members of the EU. This provides an overarching commitment by the UK.[2]

The Climate Change Act (2008)

28.2.2.2. The Climate Change Act (2008) (HM Government, 2008) established a legal requirement for an 80% reduction in the GHG emissions of the UK economy by 2050 in comparison to the 1990 baseline. In addition, in June 2019 the UK Government updated this commitment to net zero emissions by 2050[3] (HM Government, 2019).

28.2.2.3. The Climate Change Act also created the Committee on Climate Change, with responsibility for setting 5-year carbon budgets covering successive periods of emissions reduction to 2050.

[2] https://www.theccc.org.uk/tackling-climate-change/the-legal-landscape/
[3] This is likely to be achieved with the use of offsets (Committee on Climate Change, 2019).

28.2.3. PLANNING POLICY

National Policy

National Policy Statement

28.2.3.1. The National Policy Statement for Energy (EN-1) (2011) Department of Energy and Climate Change, outlines the planning policy for the energy sector. In particular, it discusses:

- The transition to a low carbon economy, and the energy sector's role in achieving that end;
- The challenge of meeting energy security and carbon reduction objectives (set out in the Climate Change Act (2008), and Energy Act (2013));
- The aim of reducing demand through energy efficiency; and
- The role of smart technologies to balance supply and demand and therefore result in carbon savings.

28.2.3.2. Part 2 of EN-1 covers the Government's energy and climate change strategy, including policies for mitigating climate change. Part 4 of the EN-1 sets out how the effects of climate change should be taken into account when planning the location, design, build, operation and where appropriate, decommissioning of new energy infrastructure. EN-1 states that the latest UK Climate Projections should be used and as a minimum and provides advice on emissions scenarios to be considered.

National Planning Policy Framework

28.2.3.3. The National Planning Policy Framework (2019) (Ministry of Housing, Communities and Local Government, 2019)) explains that achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives). One of the three objectives is an environmental objective (with the other two being economic and social), which includes the objective of 'mitigating and adapting to climate change, including moving to a low carbon economy' (paragraph 8).

28.2.3.4. Section 14 of the NPPF provides national planning policy in respect of the need to meet the challenge of climate change, flooding and coastal change. Paragraph 148 of the NPPF provides that

> "*The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing*

buildings; and support renewable and low carbon energy and associated infrastructure".

28.2.3.5. Paragraphs 149 – 154 provide policies in relation to the need to plan for climate change. Paragraph 150 provides that " *New development should be planned for in ways that:*

> *a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and*
>
> *b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design.*

28.2.3.6. Paragraph 154 provides that "*When determining planning applications for renewable and low carbon development, local planning authorities should:*

> *a) not require applicants to demonstrate the overall need for renewable or low carbon energy…; and b) approve the application if its impacts are (or can be made) acceptable.*

28.2.3.7. Whilst paragraph 5 of the NPPF confirms the framework does not contain specific policies for nationally significant infrastructure project, it is identified that the policies contained in the NPPF may include other matters that are relevant. Accordingly, the Secretary of State may determine that the policies of the NPPF in relation to climate change, in addition to those contained in local planning policy, discussed below, are relevant to their determination of the DCO Application for the Proposed Development.

Local Policy

Portsmouth City Council

The Portsmouth Plan (Portsmouth's Core Strategy)

28.2.3.8. The Core Strategy outlines how Portsmouth is vulnerable to the effects of climate change with sea level rise increasing the risk of flooding and rising temperatures increasing the risk of heat related deaths. The council has a key role in promoting environmentally sustainable development and environmentally friendly ways of travel in order to minimise climate change and become a low carbon city. Policies of relevance to this assessment include:

- PCS 15 Sustainable design and construction. All development which takes place in Portsmouth must contribute to addressing climate change (Portsmouth City Council, 2012).

Portsmouth Climate Change Strategy

28.2.3.9. Portsmouth's priorities for tackling climate change include:

- Reducing Portsmouth's carbon footprint with the main areas of focus being buildings, new developments, transport and waste;
- Adapting to climate change, particularly in relation to the risk of flooding from the impacts of sea level rise;
- Community involvement by engaging with residents, businesses and organisations; and
- Energy strategy for the city, reducing Portsmouth's carbon footprint and diversifying energy sources (Portsmouth City Council, 2011).

Havant Borough Council

Havant Borough Core Strategy

28.2.3.10. The Core Strategy identifies that the council will plan for and adapt to the challenges of climate change, particularly flooding and coastal erosion. Policies of relevance to climate change and resilience include:

- Policy CS15 Flood and Coastal Erosion Risk. Development in areas at risk of flooding now and in the future will only be permitted where flood risk and flood protection is considered (in addition to a number of other conditions).
- Policy DM12 Mitigating the Impacts of Travel. New developments will be required to mitigate their travel impact, including the environmental impacts of travel (such as noise, air and visual pollution) and impacts on amenity, health and climate change (Havant Borough Council, 2011).

Winchester City Council

Local Plan

28.2.3.11. Local Plan core policies for a high-quality environment acknowledges the need for actions to address high carbon footprint of the district and the severity of water stress in the area. Policies of relevance to climate change include:

- Policy CP11 Sustainable Low and Zero Carbon Built Development. Focuses on achieving carbon reduction targets and actions to achieve energy and water efficiency levels in advance of national requirements.
- Policy CP17 Flooding, Flood Risk and the Water Environment. Aims to avoid flood risk to people and property, focuses also on water quality measures (Winchester City Council & South Downs National Park Authority, 2013).

East Hampshire District Council

Joint Core Strategy

28.2.3.12. The joint core strategy focuses on protecting the wider environment – climate change with a commitment to address issues relating to the adaption to, and mitigation of climate change. Policies of relevance to climate change and resilience include:

- CP24 Sustainable Construction. Outlines measures to adopt in carbon reduction around construction of both small and large developments. It follows the fundamental goals outlines in Government guidance.
- CP25 Flood Risk. Ensures permission of development in areas at risk from flooding meet specific criteria to incorporate resilience measures and surface water drainage management and maintenance (East Hampshire District Council & South Downs National Park Authority, 2014).

Hampshire County Council

28.2.3.1. In the context of Carbon and Climate Change the Sustainability Policy Strategic Plan takes a wide approach with relevant focus on Transport, Flood Management, and Energy Strategy.

28.2.3.2. The Council have committed to the Emissions Reduction Pledge 2020 to achieve a 30% reduction by 2020. Its own targets strive to make this reduction 50% by 2025 leading to carbon neutrality by 2050. Projects underway to reduce carbon emissions include improving the energy efficiency of buildings, improving street lighting, monitoring energy use, and behaviour change.

28.2.3.3. Local Transport Plan Policy aims to deliver improvements in air quality and reduce carbon emissions. Measures towards a modal shift towards public transport modes, walking and cycling. Promoting cleaner vehicle technologies and supporting car clubs. Investing in infrastructure such as an urban bus network.

28.2.3.4. The Draft Local Flood Risk Management Strategy outlines how the council work with a range of partners across the region to develop sustainable long-term solutions to manage flood risk. For example, surface water management for all major planning applications in Hampshire, issuing Ordinary Watercourse Consents, investigating flood incidents and developing innovative catchment based solutions using natural flood management, traditional engineering and maintenance.

28.2.3.5. The Energy Strategy addresses key issues of supply, affordability and carbon emissions to the Council and communities of Hampshire. The Executive supports the delivery of high quality cost effective projects to reduce energy consumption and the carbon footprint of Hampshire County Council. Support extends to public sector partners to embrace new technologies and reduce spend on energy.

28.2.4. GUIDANCE

28.2.4.1. The GHG assessment draws on the following guidance:

- IEMA's EIA Guide to Assessing GHG Emissions and Evaluating Their Significance (Institute of Environmental Management and Assessment, 2017);
- PAS 2080:2016 Carbon Management in Infrastructure (BSI, 2016); and
- RICS Whole life carbon assessment for the built environment, 1st Edition (RICS, 2017).

28.2.4.2. The Resilience assessment draws on the following guidance:

- EIA guide to Climate Change Resilience and Adaptation (IEMA, 2015);
- Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment (European Commision, 2013);
- Climate Change and Major Projects (European Commission, 2016); and
- Non-paper Guidelines for Project Managers: Making vulnerable investments climate resilient. European Commission (European Commission, undated).

28.3. SCOPING OPINION AND CONSULTATION

28.3.1. SCOPING OPINION (GHG EMISSIONS AND RESILIENCE)

28.3.1.1. As detailed within Chapter 4 (EIA Methodology) of the ES Volume 1 (document reference 6.1.4), a Scoping Opinion was received by the applicant from PINS (on behalf of the SOS) on 7 December 2018.

28.3.1.2. The comments received from PINS in the Scoping Opinion in relation to the EIA Scoping Report included:

- The scoping in of land use in relation to emissions associated with the change in land use and loss of forestry – to be scoped back in should there be significant land take (see Table 28.1).
- The assessment of decommissioning - should further detail become available regarding decommissioning to enable an assessment of climate change at this life cycle stage, an assessment should be presented in the ES where significant effects are considered to be likely (see Table 28.1).
- The use of UKCP09 projections within the Scoping Report – the UKCP18 projections (now largely available) have been included within this ES chapter.
- The Carbon and Climate Change aspect chapter of the ES should define what level of impact is deemed to be significant, where this differs from the overarching assessment methodology. The methodology for defining significance is detailed in section 28.4 and 28.10.

28.3.2. INFORMAL CONSULTATION PRIOR TO PEIR

28.3.2.1. There was no informal consultation undertaken prior to the statutory consultation and the publication of the PEIR in relation to carbon and climate.

28.3.3. PEIR CONSULTATION

28.3.3.1. Statutory consultation, including the on the PEIR, was undertaken between 27 February and 29 April 2019. Comments in relation to the preliminary assessment of Carbon and Climate impacts included in the PEIR were received from the Environment Agency and Winchester City Council and included:

- Environment Agency: use of UKCP18 projections. UKCP18 should be taken into account in order to ensure planning decisions are in line with policies of the NPPF – the assessment has used the UKCP18 projections within the future baseline which has been used to inform the assessment; and
- Winchester City Council: consideration of a broadening of the scope of assessment to consider innovative measures to reduce the carbon footprint of the development.

28.3.3.2. Appendix 28.1 (Consultation Responses) of the ES Volume 3 (document reference 6.3.28.1) includes the full responses to the PEIR consultation in relation to this topic and how these have been addressed.

28.3.4. POST PEIR CONSULTATION

28.3.4.1. There was no further consultation undertaken specifically in relation to the assessment of resilience and carbon and climate change following the statutory consultation.

28.3.5. ELEMENTS SCOPED OUT OF THE GHG EMISSIONS ASSESSMENT

28.3.5.1. The elements shown in Table 28.1 were not considered to give rise to likely significant effects at Scoping and as a result of the Proposed Development and have therefore not been considered within the ES:

Table 28.1 – Topics and elements scoped out of the GHG assessment at Scoping

Element Scoped Out	Justification
Land Use Change (A5[4] and B8)	No net loss of forested areas is expected due to the Proposed Development (see Chapter 16 (Onshore Ecology) of the ES Volume 1 (document reference 6.1.16)), given that land use change from agricultural land to the Proposed Development is

[4] These alpha numeric references are used by PAS2080 to identify Proposed Development lifecyle stages (and therefore the emissions associated with them).

Element Scoped Out	Justification
	not likely to generate emissions no significant emissions are anticipated from land use change.
Final disposal of construction waste (A5)	Construction waste is expected to be inert, and as such is not expected to result in GHG emissions on disposal.
Decommissioning (C3)	Decommissioning will result in emissions from the process of deconstruction of the proposed Converter Station infrastructure, and ORS. However, in light of the buildings at the Converter Station being designed to have a design life of 40 years and that consent is not sought for the decommissioning process it is not considered to be possible to meaningfully quantify the emissions of doing so (for example in relation to the deconstruction techniques and the carbon intensity of fuels used within these deconstruction techniques). It is therefore not considered appropriate to assess this lifecycle stage and it is anticipated any decommissioning impacts would be considered at that time.

28.3.6. ELEMENTS SCOPED OUT OF THE CLIMATE RESILIENCE ASSESSMENT

28.3.6.1. A climate vulnerability assessment was undertaken and reported within the PEIR for which climate variables (such as sea level rise, precipitation and temperature – see 28.3.8.1 for full list of climate variables) assessed as high or medium vulnerability were taken forward for more detailed assessment in this assessment.

28.3.6.2. Vulnerability of the Proposed Development to the following climate variables was determined to be ‘low’, and therefore they are not assessed further:

- Change in annual average precipitation;
- Snow and ice;
- Change in annual average temperature;
- Solar radiation;
- Change in annual average humidity;
- Salinity of soils; and
- Runoff.

28.3.7. IMPACTS SCOPED IN TO THE GHG ASSESSMENT

Construction Stage

28.3.7.1. A breakdown of stages A1-B6 of whole life carbon assessments is provided by RICS (2017)[5]. The Proposed Development is considered to have the potential to give rise to likely significant effects during construction in relation to the following stages of the whole life carbon assessment, which have therefore been considered within the ES:

- Embodied emissions including raw material supply, transport and manufacture (A1-A3)[6];
- Transport of materials to site (A4);
- Construction and installation process (A5); and
- Transport of waste arisings away from site (A5).

Operational Stage

28.3.7.2. The Proposed Development is considered to have the potential to give rise to likely significant effects during operation in relation to the following stages of the whole life carbon assessment, which have therefore been assessed:

- Maintenance – energy used on visits (B2);
- Repair and Refurbishment (B3 and B5);
- Replacement of materials (including transport of those materials) (B4);
- Operational energy use and operational fuel consumption (B6);
- Transmission Losses (B6);
- Fugitive gas emissions (B8); and
- The change in emissions from generation plant due to energy transfers between UK and France (D)[7].

28.3.8. IMPACTS SCOPED INTO THE CLIMATE RESILIENCE ASSESSMENT

28.3.8.1. Change in the following climate variables are considered to have the potential to give rise to likely significant effects during both construction and operation of the Proposed Development and have therefore been assessed:

[5] https://www.rics.org/globalassets/rics-website/media/news/whole-life-carbon-assessment-for-the--built-environment-november-2017.pdf
[6] These alphanumeric values are PAS2080 lifecycle references. They ensure clarity when refereeing to Lifecyle stages.
[7] An example of emissions changes from generation plant due to the operation of the interconnector would be if hydro and nuclear power from France, was transferred to the UK over the interconnector during a period of high demand, resulting in gas fired (peaking plant) not operating, thus resulting in a reduction in emissions compared to the do-nothing scenario.

- Sea level rise;
- Storm surge and storm tide;
- Drought;
- Extreme precipitation events;
- Extreme temperature events;
- Gales and extreme wind;
- Storms (including lighting and hail);
- Soil moisture; and
- Soil stability.

PART A: GREENHOUSE GAS EMISSIONS

28.4. ASSESSMENT METHODOLOGY

28.4.1. CONSTRUCTION STAGE

28.4.1.1. The assessment approach considers the likely magnitude of GHG emissions in comparison to the baseline scenario with no development (where no emissions are produced as no construction takes place). To quantify emissions the following process was undertaken.

- Activity data was sourced from the design team (for example the quantities of materials to be used in construction detailed in Appendix 27.2 (Waste and Material Assumptions and Limitations) of the ES Volume 3 (document reference 6.3.27.2)).
- Emissions factor data was collected from publicly available sources, including the Department for Business Energy and Industrial Strategy 2019 emission factors (BEIS 2019)[8] and Inventory of Carbon and Energy v3[9].
- GHG emissions were then quantified in line the with guidance outlined in section 28.2.4 and with best practice methods.
- The results were then aggregated.

28.4.1.2. Specifically, the following steps were undertaken for each data source:

- Embodied emissions (A1-A3) – to estimate emissions associated with the materials used to construct the Proposed Development, quantities of materials were multiplied by emissions factors sourced from the Inventory of Carbon and Energy (Hammond and Jones, 2019).
- Transport of materials to site (A4) – to estimate emissions from transport of materials to site, the expected mass of materials was multiplied by transport distance. In order to estimate the transport emissions for rock, a transport distance of 1,200 km was assumed (equivalent of Stavanger in Norway to Southampton by ship) based on the source location of the material. For all other materials, transport distance assumptions were based on guidance provided by

[8] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2019
[9] http://www.circularecology.com/embodied-energy-and-carbon-footprint-database.html#.XalxuihKhPY

RICS (RICS, 2017) resulting in tonne-kilometres (a unit representing a tonne travelling one kilometre) and this was multiplied by 2019 emissions factors sourced from BEIS (BEIS,2019).

- Plant use on site (A5) – emissions from plant use on site were estimated using an assumption provided by RICS (RICS, 2017).
- Transport of waste away from site (A5) – to estimate emissions from transport of materials away from site, the mass of materials (supplied by the design team as outlined in 28.5.1.1) was multiplied by transport distance assumptions provided by the Institution of Civil Engineers (ICE, 2012) resulting in tonne kilometres (a unit representing a tonne travelling one kilometre). This was multiplied by emissions factors sourced from BEIS (BEIS, 2018).

28.4.2. OPERATIONAL STAGE

28.4.2.1. The assessment approach considers the likely magnitude of GHG emissions in comparison to the baseline scenario with no development (where no emissions are produced as no operation of new equipment takes place). As for the Construction Stage, the same process to quantify emissions outlined at para 28.4.1.2 was followed.

28.4.2.2. Specifically, the following steps were undertaken for each data source:

- Maintenance (B2) – It was assumed that two maintenance trips of 100 km would take place per year. The fuel consumption of these trips was estimated using data published by the Department for Transport[10]. Fuel consumption was then converted to emissions using data published by BEIS.
- Repair and Refurbishment (B3 and B5) – Most elements of the Proposed Development have been designed to be maintained rather than repaired, with the need for repair being unforeseen, and as such repair emissions for these elements have been assumed to be zero. However, due to the movement of sediments, and the activities of fishing and shipping, there is potential for the Marine Cable to require repair. As such quantities of materials for repair have been provided by project engineers for the Marine Cable, and these have been quantified in line with the methods used for embodied emissions (A1-A3). In addition, it has been conservatively assumed that all assets with a lifespan less than the Project Reference Lifespan will not be refurbished but will be replaced (with replacement assessed as discussed above). As such emissions from Refurbishment (B5) are assumed to be zero.

[10] DfT (2018) WebTAG data book; https://www.gov.uk/government/publications/tag-data-book

- Replacement (B4) – Data from the Project engineers and professional judgement was used to estimate the lifespan of the elements of the Proposed Development. Based on this, the number of replacements required for each element was estimated over a lifespan of 40 years. The embodied emissions associated with materials, and the transport of materials to site was multiplied by number of replacements to quantify emissions from replacement over the lifespan.
- Operational electricity consumption (B6) – The total capacity of all lighting, heating and cooling equipment was assumed to run constantly to provide a robust assessment of the total electricity consumption per year. Emissions were then calculated using future electricity grid carbon intensity data published by BEIS.
- Operational fuel consumption (B6) – The fuel consumption rate (l/hr) of the generator was used, combined with its expected hours of use, to provide a fuel consumption, which was converted to emissions using data published by BEIS.
- Transmission Losses (B6) – Transmission losses are anticipated to be 3.6% of the electricity that flows across the Project. There is uncertainty regarding the quantity of electricity that will flow across the Project. Therefore, it is not possible to estimate emissions, by quantifying 3.6% of the electricity that flows across the Project and converting this to GHG emissions. As such, it has been assumed that the emissions associated with transmission losses will be equal to 3.6% of the emissions from the change in emissions from generation plant due to energy transfers between UK and France (D). Inherent in this assumption are two other assumptions. One, it has been assumed that the carbon intensity of the electricity associated with the change in emissions from generation plant due to energy transfers between UK and France (D), will be representative of the emissions intensity of the electricity transmitted by the project. Two, that the quantity of electricity associated with the change in emissions from generation plant due to energy transfers between UK and France (D), is equivalent to the electricity transmitted by the operation of the Project.
- Fugitive gas emissions (B8) – All switchgear such as that used by the Proposed Development requires insulating gases to function. The Proposed Development uses SF6 (which is standard for the voltages the Project is designed to operate at). These gasses may slowly leak over time from the switchgear as a completely impermeable seal is not possible. The Project is expected to use SF6 recovery equipment in line with standard practice when the system is degassed for maintenance – thus reducing the leak rate. The predicted worst-case leak rate of SF6 was converted to GHG emissions data using data published by BEIS. SF6 is widely used in the electrical industry as a medium for high voltage circuit breakers and other electrical equipment.

- The change in emissions from generation plant due to energy transfers between UK and France (D) – Changes in emissions from generating plant due to the transfer of electricity over the interconnector[11] were calculated using the European Network of Transmission System Operators for Electricity Ten Years Network Development Plan (TYNDP) for 2016 and 2018.

28.4.3. SIGNIFICANCE CRITERIA

28.4.3.1. The significance of impacts has been assigned in the ES in-line with best practice. Current best practice assesses significance with reference to the magnitude of emissions, their context – including this UK Carbon Budgets (Table 28.2), guidance from IEMA (Institute of Environmental Management and Assessment, 2017), and professional judgement. As climate change impacts are global in nature, and it is not possible to link a specific project with a specific environmental impact, the sensitivity of receptors is not used to assess significance.

Table 28.2 – UK Carbon Budgets

Carbon Budget Period	UK Carbon Budget
Third: 2018-2022	2,544 $MtCO_2e$
Fourth: 2023-2027	1,950 $MtCO_2e$
Fifth: 2028-2032	1,725 $MtCO_2e$

28.4.4. ASSUMPTIONS AND LIMITATIONS

28.4.4.1. The assessment of GHG emissions has been completed based on the currently available information regarding the scale and nature of the Proposed Development. Type and quantities of material provided at this stage are outline due to the constraints of working with preliminary designs and preliminary design descriptions. Where data has been unavailable, worst-case reasonable assumptions have been used to fill in gaps (for example, the use of the RICS assumptions regarding transport distances).

28.4.4.2. A transport distance of 1,200 km has been assumed for the transport of rock (equivalent of Stavanger in Norway to Southampton) by ship.

[11] An example of emissions changes from generation plant due to the operation of the interconnector would be if hydro and nuclear power from France, was transferred to the UK over the interconnector during a period of high demand, resulting in gas fired (peaking plant) not operating, thus resulting in a reduction in emissions compared to the do-nothing scenario.

28.4.4.3. It has been assumed that items that contain two materials (e.g. the cable), contain 50% of each material.

28.4.4.4. It has been assumed that the emissions associated with transmission losses will be equal to 3.6% of the emissions from the change in emissions from generation plant due to energy transfers between UK and France (D). Inherent in this assumption are two other assumptions. One, it has been assumed that the carbon intensity of the electricity associated with the change in emissions from generation plant due to energy transfers between UK and France (D), will be representative of the emissions intensity of the electricity transmitted by the project. Two, that the quantity of electricity associated with the change in emissions from generation plant due to energy transfers between UK and France (D), is equivalent to the electricity transmitted by the operation of the Project.

28.4.4.5. It has been assumed that the Cable Corridor (marine and onshore) itself will not require maintenance within the lifespan of the Proposed Development. It has also been assumed that the Converter Station will require two maintenance visits per year, and these will be undertaken by a van in a 100 km round trip.

28.4.4.6. Some small emissions sources (e.g. use of xanthan gum), have been excluded as emissions from these sources are not considered likely to be large and therefore not material to the assessment.

28.4.4.7. Quantifying the change in emissions from generation plant due to energy transfers between UK and France (D) is inherently uncertain. Therefore, ranges and scenarios are both presented. The use of the distributed generation average scenario for the purposes of defining significance is therefore a limitation of this assessment.

28.4.4.8. It has been conservatively assumed that the fuel consumed by all four backup generators will be the same as the largest generator.

28.4.4.9. There is currently no specific guidance on carbon emissions thresholds, which, if exceeded, are considered significant. Therefore, professional judgement and IEMA guidance have been used to determine significance.

28.5. BASELINE ENVIRONMENT

28.5.1.1. Under baseline conditions (without the Proposed Development), there would not be any emissions from construction, maintenance, replacement, and on-site energy consumption. For context, a breakdown of absolute emissions in the UK is presented below in Table 28.3.

Table 28.3 – UK Emissions

Year	National ($ktCO_2$)
A. Industry and Commercial Electricity	46,415
B. Industry and Commercial Gas	34,466

Year	National ($ktCO_2$)
C. Large Industrial Installations	32,273
D. Industrial and Commercial Other Fuels	17,170
E. Agriculture	5,733
Industry and Commercial Total	**136,057**
F. Domestic Electricity	27,546
G. Domestic Gas	59,876
H. Domestic 'Other Fuels'	10,679
Domestic Total	**98,101**
I. Road Transport (A roads)	56,185
J. Road Transport (Motorways)	30,234
K. Road Transport (Minor roads)	37,978
L. Diesel Railways	2,133
M. Transport Other	2,136
Transport Total	**128,666**
N. LULUCF Net Emissions	-11,323
Grand Total	**351,501**
Population ('000s, mid-year estimate)	**66,040**
Per Capita Emissions (t)	**5**

Future Baseline

28.5.1.2. In terms of the change in emissions from generation plant due to energy transfers between UK and France (D), emissions from both the UK and France in generating electricity form part of the future baseline. This is because in a future scenario without the Project emissions will be generated in the future by generation plant in the UK and France, that will be affected by the operation of the Scheme.

28.6. PREDICTED IMPACTS

28.6.1. CONSTRUCTION STAGE

Embedded Mitigation

28.6.1.1. No Embedded Mitigation has been identified to address GHG emissions.

Impacts

28.6.1.2. Construction emissions due to the Proposed Development are presented in Plate 28.1 and Table 28.4 below. Total emissions from the construction of the Proposed Development are estimated to be approximately 257,000 tonnes of CO_2 equivalent (tCO_2e). This estimate shows that embodied emissions (A1-3) would be the biggest single source of construction emissions (89%), with transport emissions (A4) the second largest source (6%). In terms of materials, the largest source of emissions would be associated with the aluminium used for the Marine Cable (41%) followed by the Rock used in the Marine Cable Corridor (28%).

Plate 28.1 - Construction emissions breakdown

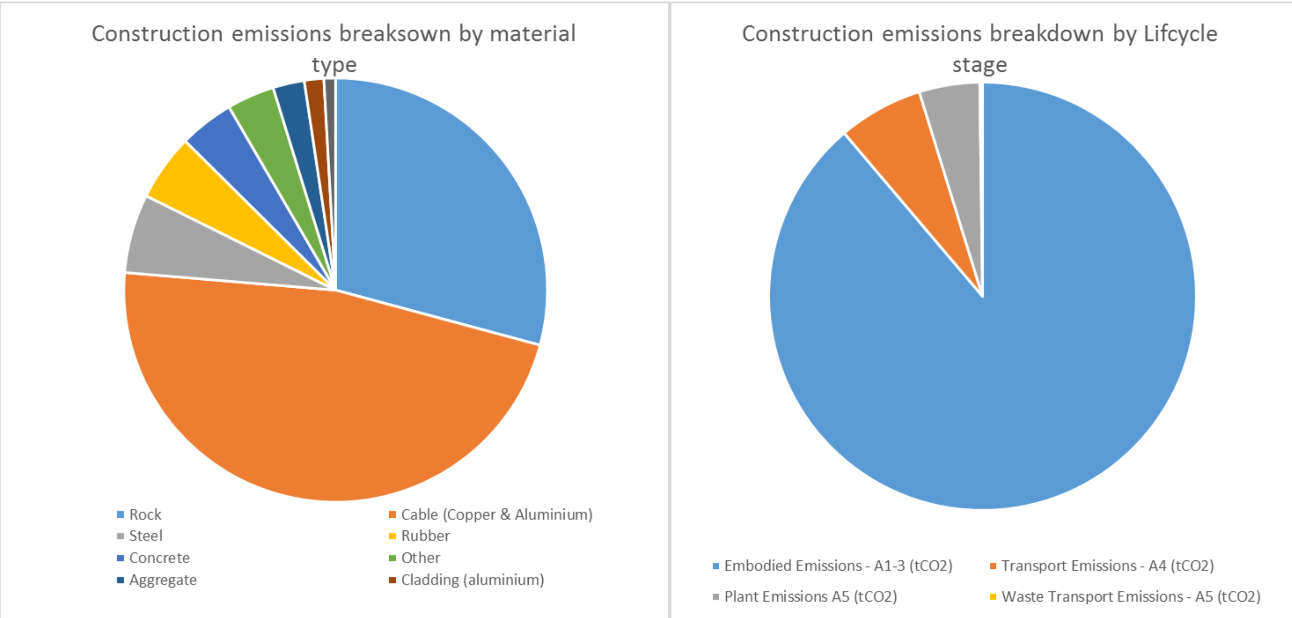

Table 28.4 – Construction Emissions by Material Type

Location	Material	Embodied Emissions - A1-3 (tCO_2)	Transport Emissions - A4 (tCO_2)	Plant Emissions A5 (tCO_2)	Waste Transport Emissions - A5 (tCO_2)	Total (tCO_2)
Converter Station	Aggregate	944	3,968	11,757	352	4,912
	Asphalt	584	331			915
	Concrete	7,517	2,413			9,931
	Cladding (aluminium)	3,609	18			3,627
	Geogrid	2,152	21			2,173
	Steel	14,260	154			14,414
Onshore Cable Corridor	Aggregate	181	760		160	941
	Asphalt	310	175			485
	Bentonite	25	14			39
	Cable (Glass & Polymers)	17	2			18
	Cable (Copper & Aluminium)	8,746	308			9,054
	Cement Bound Sand	1,247	491			1,738

Location	Material	Embodied Emissions - A1-3 (tCO_2)	Transport Emissions - A4 (tCO_2)	Plant Emissions A5 (tCO_2)	Waste Transport Emissions - A5 (tCO_2)	Total (tCO_2)
	Concrete	191	61			252
	Grout	94	16			110
	HDPE	50	3			54
	PVC	1,357	14			1,370
	Rubber	12,255	142			12,397
	Steel	275	15			290
Marine Cable Corridor	**Cable (Glass & Polymers)**	1,738	174		2	1,911
	Cable (Copper & Aluminium)	102,509	3,614			106,123
	Cable Joints (Copper)	113	4			117
	Concrete	1	0			1
	Rock	67,648	3,637			71,284
	Bentonite	23	121			144
	HDPE	1,840	1			1,841

Location	Material	Embodied Emissions - A1-3 (tCO_2)	Transport Emissions - A4 (tCO_2)	Plant Emissions A5 (tCO_2)	Waste Transport Emissions - A5 (tCO_2)	Total (tCO_2)
Telecoms Building(s)/ ORS	**Blockwork**	99	4		-	102
	Brickwork	18	3			21
	Concrete	17	6			23
	Aggregate	1	3			4
Total		227,820	16,472	11,757	514	256,563

28.6.2. OPERATIONAL STAGE

28.6.2.1. The following elements are considered to have the potential to give rise to likely significant effects during operation of the Proposed Development and have therefore been considered.

Embedded Mitigation

28.6.2.2. In terms of operation, the potential for the Proposed Development to transmit electricity with a low carbon intensity (gCO_2/kWh) – for example renewable or nuclear electricity, and in doing so to displace fossil fuel capacity, is referred to as "embedded mitigation". This is assessed further below (the changes in emissions from generation plant due to energy transfers between UK and France (D)).

Impacts

28.6.2.3. Operational emissions associated with the Proposed Development from Maintenance (B2) are presented in Table 28.5. Emissions from Replacement (B4) and repair (B3) are presented in Table 28.6. Emissions from operational electricity consumption (B6) and operational fuel consumption (B6) are presented in Table 28.7. Transmission Losses (B6) are presented in Table 28.8. Fugitive gas emissions (B8) are presented in Table 28.9 and the changes in emissions from generation plant due to energy transfers between UK and France (D), are presented in Table 28.10.

28.6.2.4. In terms of increases in emissions, (approximately 187,000 tCO_2e), repair (B3) is the single largest source (41%), followed by transmission losses (33%), and electricity consumption (21%).

Table 28.5 – Maintenance, Repair and Refurbishment emissions

Location	Maintenance Emissions - B2 (tCO_2e/ lifespan of the Proposed Development)
Converter Station	1

Table 28.6 – Repair and Replacement emissions

Location	Material	Repair Emissions – B3 (tCO_2e/ lifespan of the Proposed Development)	Replacement Emissions - B4 (tCO_2e/ lifespan of the Proposed Development)
Converter Station	Geogrid	0	2,173
Onshore Cable Route	HDPE	0	107
Onshore Cable Route	PVC	0	2,741

Location	Material	Repair Emissions – B3 (tCO_2e/ lifespan of the Proposed Development)	Replacement Emissions - B4 (tCO_2e/ lifespan of the Proposed Development)
Marine Cable Route	Rock	76,254	0
Total			81,275

Table 28.7 – Electricity and Fuel use

	Consumption (l/yr and kWh/yr)	Energy – B6 (tCO_2e/average yr)	Energy – B6 (tCO_2e/ lifespan of the Proposed Development)
Fuel	2,203	6	229
Electricity	20,183,040	939	38,503
Total		940	38,732

Table 28.8 – Transmission Losses

Transmission Losses B6 - (tCO2e/yr)	Transmission Losses – B6 (tCO_2e/Project Reference Lifespan)
1,544	61,776

Table 28.9 – Fugitive Gasses

SF6 leak rate - kg/yr	Fugitive Gasses – B8 (tCO_2e/yr)	Fugitive Gasses – B8 (tCO_2e/ lifespan of the Proposed Development)
6	137	5,490

28.6.2.5. The most significant emissions are the emissions reductions due to the reduction in emissions from generation plant due to energy transfers between UK and France (D). Table 28.10 provides 3 scenarios from TYNDP 2016 and 2018 assessment, which have been used during the development of the Proposed Development. TYNDP 2018 2030 distributed generation is the scenario from the most recent assessment, and provides a realistic worse case, and as such has been used as the basis for this assessment.

28.6.2.6. Emissions from change in emissions from generation plant due to energy transfers between UK and France (D) are expected to be between 58,500 tCO_2e/yr and -104,000 tCO_2e/yr, which is between 2,340,000 tCO_2e and -4,160,000 tCO_2e over the assumed 40-year lifespan of the Proposed Development. By using the average range (which is considered to be most likely prediction), emissions reductions due to the Proposed Development over its lifespan are expected to be approximately -1,716,000 tCO_2e.

28.6.2.7. This means that the net emissions (emissions increases minus emissions reductions), due to the operation of the scheme over the lifespan of the Proposed Development, are a reduction in emissions of approximately -1,529,000 tCO_2e. All operational emissions are summarised in **Error! Reference source not found.**11.

Table 28.10 – Emissions due to electricity flows by range and scenario[12]

Range	TYNDP 2016 – Vision 3 (tCO_2e/yr)	TYNDP 2016 – Vision 4 (tCO_2e/yr)	TYNDP 2018 - 2030 Distributed generation (tCO_2e/yr)
Min	-800,000	-1,300,000	-104,000
Avg	-700,000	-900,000	-42,900
Max	-600,000	-500,000	58,500

Table 28.11 – Operational Emissions Summary

Emissions Source	Emissions (tCO2e/ lifespan of the Proposed Development)
Maintenance Emissions - B2	1
Repair Emissions – B3	76,254
Replacement Emissions - B4	5,021
Energy – B6	38,732
Transmission Losses – B6	61,776
Fugitive Gasses – B8	5,490
change in emissions from generation plant due to energy transfers between UK and France (D)	-1,716,000
Net total	-1,529,000

EMISSIONS CONTEXT

28.6.2.8. To aid in the determination of significance in line with the methods outlined in section 28.5.3, the emissions due to the Proposed Development, have been presented in the context of the UK's Carbon Budgets in Table 28.12.

[12] Quantifying emissions due to the transfer of electricity is inherently uncertain. This is why ranges and scenarios are both presented.

Table 28.12 – Emissions context[13]

Time Period	Carbon Budget KtCO2	Proposed Development emissions KtCO2	Proportion %
2018-2022	2,544,000	257	0.01
2023-2027	1,950,000	-186	-0.01
2028-2032	1,725,000	-188	-0.01

CONSTRUCTION SIGNIFICANCE

28.6.2.9. In terms of construction, the context provided by Table 28.12 results in the conclusion that the Proposed Development will result in **minor, significant adverse** emissions.

OPERATION SIGNIFICANCE

28.6.2.10. In terms of operation, the context provided by Table 28.12 results in the conclusions that the Proposed Development will result in **moderate, significant, beneficial** emissions.

28.7. CUMULATIVE EFFECTS

28.7.1.1. The impacts of GHG emissions, in terms of their contribution to climate change, are global and cumulative in nature, with every tonne contributing to impacts on natural and human systems. GHGs are natural and anthropogenic gases occurring in the atmosphere that absorb and emit infrared radiation, thereby maintaining the sun's energy within the earth's atmosphere. There is an overwhelming scientific consensus that the major increase in the atmospheric concentration of GHGs since the industrial revolution is contributing to climate change. It is the increase in concentrations of GHGs in the global atmosphere due to all GHG causing human activities that cause climate change.

28.7.1.2. As such, it is the cumulative effect of all GHG causing human activities that cause climate change, and therefore the assessment of the GHGs due to the Proposed Development implicitly assesses the cumulative effect of GHG emissions. Therefore, the quantification of emissions from the Proposed Development in the assessment of significance or effects inherently assesses the combined and cumulative effects. No further assessment has therefore been undertaken in this chapter.

[13] The change in emissions from generation plant due to energy transfers between UK and France (D) occurs both in the UK and France, but has been compared to the UK carbon budgets to provide 'context'. It is expected that these benefits will occur mostly within the UK.

28.8. PROPOSED MITIGATION AND ENHANCEMENT

28.8.1.1. The Converter Station design will adopt a sustainable approach which will involve the following measures:

- Reducing where practicable material use in construction and minimising the use of high carbon materials.
- Buildings should be energy and resource efficient.

28.8.1.2. In addition, the Onshore Outline Construction Environmental Management Plan ('CEMP') (document reference 6.9) includes the following commitments:

- Minimise energy consumption including fuel usage by, for example, reducing the requirement for earth movements to/from and within the construction site; and
- Maximise the local sourcing of materials and local waste management facilities.

28.8.1.3. The Marine Cable Corridor of the Proposed Development requires rock for backfill, non-burial protection, pre- and post-lay bunds (during construction) and for remedial protection during operation. To help identify a sustainable source for this material, the appointed contractor will record decisions (made by consensus, and taking into account the associated economic and environmental factors, including carbon) which have been made to ascertain whether or not the source of rock required for the Marine Cable Corridor can originate from the UK, to minimise the impacts of using material imported from an international source.

28.8.1.4. In addition, it is recommended that the following potential mitigation and enhancement measures, which may be available as the Proposed Development progresses through detailed design and into construction and operation are investigated:

Design

- Detailed design optimisation to reflect the carbon reduction hierarchy (BSI, 2016).
- Reduce the requirement for construction materials, where practicable.
- Substitute construction elements for lower-carbon alternatives (e.g. using low temperature asphalt), where practicable.
- To consider the specification of materials and products with reduced embodied GHG emissions including through material substitution, recycled or secondary content and from renewable sources.
- To consider the sustainability credentials of material suppliers and construction contractors and, where practicable, to take into account their policies and commitments to reduction of GHG emissions, including embodied emission in materials.
- Designing, specifying and constructing the Proposed Development with a view to maximising the operational lifespan and minimising the need for maintenance and refurbishment (and all associated emissions).
- Designing, specifying and constructing the Proposed Development with a view to maximising the potential for re-use and recycling of materials/elements at the end-of-life stage.
- Consider opportunities to minimise operational energy use, including the specification of efficient buildings and plant.
- Consider the potential for onsite renewable electricity generation during operation.

Construction

- Use efficient construction processes, such as design for manufacture and assembly.
- Implement a CEMP, incorporating a Site Waste Management Plan ('SWMP') and Materials Management Plan ('MMP'), by the Principal Contractor; and, re-use of material resources where practicable.
- As far as possible, incorporating material resource efficiency and waste minimisation best practice into design, in particular improving the cut/fill balance of the Proposed Development.

Operation

- Operate, maintain and refurbish the Proposed Development using best-practice efficient approaches and equipment.

28.9. RESIDUAL EFFECTS

28.9.1.1. Although mitigation measures are committed to and further recommended in section 28.10, the final impact of these measures is not quantifiable at the time of this assessment. As such the residual impacts of the Proposed Development are unchanged from the impacts presented in section 28.7 for the purposes of this assessment. The results of this are summarised below.

Construction

28.9.1.2. In terms of construction, the context provided by Table 28.12 results in the conclusion that the Proposed Development will result in **minor, significant, adverse** emissions.

Operation

28.9.1.3. In terms of operation, the context provided by Table 28.12 results in the conclusions that the Proposed Development will result in **moderate, significant**, **beneficial** emissions.

PART B: CLIMATE RESILIENCE

28.10. ASSESSMENT METHODOLOGY

28.10.1. CONSTRUCTION AND OPERATION STAGE

28.10.1.1. Baseline data for this assessment has been gathered through a desk study, with data obtained from the Met Office regional climate profile for South East England (to inform the current climate conditions) and UKCP18 (to inform the future baseline).

28.10.1.2. The methodology for the climate resilience assessment for the construction and operation stages is based on a Climate Risk and Vulnerability Assessment ('CRVA') approach. The CRVA approach consists of an initial vulnerability assessment to identify climate variables which the Proposed Development is vulnerable to. A more detailed risk assessment is then undertaken to assess the level of risk associated with hazards caused by the climate variables. The assessment is based on professional experience and is undertaken with reference to published guidance including IEMA (2015), Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation and European Commission (2016), Climate Change and Major Projects.

28.10.1.3. The CRVA method consists of five steps:

- Step 1 – identify receptors (relevant receptors which may be affected by climate change);
- Step 2 – identify potential impacts of change in scoped in climate variables on receptors (high level impact identification based on typical potential impacts for a Development of this nature);
- Step 3 – identify mitigation measures;
- Step 4 – determine significance of effects through assessing the likelihood and consequence of potential impacts occurring, taking into account embedded mitigation; and
- Step 5 – identify further/appropriate mitigation measures for any effects identified as significant.

28.10.1.4. Steps 1 and 2 were undertaken during the PEIR stage and are presented in Appendix 28.2 (ES Climate Vulnerability Assessment) of the ES Volume 3 (document reference 6.3.28.2).

28.10.1.5. Climate resilience relative to the functioning and capacity of the Proposed Development's drainage system, and the risk of flooding is considered in detail in Chapter 20 (Surface Water Resources and Flood Risk) of the ES Volume 1 (document reference 6.1.20).

28.10.2. SIGNIFICANCE CRITERIA

28.10.2.1. The determination of significance is based on the consequence and likelihood of potential impacts occurring. The descriptors presented in Table 28.13 and Table 28.14 have been determined based on experience of undertaking similar assessments and are consistent with the guidance listed in paragraph 28.2.4.2.

Table 28.13 - Qualitative Description of Consequence

Measure of Consequence	Description
Not significant	No infrastructure damage, little change to service and disruption lasting less than one day. No adverse effects on society or the natural environment.
Minor	Localised infrastructure disruption or loss of service. No permanent damage, minor restoration work required: disruption lasting around one day. Slight adverse social or environmental effects.
Moderate	Limited infrastructure damage and loss of service with damage recoverable by maintenance or minor repair. Disruption lasting more than one day but less than one week. Adverse effects on society or the environment.
Major	Extensive infrastructure damage requiring major repair. Severe loss of service. Disruption lasting more than one week. Significant effect on society and the environment, requiring remediation.
Catastrophic	Permanent damage and complete loss of service. Disruption lasting more than one week. Very significant effect on society and the environment requiring remediation and restoration.

Table 28.14 - Qualitative Description of Likelihood

Measure of Likelihood	Description
Almost certain	The event occurs multiple times during the lifetime of the Development e.g. approximately annually. Typically 40 times - 1 in 1 event.
Likely	The event occurs several times during the lifetime of the Proposed Development e.g. approximately once every five years.
Moderate	The event occurs limited times during the lifetime of the Proposed Development e.g. approximately once every 10 years.

Measure of Likelihood	Description
Unlikely	The event occurs occasionally during the lifetime of the Proposed Development e.g. approximately once every 20 years.
Very unlikely	The event may occur once during the lifetime of the Proposed Development e.g. once in 40 years.

28.10.2.2. The significance of climate impacts (Table 28.15) is determined based on the likelihood and consequence.

Table 28.15 – Climate Vulnerability Significance Criteria

Likelihood	Consequence				
	Insignificant	**Minor**	**Moderate**	**Major**	**Catastrophic**
Almost certain	NS	S	S	S	S
Likely	NS	NS	S	S	S
Moderate	NS	NS	S	S	S
Unlikely	NS	NS	NS	S	S
Very unlikely	NS	NS	NS	S	S
Key:					
NS- Not Significant		***S- Significant***			

28.10.2.3. The methodology presented in the PEIR proposed to determine the significance of climate impacts based on the risk rating (pre-mitigation) and the resilience rating (post-mitigation) for each impact. The methodology used in this ES chapter has been updated to assess the significance of effects with embedded mitigation taken into account as this is a more accurate representation of the actual effects the Proposed Development will face. The ES assessment methodology has combined steps 3, 4 and 5 of the PEIR.

28.10.2.4. The methodology has therefore been updated from that presented in the PEIR. The updates are summarised in Table 28.16.

Table 28.16 - Summary of assessment methodology amendments

PEIR assessment methodology	ES assessment methodology
• Step 1 – identify receptors; • Step 2 – vulnerability assessment; • Step 3 – risk assessment; • Step 4 – mitigation actions; and • Step 5 – significance.	• Step 1 – identify receptors; • Step 2 – identify potential impacts of climate change on receptors; • Step 3 – identify mitigation measures; • Step 4 – assess likelihood and consequence of impacts occurring for the Proposed Development to determine significance of effects.

28.10.3. ASSUMPTIONS AND LIMITATIONS

28.10.3.1. The assessment assumes that potential impacts during decommissioning would be similar to those identified during construction.

28.11. BASELINE ENVIRONMENT

28.11.1.1. The current climate of the Study Area is warm and dry compared to the UK average. Features of the current climate include:

- Rainfall is well-distributed throughout the year with an autumn/early winter maximum.
- Rainfall tends to be associated with Atlantic depressions (autumn and winter) or with convection (summer).
- Little snow - less than 10 days of lying snow per year.
- Warmer than UK average – July is the warmest month, February is the coldest month.
- Extreme maximum temperatures can occur in July or August - usually associated with heat waves lasting several days.
- One of the more sheltered parts of the UK - strongest winds are associated with the passage of deep areas of low pressure close to or across the UK particularly between December and February.

28.11.1.2. More detailed information on the current climate is presented in Appendix 28.3 (Climate Baseline) of the ES Volume 3 (document reference 6.3.28.3), Section 1.1.

Future Baseline

28.11.1.3. Information on projected climate is taken from the UK Climate Projections 2018 where available. The UKCP18 projections are the most up-to-date projections of climate change for the UK. UKCP18 includes probabilistic projections of a range of climate variables for different emissions scenarios, Representative Concentration Pathways[14], and for a range of time slices to the end of the 21st Century.

28.11.1.4. The 10th, 50th and 90th percentile values are presented for the 2050s and 2080s high emissions scenario (RCP8.5) in Appendix 28.3 (Climate Baseline).

28.11.1.5. Climate projections indicate that the region will become hotter and drier in summer and warmer and wetter in winter with more extreme rainfall and temperature events. Key messages from the UKCP18 projections for the South East England in 2080 under a high emissions scenario (RCP8.5) include:

- Wetter winter – increase in mean winter precipitation in the 2080s up to 30% (50th percentile).
- Drier summers – decrease in mean summer precipitation in the 2080s up to 40% (50th percentile).
- Warmer winters - increase in mean winter temperature between 2 and 3ºC (50th percentile).
- Hotter summers – increase in mean summer temperature between 3 and 4ºC (50th percentile).
- More extreme rainfall events, particularly in the winter and extreme temperature events (heatwaves).
- Rising sea levels.

28.11.1.6. Detailed information on the projected climate is presented in Appendix 28.3 (Climate Baseline), Section 1.2.

28.12. PREDICTED IMPACTS

28.12.1. CONSTRUCTION STAGE

Embedded Mitigation

Embedded Mitigation includes measures designed into the Proposed Development's infrastructure which promotes climate resilience. The embedded mitigation and elements of the design of relevance to the climate vulnerability construction

[14] The RCPs provide a range of possible trajectories of how global land use and emissions of GHGs and air pollutants may change through the 21st century. They are named according to their radiative forcing values in the year 2100 (2.6, 4.5, 6.0 and 8.5 Wm-2).

assessment are identified in Table 28.17. Error! Not a valid bookmark self-reference.Table 28.17 - Embedded mitigation within the Construction Stage

Receptor	Embedded Mitigation	Potential impact addressed
Plant and equipment	Completed sections of the cable ducts are to be sealed at each end against water ingress. Joint bay chambers are only to be excavated immediately before cable pulling and jointing, where practicable. It may be necessary, for programming reasons, to excavate a cable and pull one section of cable, then temporarily backfill. In this case, temporary water seals would be fitted around the pulled cables.	Flooding leading to plant and equipment failure or disruption
Site compound	The engineering works associated with the construction of building platforms, the development of the site drainage system and the construction of permanent access, internal roads within the proposed Converter Station would be completed prior to the construction of the Converter Station. Temporary laydown areas which will include welfare facilities, vehicle parking, site offices, equipment storage, local power and water supplies and spoil/waste containment will be set up.	Flooding of the site and construction compounds Waterlogging of site and excavations Increased surface runoff leading to surface water flooding and siltation Health and safety risks to construction workers from high temperatures and flooding

Impacts

28.12.1.1. The construction assessment has considered anticipated changes in climate (taking the during the anticipated construction period of 3-4 years from 2021 to 2024. The Climate Resilience assessment has considered potential hazards associated with climate change on each construction receptor as presented in Table 28.18. The potential impacts associated with each climate hazard are then considered. The assessment has identified areas associated with the following climate hazards:

- Sea level rise;
- Storm surge and storm tide;
- Extreme precipitation events;
- Drought;
- Extreme temperature events (Hotter summers); and
- Gales and extreme wind events, Storms (including lightning, hail).

Table 28.18 – Hazards and potential impacts of climate change during the Construction Stage

Receptor	Hazard	Impact	Likelihood	Consequence	Significance
Materials	Sea level rise Storm surge and storm tide Extreme precipitation events	Increased runoff from materials piles	Likely	Moderate	S
		Excessive moisture in materials	Likely	Moderate	S
	Drought Extreme temperature events (Hotter summers)	Deformation and melting of materials	Moderate	Moderate	S
		Shorter drying times in summer	Likely	Moderate	S
		Drying out of materials	Likely	Moderate	S
Plant and equipment	Sea level rise Storm surge and storm tide Extreme precipitation events	Plant and equipment failure or disruption	Likely	Moderate	S
	Drought Extreme temperature events	Overheating of machinery	Likely	Moderate	S

Receptor	Hazard	Impact	Likelihood	Consequence	Significance
	(Hotter summers)				
	Gales and extreme wind events, Storms (inc. lightning, hail)	Risk to cranes and working at height	Likely	Moderate	S
Site compound	Sea level rise Storm surge and storm tide Extreme precipitation events	Flooding of the site and construction compounds	Moderate	Minor	NS
		Waterlogging of site and excavations	Likely	Moderate	S
		Increased surface runoff leading to surface water flooding and siltation	Moderate	Minor	NS
		Flooding of access road	Moderate	Minor	NS
	Drought Extreme temperature events (Hotter summers)	Drying out and cracking of ground	Moderate	Minor	NS
		Shorter drying times in summer	Likely	Moderate	S
Traffic	Sea level rise	Traffic disruption and congestion from road surface flooding	Likely	Moderate	S

Receptor	Hazard	Impact	Likelihood	Consequence	Significance
	Storm surge and storm tide Extreme precipitation events				
Workforce	Sea level rise Storm surge and storm tide Extreme precipitation events	Health and safety risks to construction workers	Likely	Minor	NS
	Drought Extreme temperature events (Hotter summers)	Health and safety risk from heatstroke and UV radiation	Likely	Minor	NS
		Increased fire risk	Likely	Minor	NS
		Hot surfaces which may cause injury	Moderate	Moderate	S
		Increase in dust	Likely	Minor	NS
	Gales and extreme wind events, Storms (inc. lightning, hail)	Risk to cranes and working at height	Likely	Moderate	S
		Increase in dust	Likely	Minor	NS

28.12.2. OPERATIONAL STAGE

Section 1 – Lovedean (Converter Station Area)

Embedded Mitigation

28.12.2.1. Embedded mitigation and features within the design of the Converter Station, including the access road, drainage and associated structures is presented in Table 28.19.

Table 28.19 – Resilience features within the design of the Converter Station

Receptor	Design Consideration	Potential impact addressed
Converter Station	Cooling systems will be required to remove heat generated within the Converter Station building. Power electronics equipment is to be housed indoors, within the two converter hall buildings. Auxiliary power supplies will be provided in the event of a power failure at the Converter Station to ensure continuity of operation. Back-up sources such as stand-by diesel generators will be only used if other sources of auxiliary supply are unavailable during construction and operational timescales. A Fire Prevention Procedure will be implemented and developed alongside the final design and implemented for operation.	Overheating of Converter Station buildings and equipment Risk of fire as a result of overheating Flooding of the converter station and supporting infrastructure, resulting in loss of supply
Access Road	Attenuation ponds are proposed to capture surface water run-off from the Converter Station and Access Road. levels (See Appendix 20.1 (Flood Risk Assessment ('FRA')) of the ES Volume 3 (document reference 6.3.20.1).	Increased surface water runoff Flooding of access road

Receptor	Design Consideration	Potential impact addressed
	During general maintenance and operational outages, access by maintenance staff is typically light vehicles (e.g. cars, vans) and use of HGVs will only be required in the rare event of a major equipment failure.	
Drainage	Attenuation ponds are proposed to capture surface water run-off from the Converter Station and Access Road.	Drainage infrastructure overwhelmed leading to surface water flooding Increased surface runoff leading to surface water flooding and siltation
Structures	Given the topography of the Converter Station Area, bulk earthworks would be required to create a level platform of 84.8 m AOD. The buildings will likely be constructed of steel frame and cladding.	Flooding of the Converter Station site Deterioration of material structure and fabric Damage from high winds and rain-infiltration into surfaces and materials

Impacts

28.12.2.2. The Climate Resilience assessment has considered potential hazards associated with climate change (as identified in section 28.15 and Appendix 28.3 (Climate Baseline)) on each Operational Stage receptor as presented in Table 28.20. The Operational Stage of the Proposed Development has been considered as a minimum of 40 years from 2024 (construction completed). The potential impacts associated with each climate hazard are then considered. The assessment has identified areas associated with the following climate hazards:

- Sea level rise;
- Storm surge and storm tide;
- Extreme precipitation events;
- Drought;
- Extreme temperature events (such as hotter summers); and
- Gales and extreme wind events, Storms (inc. lightning and hail).

Table 28.20 - Potential impacts of climate change and associated hazards on the Converter Station and associated assets

Receptor	Hazard	Impact	Likelihood	Consequence	Significance
Converter Station (including telecommunications buildings)	Sea level rise Storm surge and storm tide Extreme precipitation events	Flooding of the converter station and supporting infrastructure, resulting in loss of supply	Moderate	Moderate	S
	Drought Extreme temperature events (Hotter summers)	Overheating of equipment - electronic, ICT equipment and substations are particularly sensitive	Moderate	Minor	NS
		Deterioration of material structure and fabric	Unlikely	Minor	NS
		Risk of fire	Unlikely	Moderate	NS
		Damage from high winds and	Unlikely	Moderate	NS

Receptor	Hazard	Impact	Likelihood	Consequence	Significance
	Gales and extreme wind events, Storms (inc. lightning, hail)	rain-infiltration into surfaces and materials			
		Lightning strike can cause fire as well as power surges and shock waves which can destabilise energy systems and damage equipment	Unlikely	Major	S
Access Road	Sea level rise Storm surge and storm tide Extreme precipitation events	Flooding of access road	Unlikely	Moderate	NS
	Drought Extreme temperature events (Hotter summers)	Deterioration and potential melting of road surface	Unlikely	Moderate	NS
		Cracking and expansion, particularly	Unlikely	Moderate	NS

Receptor	Hazard	Impact	Likelihood	Consequence	Significance
		impacting the access road			
	Gales and extreme wind events, Storms (inc. lightning, hail)	Damage from high winds and rain-infiltration into surfaces and material	Unlikely	Minor	NS
Drainage	Sea level rise Storm surge and storm tide Extreme precipitation events	Drainage infrastructure overwhelmed leading to surface water flooding	Unlikely	Moderate	NS
		Increased surface runoff leading to surface water flooding and siltation	Unlikely	Moderate	NS
		Blockages of drainage assets	Unlikely	Moderate	NS
	Drought	Drainage infrastructure	Unlikely	Minor	NS

Receptor	Hazard	Impact	Likelihood	Consequence	Significance
	Extreme temperature events (Hotter summers)	could get blocked from lack of precipitation			
	Gales and extreme wind events, Storms (inc. lightning, hail)	Windborne dust and debris clogging drainage channels and requiring clearing	Moderate	Minor	NS
Ground surface stability/ structure	Sea level rise Storm surge and storm tide Extreme precipitation events	Softening of subsurface materials, reduction of earthwork stability and deterioration of materials from flooding	Moderate	Moderate	S
		Greater mobilisation of pollutants in soil/ground causing	Unlikely	Minor	NS

Receptor	Hazard	Impact	Likelihood	Consequence	Significance
		premature deterioration of materials			
	Drought Extreme temperature events (Hotter summers)	Increase in earth pressures	Unlikely	Moderate	NS
		Shrinking and cracking of soils and surfaces	Unlikely	Moderate	NS
		Increased rate of deterioration of materials, potentially leading to need for early replacement	Unlikely	Minor	NS
	Gales and extreme wind events, Storms (inc. lightning, hail)	Increased rate of deterioration of materials	Unlikely	Moderate	NS
		Risk of damage to structures	Unlikely	Moderate	NS

Receptor	Hazard	Impact	Likelihood	Consequence	Significance
		Erosion of banks and exposed surfaces	Unlikely	Minor	NS
	Water quality and soils – soil moisture and stability	Shrinking and cracking of soils leading to subsidence	Unlikely	Moderate	NS
		Soil softening and erosion leading to collapse and settlement of structures	Unlikely	Moderate	NS
		Increased slope instability	Unlikely	Moderate	NS
		Soil saturation	Moderate	Minor	NS
	Water quality and soils – soil moisture and stability	Subsidence impacting structures	Unlikely	Moderate	NS

Receptor	Hazard	Impact	Likelihood	Consequence	Significance
		Failure of earthworks due to desiccation	Unlikely	Moderate	NS
		Shrinking and cracking of soils	Unlikely	Moderate	NS
		Greater rates of soil erosion	Unlikely	Minor	NS

Embedded Mitigation

28.12.2.3. Embedded mitigation and features within the design of the Onshore Cable are presented in Table 28.21.

Table 28.21 – Resilience features within the design of the Onshore Cable Corridor

Receptor	Design features	Potential impact addressed
Onshore Cable Corridor	The Onshore Cables are buried in a cable ducts The AC cables may be installed alongside an Earth Continuity Conductor, an insulated metallic conductor to provide a path to earth for any fault currents.	Reduction in the ability of the ground to conduct heat away from underground cables during high temperatures UV degradation of exposed cabling equipment Lightning strike
	Link boxes / HVDC joints / Terminations will be fully sealed to water ingress damage.	Damage due to flooding
Drainage	Soil bunds are to be seeded to prevent surface runoff across the site, which otherwise might erode or impact on exposed soil and stockpiles, to carry suspended solids in the runoff. Silt fencing, dams, cut off ditches, settlement ponds or proprietary settlement equipment (e.g. Silt buster) are to be used to prevent water pollution entering watercourses/ and surface water drains.	Drainage infrastructure overwhelmed Increased surface water runoff
Structures	ORS have been designed to a level above flood levels (See Appendix 20.1 (Flood Risk Assessment ('FRA')) of the ES	Reduction of earthwork stability due to sea level rise and flooding Increased rate of deterioration of materials

Receptor	Design features	Potential impact addressed
	Volume 3 (document reference 6.3.20.1). The shore landing ducts, installed by Horizontal Directional Drilling ('HDD') will run from 250 m inland to approximately 1000 m offshore, passing below the beach at a depth of 15-20 m, so costal erosion is not expected to affect the Onshore HVDC Cable Corridor.	

Impacts

28.12.2.4. The assessment presented in Table 28.22 has considered potential hazards associated with climate change on the Onshore Cable Corridor. As identified in section 28.15 and Appendix 28.3 (Climate Baseline) the assessment has identified areas associated with the following climate hazards:

- Sea level rise;
- Storm surge and storm tide;
- Extreme precipitation events;
- Drought;
- Extreme temperature events (such as hotter summers); and
- Gales and extreme wind events, Storms (inc. lightning and hail).

Table 28.22 - Potential impacts of climate change and associated hazards on the Onshore Cable Corridor

Receptor	Hazard	Impact	Likelihood	Consequence	Significance
Cables	Sea level rise Storm surge and storm tide Extreme precipitation events	Damage to cables, cable joints and the transition joint bay	Unlikely	Moderate	NS
		Flooding of cable infrastructure	Unlikely	Moderate	NS
	Drought Extreme temperature events (Hotter summers)	Development of cable faults	Unlikely	Minor	NS
		Reduction in the ability of the ground to conduct heat away from underground cables, resulting in the maximum current rating of the cables being reduced	Unlikely	Moderate	NS
		UV degradation of exposed	Unlikely	Minor	NS

Receptor	Hazard	Impact	Likelihood	Consequence	Significance
		cabling equipment			
	Gales and extreme wind events, Storms (inc. lightning, hail)	Lightning strike can cause fire as well as power surges and shock waves which can destabilise energy systems and damage equipment	Unlikely	Moderate	NS
Drainage	Same as for the Converter Station (Refer to Table 28.20)				NS
Structures	Same as for the Converter Station (Refer to Table 28.20)				NS

Marine Cable Corridor

28.12.2.5. Embedded mitigation and features within the design of the Marine Cable are presented in Table 28.23.

Table 28.23 – Resilience features within the design of the Marine Cable Corridor

Receptor	Design Considerations	Potential impact addressed
Offshore Cable Corridor	The cable will be buried at sufficient depth to prevent scour and to allow a natural substrate to develop. The HVDC cables will be fully sealed to water ingress damage. As identified in Chapter 3 (Description of the Proposed Development), the recommended burial depth of the Marine Cable will be outlined in the Cable Burial Risk Assessment. The final burial depth will be dependent upon the pre-installation surveys and the requirements of the contractor, including selected installation/burial techniques. Prior to the installation of the Marine Cables, ground condition surveys will be required to be undertaken by the appointed contractors and would identify whether there have been any physical changes to the seabed. Analysis of the survey data will identify the location and extent of route preparation along the Marine Cable Corridor. Preparation will be required prior to the installation of the marine cable including the clearance of obstacles and/or seabed features (seabed debris, boulders, sandwaves and large ripples and uneven seabed). Where practicable and within the limits of the Marine Cable Corridor, the Marine Cables will be routed to	Damage to cables and cable joints Mobile sediments (i.e. ripples, large ripples and sandwaves) disrupting shore profile.

Receptor	Design Considerations	Potential impact addressed
	avoid mobile bedforms and therefore minimise the requirement for clearance. This will be undertaken during route engineering. However, since mobile sediments are, by definition, mobile, there may be a requirement for additional re-routing after the pre-installation survey and prior to construction. For further information, Refer to Chapter 3 (Description of the Proposed Development).	

Impacts

Table 28.24 - Potential impacts of climate change and associated hazards on the Offshore Cable Corridor

Hazard	Impact	Likelihood	Consequence	Significance
Sea level rise **Storm surge and storm tide**	Mobile sediments (i.e. ripples, large ripples and sandwaves) disrupting shore profile.	Unlikely	Moderate	NS
	Damage to cables and cable joints	Unlikely	Moderate	NS

28.13. CUMULATIVE EFFECTS

28.13.1.1. The resilience assessment looks at the potential impacts of environmental change on the Proposed Development, rather than impacts of the Proposed Development on the environment: the receptor for the resilience assessment is the Proposed Development. In terms of cumulative effects, the effect of other proposed developments in the vicinity of the Proposed Development in relation to flood risk have been assessed within Chapter 20 (Surface Water Resources and Flood Risk) of this ES.

28.14. PROPOSED MITIGATION AND ENHANCEMENT

28.14.1. CONSTRUCTION

28.14.1.1. The resilience of the Proposed Development during construction to climate change hazards can be improved through the following additional mitigation measures presented in Table 28.25. These measures would be implemented and secured as part of the Onshore and Marine Outline CEMPs (respectively) (document reference 6.9 and 6.5).

28.14.1.2. The contractor(s) would use weather forecasting services to manage risks associated with extreme weather events. The contractor would also register with the Environment Agency's Floodline Warning Direct service and the Met Office weather warnings. The contractor would consider the potential risks associated with extreme weather to inform programme management and impact mitigation measures.

28.14.1.3. The CEMP would include measures to maximise the resilience of the Proposed Development to extreme weather events during construction, including personnel training.

Table 28.25 - Mitigation to be included within the Construction Stage

Receptor	Hazards	Mitigation
Materials	Sea level rise Storm surge and storm tide Extreme precipitation events	Ensuring site and compound drainage infrastructure has sufficient capacity and that silt traps are in use / regularly emptied and maintained. Ensure any materials on site are stored safely and covered with waterproof materials. Using mould inhibiting paint. Safe storage of spoil heaps
	Drought High temperatures	Dust control measures would be in place, for example speed limits on site, water available for dampening down, excavated materials to be removed from site as soon as practicable, and backfilling materials installed immediately after delivery.

Receptor	Hazards	Mitigation
Plant and equipment	Wetter winters	Using rainwater recycling to support other facilities (e.g. washing of machinery etc.).
	Storms	Reviewing wind speed before commencing work at height. Ceasing work at height during storms.
	Extreme temperature	Switching machinery off when not in use. Use of machinery which has the potential to overheat during cooler periods
Workforce	Extreme temperatures Increase in UV radiation	PPE to be suitable for hot weather conditions, lightweight vests / jackets, two piece rather than coveralls. Regular breaks to be taken, additional supply of drinking water & sun cream to be made available. Areas of shade to be made available for workforce where practicable. Ensuring welfare facilities are available and sufficiently cool. Ensure rest breaks are taken, particularly during the hottest part of the day (generally, 11am – 3pm) or when temperatures rise above 24°C[15].
Site compound	Sea level rise Storm surge and storm tide Extreme precipitation events	Storing chemicals, hazardous materials and plant above projected flood level (see FRA) or protecting with bunds / flood barriers. Using pumps to ensure water levels in excavations do not exceed critical levels. Reducing the area of impermeable surface, where practicable e.g. permeable paving.

[15] TUC (2019) Heat – The case for a maximum temperature at work https://www.tuc.org.uk/sites/default/files/Temperature.pdf

Receptor	Hazards	Mitigation
		Using vegetation to slow down the movement of surface water e.g. vegetating compound, where practicable, with grass and minimising impermeable area. Installing lightening protection for site buildings.
	Drought Extreme temperature events	Dust control measures e.g. water spraying, covering spoil heaps.
	Storms (lightning)	Installing lightening protection for site buildings.
Traffic	Sea level rise Storm surge and storm tide Extreme precipitation events	Ensure the access road and roads used during construction are monitored during periods of heavy rainfall and appropriate traffic management put in place to avoid areas of potential flooding.

28.14.2. OPERATION

28.14.2.1. The resilience of the Proposed Development during operation can be improved through the following measures:

- Regularly clearing and maintenance of drainage infrastructure to prevent blockage.
- Reducing area of impermeable surface e.g. use permeable paving.
- Using vegetation to slow down the movement of surface water.
- Consider projected change in soil moisture when specifying foundation depth – potentially need deeper foundations.
- Specifying appropriate materials (e.g. asphalt, concrete mix) to take account of higher average temperatures.
- Using mould inhibiting paints as part of regular maintenance and updating.
- Using slope stabilisation measures.

28.15. RESIDUAL EFFECTS

28.15.1. CONSTRUCTION

28.15.1.1. Following the implementation of the mitigation measures identified in Table 28.25, the residual effects are identified in Table 28.26.

28.15.2. OPERATION

28.15.2.1. Following the implementation of the mitigation measures identified in section 28.8, there are no residual significant effects during operation, as identified in Table 28.27.

28.15.2.2. Table 28.28 provides a summary of the overall findings of the assessment.

Table 28.26 - Residual impacts of climate change and associated hazards during the Construction Stage following mitigation measures

Receptor	Hazard	Impact	Likelihood	Consequence	Significance
Materials	Sea level rise	Increased runoff from materials piles	Moderate	Minor	NS
	Storm surge and storm tide Extreme precipitation events	Excessive moisture in materials	Moderate	Minor	NS
	Drought	Deformation and melting of materials	Unlikely	Moderate	NS
	Extreme temperature events	Shorter drying times in summer	Moderate	Minor	NS
	(Hotter summers)	Drying out of materials	Moderate	Minor	NS
Plant and equipment	Sea level rise Storm surge and storm tide Extreme precipitation events	Plant and equipment failure or disruption	Moderate	Minor	NS
	Drought Extreme temperature events	Overheating of machinery	Moderate	Minor	NS

Receptor	Hazard	Impact	Likelihood	Consequence	Significance
	(Hotter summers)				
	Gales and extreme wind events, Storms (inc. lightning, hail)	Risk to cranes and working at height	Moderate	Minor	NS
Site compound	Sea level rise Storm surge and storm tide Extreme precipitation events	Waterlogging of site and excavations	Moderate	Minor	NS
		Risk to CLV vessels	Unlikely	Moderate	NS
	Drought Extreme temperature events (Hotter summers)	Shorter drying times in summer	Moderate	Minor	NS
Traffic	Sea level rise Storm surge and storm tide Extreme precipitation events	Traffic disruption and congestion from road surface flooding	Moderate	Minor	NS

Receptor	Hazard	Impact	Likelihood	Consequence	Significance
Workforce	Sea level rise Storm surge and storm tide Extreme precipitation events	Health and safety risks to construction workers	Moderate	Minor	NS
	Drought Extreme temperature events (Hotter summers)	Health and safety risk from heatstroke and UV radiation	Moderate	Minor	NS
		Increased fire risk	Moderate	Minor	NS
		Hot surfaces which may cause injury	Unlikely	Moderate	NS
		Increase in dust	Moderate	Minor	NS
	Gales and extreme wind events, Storms (inc. lightning, hail)	Risk to cranes and working at height	Moderate	Minor	NS
		Increase in dust	Moderate	Minor	NS

Table 28.27 - Residual impacts of climate change and associated hazards during the Operational Stage following mitigation measures

Receptor	Hazard	Impact	Likelihood	Consequence	Significance
Converter Station	Sea level rise Storm surge and storm tide Extreme precipitation events	Flooding of the converter station and supporting infrastructure, resulting in loss of supply.	Unlikely	Moderate	NS
	Drought Extreme temperature events (Hotter summers)	Overheating of equipment - electronic, ICT equipment and substations are particularly sensitive	Unlikely	Moderate	NS
	Gales and extreme wind events, Storms (inc. lightning, hail)	Lightning strike can cause fire as well as power surges and shock waves which can destabilise energy systems and damage equipment	Unlikely	Moderate	NS
Ground surface	Sea level rise	Softening of subsurface materials, reduction of	Unlikely	Moderate	NS

Receptor	Hazard	Impact	Likelihood	Consequence	Significance
stability/ structure	Storm surge and storm tide Extreme precipitation events	earthwork stability and deterioration of materials from flooding.			

Table 28.28 – Summary of Effects Table for Carbon and Climate Resilience

Description of Effects	Receptor	Significance and Nature of Effects Prior to mitigation	Summary of Mitigation/Enhancement	Significance and Nature of Residual Effects following Mitigation / Enhancement
Construction Stage				
GHG	No receptor	See sections 28.1.2 (Study area), 28.6 (Predicted Impacts) and 28.7 (Cumulative Effects) Moderate Adverse - / P / D / LT	See Section 28.8.1.1 GHG Mitigation Measures	See sections 28.9.1.1 (Residual Effects) Minor Adverse - / P / D / LT
Climate Resilience	The Proposed Development	See Table 28.15 Moderate Adverse - / P / D / LT	See Section 28.24 Proposed Mitigation and Enhancement	See sections 28.9.1.1 (Residual Effects) Minor Adverse - / P / D / LT
Operational Stage				

Description of Effects	Receptor	Significance and Nature of Effects Prior to mitigation	Summary of Mitigation/Enhancement	Significance and Nature of Residual Effects following Mitigation / Enhancement
GHG	No receptor	See sections 28.1.2 (Study area), 28.6 (Predicted Impacts) and 28.7 (Cumulative Effects) Minor Adverse - / P / D / LT	See Section 28.8.1.1 GHG Mitigation Measures	See sections 28.9.1.1 (Residual Effects) Moderate Beneficial + / P / D / LT
Climate Resilience	The Proposed Development	See Table 18.17, 28.19, 28.21 Moderate Adverse - / P / D / LT	See Section 28.8 Proposed Mitigation and Enhancement	See sections 28.9.1.1 (Residual Effects) Minor Adverse - / P / D / LT

Key to table:

+ / - = Beneficial or Adverse P / T = Permanent or Temporary, D / I = Direct or Indirect, ST / MT / LT = Short Term, Medium Term or Long Term, N/A = Not Applicable

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