BALLINA FLOOD RELIEF SCHEME

Environmental Impact Assessment Report
Chapter 14: Climate

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14 CLIMATE

14.1 Introduction

This chapter assesses the likely significant effects on climate associated with the proposed Ballina Flood Relief Scheme as well as the vulnerability of the Proposed Scheme to climate change. A full description of the development is available in **Chapter 5: Project Description**.

14.2 Methodology

The climate assessment comprises two main elements, these include:

- A greenhouse gas (GHG) assessment (GHGA) which assesses the impact of the Proposed Scheme on climate.
- A climate change risk assessment (CCRA) which assesses the vulnerability of the Proposed Scheme to future climate change.

The following sections first detail the relevant guidelines, policy and legislation which drive the need for the climate assessment as well as outlining the relevant criteria for assessing impacts to climate. Secondly, the significance criteria for the GHG assessment and climate change vulnerability assessment are set out. Lastly the methodology used to conduct the construction and operational phase assessments is detailed.

14.2.1 Legislation, Policy and Guidance

In 2015, the Climate Action and Low Carbon Development Act 2015 (No. 46 of 2015) was enacted (the Act) (Government of Ireland , 2015). The purpose of the Act was to enable Ireland '*to pursue, and achieve, the transition to a low carbon, climate resilient and environmentally sustainable economy by the end of the year 2050*' (3. (1) of No. 46 of 2015). This is referred to in the Act as the '*national transition objective*'. The Act made provision for, *inter alia*, a national adaptation framework. In addition, the Act provided for the establishment of the Climate Change Advisory Council with the function to advise and make recommendations on the preparation of the national mitigation and adaptation plans and compliance with existing climate obligations.

The first Climate Action Plan (CAP) was published by the Irish Government in June 2019 (Government of Ireland, 2019). The Climate Action Plan 2019 outlined the current status across key sectors including Electricity, Transport, Built Environment, Industry and Agriculture and outlined the various broadscale measures required for each sector to achieve ambitious decarbonisation targets. The 2019 CAP also detailed the required governance arrangements for implementation including carbon-proofing of policies, establishment of carbon budgets, a strengthened Climate Change Advisory Council and greater accountability to the Oireachtas. The Government published the most recent Climate Action Plan – CAP24 in December 2023.

Following on from Ireland declaring a climate and biodiversity emergency in May 2019 and the European Parliament approving a resolution declaring a climate and environment emergency in Europe in November 2019, the Government approved the publication of the General Scheme for the Climate Action (Amendment) Bill 2019 in December 2019 (Government of Ireland, 2020) followed by the publication of the Climate Action and Low Carbon Development (Amendment) Act 2021 (No. 32 of 2021) (hereafter referred to as the 2021 Climate Act) in July 2021 (Government of Ireland , 2021). The 2021 Climate Act was prepared for the purposes of giving statutory effect to the core objectives stated within the CAP.

The purpose of the 2021 Climate Act is to provide for the approval of plans '*for the purpose of pursuing the transition to a climate resilient, biodiversity rich and climate neutral economy by no later than the end of the year 2050'*. The 2021 Climate Act will also '*provide for carbon budgets and a decarbonisation target range for certain sectors of the economy*'. The 2021 Climate Act defines the carbon budget as '*the total amount of greenhouse gas emissions that are permitted during the budget period*'. The 2021 Climate Act removes any reference to a national mitigation plan and instead refers to both the Climate Action Plan, as published in 2019, and a series of National Long Term Climate Action Strategies. In addition, the Environment Minister

shall request each local authority to make a '*local authority climate action plan'* lasting five years and to specify the mitigation measures and the adaptation measures to be adopted by the local authority.

In relation to carbon budgets, the Climate Action and Low Carbon Development (Amendment) Act states 'A carbon budget, consistent with furthering the achievement of the national climate objective, shall be proposed by the Climate Change Advisory Council, finalised by the Minister and approved by the Government for the period of 5 years commencing on the 1 January 2021 and ending on 31 December 2025 and for each subsequent period of 5 years (in this Act referred to as a 'budget period')'. The carbon budget is to be produced for 3 sequential budget periods, as shown in **Table 14.1**. The carbon budget can be revised where new obligations are imposed under the law of the European Union or international agreements or where there are significant developments in scientific knowledge in relation to climate change. In relation to the sectoral emissions ceiling, the Minister for the Environment, Climate and Communications (the Minister for the Environment) shall prepare and submit to government the maximum amount of GHG emissions that are permitted in different sectors of the economy during a budget period and different ceilings may apply to different sectors. The sectorial emission ceilings for 2030 were published in July 2022 and are shown in **Table 14.2**. The applicable sector in relation to the Proposed Scheme is Industry which has a 35% reduction requirement and emissions ceiling of 4 Mt CO_2e[1].

Table 14.1: 5-Year Carbon Budgets 2021-2025, 2026-2030 and 2031-2025 (Department of the Taoiseach, 2022)

Budget Period	Carbon Budget	Reduction Required
2021-2025	295 Mt CO_2e	Reduction in emissions of 4.8% per annum for the first budget period.
2026-2030	200 Mt CO_2e	Reduction in emissions of 8.3% per annum for the second budget period.
2031-2035	151 Mt CO_2e	Reduction in emissions of 3.5% per annum for the third provisional budget.

Table 14.2: Sectoral Emission Ceilings 2030 (Department of the Taoiseach, 2022)

Sector	Baseline (Mt CO_2e)	Carbon Budgets (Mt CO_2e)		2030 Emissions (Mt CO_2e)	Indicative Emissions % Reduction in Final Year of 2025- 2030 Period (Compared to 2018)
	2018	2021-2025	2026-2030		
Transport	12	54	37	6	50
Electricity	10	40	20	3	75
Built Environment - Residential	7	29	23	4	40
Built Environment - Commercial	2	7	5	1	45
Agriculture	23	106	96	17.25	25
Land Use, Land-use Change and Forestry (LULUCF)	5	TBC	TBC	TBC	TBC
Industry	7	30	24	4	35
Other (F-gases, waste, petroleum refining)	2	9	8	1	50

[1] Mt CO_2e – Mega tonne carbon dioxide equivalent. A carbon dioxide equivalent is a metric measure used to compare the emissions from various greenhouse gases on the basis of their global-warming potential (GWP), by converting amounts of other gases to the equivalent amount of carbon dioxide with the same global warming potential.

Sector	Baseline (Mt CO_2e)	Carbon Budgets (Mt CO_2e)		2030 Emissions (Mt CO_2e)	Indicative Emissions % Reduction in Final Year of 2025- 2030 Period (Compared to 2018)
	2018	2021-2025	2026-2030		
Unallocated Savings	-	7	5	-5.25	-
Total	**68**	**TBC**	**TBC**	**-**	**-**
Legally Binding Carbon Budgets and 2030 Emission Reduction Targets	**-**	**295**	**200**	**-**	**51**

In December 2023, CAP24 was published (DECC, 2023a). This is the second CAP since the publication of the carbon budgets and sectoral emissions ceilings and builds on the progress of CAP23, and it aims to implement the required changes to achieve a 51% reduction in carbon emissions by 2030 and 2050 net zero goal. The CAP has six vital high impact sectors where the biggest savings can be made: renewable energy, energy efficiency of buildings, transport, sustainable farming, sustainable business and change of land-use. CAP24 states that the decarbonisation of Ireland's manufacturing industry is key for Ireland's economy and future competitiveness. There is a target to reduce the embodied carbon in construction materials by 10% for materials produced and used in Ireland by 2025 and by at least 30% for materials produced and used in Ireland by 2030. CAP24 states that these reductions can be brought about by product substitution for construction materials and reduction of clinker content in cement. Cement and other high embodied carbon construction elements can be reduced by the adoption of the methods set out in the Construction Industry Federation 2021 report Modern Methods of Construction. In order to ensure economic growth can continue alongside a reduction in emissions, the IDA Ireland will also seek to attract businesses to invest in decarbonisation technologies.

In April 2023 the Government published a draft *Long-term Strategy on Greenhouse Gas Emissions Reductions* (Government of Ireland, 2023).This strategy provides a long-term plan on how Ireland will transition towards net carbon zero by 2050, achieving the interim targets set out in the Climate Action Plan. The strategy will be updated on the basis of a second round of public consultation throughout 2023 with an updated strategy published after this is complete.

14.2.2 Zone of Influence

Impacts to climate are assessed against compliance with national targets and sectoral emissions ceiling. As climate is assessed at a national scale no project-specific zone of influence can be set. The Zone of Influence will be the Irish State.

14.2.3 Sources of Information to Inform the Assessment

The following sources were used to inform the climate assessment:

- Environmental Protection Agency (EPA) Ireland's Greenhouse Gas Emissions 1990-2022 (EPA, 2023)
- Climate Ireland Website Available at: https://www.climateireland.ie/#!/tools/climateDataExplorer
- Met Éireann TRANSLATE website. Available at: https://www.met.ie/science/translate

14.2.4 Key Parameters for Assessment

During the construction phase the main source of climate impacts will be as a result of GHG emissions and embodied carbon associated with the proposed construction materials and activities for the Proposed Scheme. Embodied carbon refers to the sum of the carbon needed to produce a good or service. It incorporates the energy needed in the mining or processing of raw materials, the manufacturing of products and the delivery of these products to site. The embodied carbon of the Proposed Scheme has been quantified as part of the construction phase assessment.

There may be some minor vehicle or plant emissions during the operational phase if maintenance work is required. Additionally, operational wastes from maintenance works will have an embodied carbon content. It is not predicted that maintenance vehicle or plant emissions will have a significant impact on GHG emissions and climate. The Proposed Scheme will provide protection from flooding once operational which will decrease the vulnerability of the area to climate change related flooding which is beneficial.

14.2.5 Assessment Criteria and Significance

14.2.5.1 Significance Criteria for Greenhouse Gas Assessment (GHGA)

The Transport Infrastructure Ireland (TII) guidance document entitled *PE-ENV-01104 Climate Guidance for National Roads, Light Rail and Rural Cycleways (Offline & Greenways) – Overarching Technical Document* (TII, 2022) outlines a recommended approach for determining the significance of both the construction and operational phases of a development. The approach is based on comparing the '*Do Something*' scenario and the net project GHG emissions (i.e. *Do Something – Do Minimum*) to the relevant carbon budgets (Department of the Taoiseach, 2022).With the publication of the Climate Action Act in 2021, sectoral carbon budgets have been published for comparison with the Net Carbon Dioxide (CO_2) project GHG emissions from the Proposed Scheme. The Industry sector emitted approximately 7 Mt CO_2e in 2018 and has a ceiling of 4 Mt CO_2e in 2030 which is a 35% reduction over this period (see **Table 14.2**).

The significance of GHG effects set out in PE-ENV-01104 (TII, 2022) is based on IEMA guidance (IEMA, 2022) which is consistent with the terminology contained within Figure 3.4 of the EPA's (2022) 'Guidelines on the information to be contained in Environmental Impact Assessment Reports'.

The 2022 IEMA Guidance sets out the following principles for significance:

- When evaluating significance, all new GHG emissions contribute to a negative environmental impact; however, some projects will replace existing development or baseline activity that has a higher GHG profile. The significance of a project's emissions should therefore be based on its net impact over its lifetime, which may be positive, negative or negligible.
- Where GHG emissions cannot be avoided, the goal of the EIA process should be to reduce the project's residual emissions at all stages.
- Where GHG emissions remain significant, but cannot be further reduced, approaches to compensate the project's remaining emissions should be considered.

The criterion for determining the significance of effects is a two-stage process that involves defining the magnitude of the impacts and the sensitivity of the receptors (i.e. Ireland's National GHG targets). In relation to climate, there is no project specific assessment criteria, but the project will be assessed against the recommended IEMA significance determination. This takes account of any embedded or committed mitigation measures that form part of the design which should be considered.

TII (2022a) states that professional judgement must be taken into account when contextualising and assessing the significance of a project's GHG impact. In line with IEMA Guidance (IEMA, 2022),TII state that the crux of assessing significance is "*not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero*[2] *by 2050*". As per the IEMA guidance (2022), a project that causes GHG emissions to be avoided or removed from the atmosphere has a beneficial effect that is significant. Only projects that actively reverse (rather than only reduce) the risk of severe climate change can be judged as having a beneficial effect. Where the fundamental reason for a proposed project is to combat climate change (e.g. a wind farm or carbon capture and storage project) and this beneficial effect drives the project need, then it is likely to be significant.

[2] Net Zero: "*When anthropogenic emissions of greenhouse gases to the atmosphere are balanced by anthropogenic removals over a specified period.*" Net zero is achieved where emissions are first educed in line with a 'science-based' trajectory with any residual emissions neutralised through offsets.

Significance is determined using the criteria outlined in **Table 14.3** (derived from Table 6.7 of PE-ENV-01104 (TII, 2022)) along with consideration of the following two factors:

- The extent to which the trajectory of GHG emissions from the project aligns with Ireland's GHG trajectory to net zero by 2050.
- The level of mitigation taking place.

Table 14.3: GHGA Significance Criteria

Effects	Significance Level	Description
Significant adverse	Major adverse	• The project's GHG impacts are not mitigated. • The project has not complied with do-minimum standards set through regulation, nor provided reductions required by local or national policies. • No meaningful absolute contribution to Ireland's trajectory towards net zero.
	Moderate adverse	• The project's GHG impacts are partially mitigated. • The project has partially complied with do-minimum standards set through regulation and have not fully complied with local or national policies. • Falls short of full contribution to Ireland's trajectory towards net zero.
Not Significant	Minor adverse	• The project's GHG impacts are mitigated through 'good practice' measures. • The project has complied with existing and emerging policy requirements. • Fully in line to achieve Ireland's trajectory towards net zero.
	Negligible	• The project's GHG impacts are mitigated beyond design standards. • The project has gone well beyond existing and emerging policy requirements. • Well 'ahead of the curve' for Ireland's trajectory towards net zero.
Beneficial	Beneficial	• The project's net GHG impacts are below zero and it causes a reduction in atmosphere GHG concentration. • The project has gone well beyond existing and emerging policy requirements. • Well 'ahead of the curve' for Ireland's trajectory towards net zero, provides a positive climate impact.

14.2.5.2 Significance Criteria for Climate Change Risk Assessment (CCRA)

The CCRA involves an initial screening assessment to determine the vulnerability of the Proposed Scheme to various climate hazards. The vulnerability is determined by combining the sensitivity and the exposure of the Proposed Scheme to various climate hazards.

Vulnerability = Sensitivity x Exposure

The vulnerability assessment takes any proposed mitigation into account. **Table 14.4** details the vulnerability matrix; vulnerabilities are scored on a high, medium and low scale. TII, 2022a and the EU technical guidance (European Commission, 2021) note that if all vulnerabilities are ranked as low in a justified manner, no detailed climate risk assessment may be needed. The impact from climate change on the Proposed Scheme can therefore considered to be not significant. However, where residual medium or high vulnerabilities exist the assessment may need to be progressed to a detailed climate change risk assessment and further mitigation implemented to reduce risks.

Table 14.4: CCRA Vulnerability Matrix

		Exposure		
		High (3)	Medium (2)	Low (1)
Sensitivity	High (3)	9 - High	6 – High	3 - Medium
	Medium (2)	6 - High	4 - Medium	2 - Low
	Low (1)	3 - Medium	2 – Low	1 - Low

14.2.6 Construction Phase Methodology

14.2.6.1 Greenhouse Gas Assessment

As per the EU guidance document *Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment* (European Commission , 2013) the climate baseline is first established with reference to EPA data on annual GHG emissions (see **Section 14.3.1**). The impact of the Proposed Scheme on climate is determined in relation to this baseline.

PE-ENV-01104 (TII, 2022) recommends the calculation of the construction stage embodied carbon using the TII Online Carbon Tool (TII, 2022). The TII Online Carbon Tool has been commissioned by TII to assess GHG emissions associated with road or rail projects using Ireland-specific emission factors and data. The Carbon Tool aligns with Section 7 of PAS 2080, which was published by the British Standards Institution (BSI), the Construction Leadership Council and the Green Construction Board in 2016. Given the nature of the Proposed Scheme, use of the TII carbon tool is not ideal. However, the approach can be applied to other types of developments to provide a high-level assessment prior to detailed design stage. The use of the TII Carbon Tool was thus deemed appropriate at this stage of the project.

The TII Online Carbon Tool uses emission factors from recognised sources including the Civil Engineering Standard Method of Measurement (CESSM) Carbon and Price Book database (CESSM, 2013), UK National Highways Carbon Tool v2.4 and UK Government 2021 Greenhouse Gas Reporting Conversion Factors. The carbon emissions are calculated by multiplying the emission factor by the quantity of the material that will be used over the entire construction / maintenance phase. The outputs are expressed in terms of tCO_2e (tonnes of carbon dioxide equivalent).

Information on the material quantities, site activities, land clearance, waste product and construction traffic were provided by RPS and input into the carbon tool. This information was used to determine an estimate of the GHG emissions associated with the Proposed Scheme. Where detailed information regarding the proposed construction materials or material sources was not available best estimates were used to provide an estimate of the GHGs associated with the Proposed Scheme.

14.2.7 Operational Phase Methodology

14.2.7.1 Climate Change Vulnerability Assessment

The operational phase assessment involves determining the vulnerability of the Proposed Scheme to climate change. This involves an analysis of the sensitivity and exposure of the development to climate hazards which together provide a measure of vulnerability.

PE-ENV-01104 (TII, 2022)states that the CCRA is guided by the principles set out in the overarching best practice guidance documents:

- EU (2021) Technical guidance on the climate proofing of Infrastructure in the Period 2021-2027 (European Commission, 2021).
- The Institute of Environmental Management and Assessment, Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation (2nd Edition) (IEMA, 2020)

The baseline environment information provided in **Section 14.3.1**, future climate change modelling and input from other experts working on the Proposed Scheme (i.e. hydrologists) should be used in order to assess the likelihood of a climate risk.

The initial stage of an assessment is to establish a scope and boundary for the assessment taking into account the following criteria:

- **Spatial Boundary** As per PE-ENV-01104 (TII, 2022), the study area with respect to the GHGA is Ireland's Climate budget. The study area with respect to the CCRA can be considered the project boundary and its assets. The study area will be influenced by current and future baselines (**Section 14.3.1**). This study area is influenced by the input of other experts within the EIAR team.
- **Climate Hazards** The outcomes of the climate screening i.e. vulnerability assessment and baseline assessment.

- **Project Receptors** TII state that the project receptors are the asset categories considered in the climate screening. In addition, any critical connecting infrastructure and significant parts of the surrounding environment e.g. water bodies that should be considered as a part of the indirect, cumulative and in combination impact assessment should also be considered project receptors.

Technical guidance on the climate proofing of infrastructure in the period 2021-2027 (European Commission, 2021) outlines an approach for undertaking a climate change risk assessment where there is a potentially significant impact on the Proposed Scheme due to climate change. The risk assessment assesses the likelihood and consequence of the impact occurring, leading to the evaluation of the significance of the impact. The role of the climate consultant in assessing the likelihood and impact is often to facilitate the climate change risk assessment process with input from the design team or specific specialists such as hydrology.

The climate screening risk assessment or vulnerability assessment is carried out by determining the sensitivity and exposure of the project to climate change. Firstly, the project asset categories must be assigned a level of sensitivity to climate hazards irrespective of the project location (example: Sea level rise will affect seaport projects regardless of specific location). PE-ENV-01104 (TII, 2022) provides the below list of asset categories and climate hazards to be considered. The asset categories will vary for project type and need to be determined on a project by project basis. The asset categories relevant to the Proposed Scheme include:

- **Asset Categories** Pavements; drainage; structures; utilities; landscaping; signs, light posts, buildings, and fences.
- **Climate Hazards** Flooding (coastal, pluvial, fluvial); extreme heat; extreme cold; wildfire; drought; extreme wind; lightning and hail; landslides; fog.

The sensitivity is based on a High, Medium or Low rating with a score of 1 to 3 assigned as per the criteria below.

- **High Sensitivity** The climate hazard will or is likely to have a major impact on the asset category. This is a sensitivity score of 3.
- **Medium Sensitivity** It is possible or likely the climate hazard will have a moderate impact on the asset category. This is a sensitivity score of 2.
- **Low Sensitivity** It is possible the climate hazard will have a low or negligible impact on the asset category. This is a sensitivity score of 1.

Once the sensitivities have been identified the exposure analysis is undertaken. The exposure analysis involves determining the level of exposure of each climate hazard at the project location irrespective of the project type for example: flooding could be a risk if the project location is next to a river in a floodplain. Exposure is assigned a level of High, Medium or Low as per the below criteria.

- **High Exposure** It is almost certain or likely this climate hazard will occur at the project location i.e. might arise once to several times per year. This is an exposure score of 3.
- **Medium Exposure** It is possible this climate hazard will occur at the project location i.e. might arise a number of times in a decade. This is an exposure score of 2.
- **Low Exposure** It is unlikely or rare this climate hazard will occur at the project location i.e. might arise a number of times in a generation or in a lifetime. This is an exposure score of 1.

Once the sensitivity and exposure are categorised, a vulnerability analysis is conducted by multiplying the sensitivity and exposure to calculate the vulnerability, as shown in **Table 14.4**. TII guidance (TII, 2022) and the EU technical guidance (European Commission, 2021) note that if all vulnerabilities are ranked as low in a justified manner, no detailed climate risk assessment may be needed. The impact from climate change on the Proposed Scheme can therefore considered to be not significant. However, where residual medium or high vulnerabilities exist the assessment may need to be progressed to a detailed climate change risk assessment and further mitigation implemented to reduce risks.

14.2.8 Data Limitations

There were no difficulties or limitations encountered when carrying out this assessment.

14.2.9 Consultations

Meetings and follow up consultations were arranged with stakeholders at all phases of the project. Comments and queries from stakeholders informed design and are addressed throughout this report and summarised in **Table 14.5**.

Table 14.5: List of Consultations

Consultees	Feedbacks	Location where Comments were Addressed
The Heritage Council	Consider Government Climate Policy: Climate Action Plan 2023. We request that full consideration be given to integrating nature-based catchment management (NBCM) to the delivery of the scheme, as required in the Draft National Biodiversity Action Plan and the Climate Change Sectoral Adaptation Plan for Flood Risk Management.	Climate Action Plan 2023 considered as part of this assessment. RPS produced a NBCM Feasibility Report, included as part of the Ballina FRS Options Report (RPS, 2022a).

14.3 Description of the Existing Environment

14.3.1 Baseline Environment

PE-ENV-01104 (TII, 2022) states that a baseline climate scenario should identify, consistent with the study area for the project, GHG emissions without the project for both the current and future baseline.

Ireland declared a climate and biodiversity emergency in May 2019 and in November 2019 there was European Parliament approval of a resolution declaring a climate and environment emergency in Europe. This, in addition to Ireland's current failure to meet its EU binding targets under Regulation 2018/842 (European Union, 2018) results in changes in GHG emissions either beneficial or adverse being of more significance than previously considered prior to these declarations.

14.3.1.1 Greenhouse Gas Emissions

Data published in July 2023 (EPA, 2023) predicts that Ireland exceeded (without the use of flexibilities) its 2022 annual limit set under EU's Effort Sharing Decision (ESD) (EU 2018/842) by 3.72 Mt CO_2e. When the available flexibilities are taken into account, the limit is exceeded by 1 Mt CO_2e. The sectoral breakdown of 2022 GHG emissions is shown in **Table 14.6**. The sector with the highest emissions was agriculture at 38.4% of the total, followed by transport at 19.1%. Total national emissions (excluding LULUCF) were estimated to be 60.76 Mt CO_2e as shown in **Table 14.6** (EPA, 2023).

The future baseline with respect to the GHGA can be considered in relation to the future climate targets which the assessment results will be compared against. In line with TII (TII, 2022) and IEMA Guidance (IEMA, 2022) the future baseline is a trajectory towards net zero by 2050, "*whether it* [the project] *contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050*".

The future baseline will be determined by Ireland meeting its targets set out in the CAP23, and future CAPs, alongside binding 2030 EU targets. In order to meet the commitments under the Paris Agreement, the European Union (EU) enacted 'Regulation (EU) 2018/842 on binding annual GHG emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No. 525/2013' (hereafter referred to as the Regulation) (European Union, 2018). The Regulation aims to deliver, collectively by the EU in the most cost-effective manner possible, reductions in GHG emissions from the Emission Trading Scheme (ETS) and non-ETS sectors amounting to 43% and 30%, respectively, by 2030 compared to 2005. The Regulation was amended in April 2023 and Ireland must now limit its greenhouse gas emissions by at least 42% by 2030. The ETS is an EU-wide scheme which regulates the GHG emissions of larger industrial emitters including electricity generation, cement manufacturing and heavy industry. The non-ETS sector includes all domestic GHG

emitters which do not fall under the ETS scheme and thus includes GHG emissions from transport, residential and commercial buildings and agriculture.

Table 14.6: Total National GHG Emissions in 2022

Sector	2022 Emissions (Mt CO_2e)	% Total 2022 (including LULUCF)
Agriculture	23.337	34%
Transport	11.634	17%
Energy Industries	10.076	15%
Residential	6.105	9%
Manufacturing Combustion	4.288	6%
Industrial Processes	2.289	3%
F-Gases	0.741	1%
Commercial Services	0.767	1%
Public Services	0.659	1%
Waste [Note 2]	0.867	1%
Land Use, Land-use Change and Forestry (LULUCF)	7.305	11%
National total excluding LULUFC	**60.764**	**89%**
National total including LULUFC	**68.069**	**100%**

Note 1: *Reproduced from Latest emissions data on the EPA website (EPA, 2023)*

Note 2: *Waste includes emissions from solid waste disposal on land, solid waste treatment (composting and anaerobic digestion), wastewater treatment, waste incineration and open burning of waste.*

14.3.1.2 Climate Change Vulnerability

Ireland has seen increases in the annual rainfall in the north and west of the country, and small increases or decreases in the south and east (EPA, 2021). The EPA have compiled a list of potential adverse impacts as a result of climate change including the following which may be of relevance to the Proposed Scheme (EPA, 2021):

- More intense storms and rainfall events.
- Increased likelihood and magnitude of river and coastal flooding.
- Water shortages in summer in the east.
- Adverse impacts on water quality.
- Changes in distribution of plant and animal species.

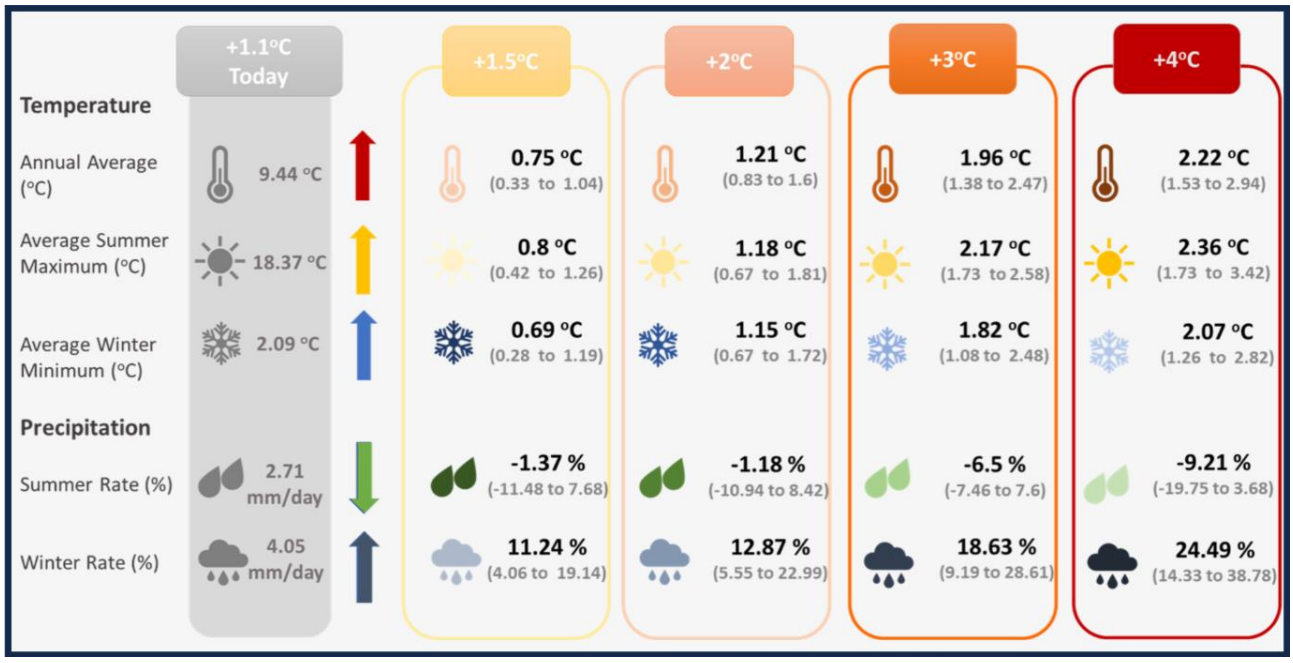
The EPA's *State of the Irish Environment Report (Chapter 2: Climate Change)* (EPA, 2020) notes that projections show that full implementation of additional policies and measures, outlined in the 2019 Climate Action Plan, will result in a reduction in Ireland's total GHG emissions by up to 25 per cent by 2030 compared with 2020 levels. Climate change is not only a future issue in Ireland, as a warming of approximately 0.8°C since 1900 has already occurred. The report underlines that the next decade needs to

be one of major developments and advances in relation to Ireland's response to climate change in order to achieve these targets and that Ireland must accelerate the rate at which it implements GHG emission reductions (EPA, 2020). The report states that mid-century mean annual temperatures in Ireland are projected to increase by between 1.0°C and 1.6°C (subject to the emissions trajectory). In addition, heat events are expected to increase by mid-century (EPA, 2020). While individual storms are predicted to have more severe winds, the average wind speed has the potential to decrease (EPA, 2020).

TII's Guidance document PE-ENV-01104 (TII, 2022) states that for future climate change moderate to high Representative Concentration Pathways (RCP) should be adopted. RPC 4.5 is considered moderate while RPC 8.5 is considered high. RCPs describe different 21st century pathways of GHG emissions depending on the level of climate mitigation action undertaken.

RCPs provide a broad range of possible futures based on assumptions of human activity. The modelled scenarios include for "least" (RCP2.6), "more" (RCP4.5) or "most" (RCP8.5) climate change.

National Framework for Climate Services (NFCS) was founded in June 2022 to streamline the provision of climate services in Ireland and will be led by Met Éireann. Under this the TRANSLATE project has been established which includes research on climate projects in Ireland. TRANSLATE (Met Eireann, 2023) provides the first standardised and bias-corrected national climate projections for Ireland to aid climate risk decision making across multiple sectors (for example, transport, energy, water), by providing information on how Ireland's climate could change as global temperatures increase to 1.5˚C ,2˚C, 2.5˚C, 3˚C or 4˚C. Projections broadly agree with previous projections for Ireland. With climate change Ireland's temperature and rainfall will undergo more and more significant changes e.g. on average summer temperature could increase by more than 2°C, summer rainfall could decrease by 9% while winter rainfall could increase by 24%. Future projects also include a 10-fold increase in the frequency of summer nights (values > 15°C) by the end of the century, a decrease in the frequency of cold winter nights and an increase in the number of heatwaves. A heatwave in Ireland is defined as a period of 5 consecutive days where the daily maximum temperature is greater than 25°C.



Source: TRANSLATE project storymap (Met Éireann, 2023)

Figure 14-1: Change of Climate Variables for Ireland for Different Global Warming Thresholds

14.3.2 Evolution of the Environment in the Absence of the Proposed Scheme

Impacts as a result of climate change will evolve with a changing future baseline, changes have the potential to include increases in global temperatures and increases in the number of rainfall days per year. Therefore,

it is expected that the baseline climate will evolve over time and consideration is needed with respect to this within the design of the Proposed Scheme.

14.4 Description of the Likely Significant Effects

The IEMA guidance (2022) on which the TII guidance (2022a) and associated significance criteria in **Table 14.3** are based states that "*The significance of a project's emissions should be based on its net impact over its lifetime, which may be positive, negative or negligible*". Therefore, the impact and significance of the Proposed Scheme has been assessed on this basis and is detailed in **Section 14.6**.

14.4.1 Construction Phase

14.4.1.1 Greenhouse Gas Assessment

There is the potential for a number of greenhouse gas emissions to atmosphere during the construction of the scheme. As part of the Proposed Scheme, construction stage embodied GHG emissions have been calculated under the following headings within the TII Carbon Tool where applicable:

- Pre-Construction
- Embodied Carbon of Materials
- Construction Activities
- Construction Waste
- Maintenance

Pre-construction includes land-use changes and site clearance activities. There is the requirement for some site clearance works to allow for the construction of the scheme. This site clearance work and the land-use change has been quantified within the carbon tool.

Transport GHG emissions associated with delivery of materials to site were included in the calculator. In addition, construction worker travel to site was also included within the calculations. The exact location of all facilities to be used is not known at this stage, where required, an approximate radius from the site was used for the purposes of this assessment. Where specific locations were known the exact transport distance was included within the calculations.

Not all data were available for each category at this stage in the development. Specific material details and sources will not be known until the detailed design stage. However, this assessment has aimed to quantify the embodied carbon associated with the Proposed Scheme as much as possible.

Where possible, construction materials will be sourced from local suppliers thereby reducing GHG emissions associated with travel to the site. The embodied carbon of construction materials also includes a maintenance percentage for ongoing maintenance and replacement of the materials over the lifetime of the development.

There is the potential to reduce the embodied carbon associated with wastes by re-using materials on site where possible, by sending materials for re-use at other locations, or by sending wastes for recycling rather than sending to landfill which has a much higher embodied carbon footprint. Where material is deemed suitable it will be re-used on site to avoid disposal.

The Proposed Scheme is divided into a number of subsections to represent the works required and different areas of the scheme. The GHG assessment has investigated the individual impact as a result of each subsection of the scheme, these are presented in the below sections.

14.4.1.1.1 River Moy

Table 14.7 details the embodied carbon emissions associated with each category within the Carbon Tool for the River Moy subsection of the Proposed Scheme. The embodied carbon associated with construction materials is the largest contributor to GHG emissions during the construction phase at 86.3% of the total.

The embodied carbon of the construction activities is the second highest source of carbon emissions at 13.2% of the total. Pre-construction activities and construction wastes makes up the remainder of the carbon emissions.

The results of the assessment have been compared against the 2030 sectoral emissions ceiling of 4 $MtCO_2e$ for the Industry sector. The River Moy subsection of the Proposed Scheme will result in total annualised construction phase emissions of 542 tonnes CO_2e over the approximate 3-year construction period as calculated using the TII Carbon Tool. The predicted embodied carbon is averaged over the full construction phase to give the predicted annual emissions to allow for a direct comparison with annual emissions and targets. When averaged over the c.3-year construction period the total embodied carbon amounts to 0.014% of the Industry Sector emissions ceiling for 2030. In the context of total national GHG emissions, Ireland's national GHG emissions in 2022 were 60.76 Mt CO_2e (**Table 14.6**), the annualised project related GHG emissions for the Moy subsection equate to 0.0009% of Ireland's 2022 GHG emissions.

Table 14.7: Construction Phase Greenhouse Gas Assessment – Moy Subsection

Source	Carbon Emissions (tCO_2e)	% of total
Pre-Construction	3.21	0.2%
Embodied Carbon	1,403.00	86.3%
Construction Activities	214.06	13.2%
Construction Waste	5.25	0.3%
Total	**1,626**	**100.0%**
Total annualised emissions over construction period	**542**	
2030 Sectoral Emissions Ceiling (Industry Sector)	4,000,000	
Total annualised project carbon as % of sectoral ceiling	0.014%	

14.4.1.1.2 Quignamanger

Table 14.8 details the embodied carbon emissions associated with each category within the Carbon Tool for the Quignamanger subsection of the Proposed Scheme. The embodied carbon associated with construction materials is the largest contributor to GHG emissions during the construction phase at 91% of the total.

The embodied carbon of the construction activities is the second highest source of carbon emissions at 8.8% of the total. Pre-construction activities and construction wastes makes up the remainder of the carbon emissions.

The results of the assessment have been compared against the 2030 sectoral emissions ceiling of 4 $MtCO_2e$ for the Industry sector. The Quignamanger subsection of the Proposed Scheme will result in total annualised construction phase emissions of 472 tonnes CO_2e over the approximate 1-year construction period as calculated using the TII Carbon Tool. The predicted embodied carbon is averaged over the full construction phase to give the predicted annual emissions to allow for a direct comparison with annual emissions and targets. When averaged over the c.1-year construction period the total embodied carbon amounts 0.012% of the Industry Sector emissions ceiling for 2030. In the context of total national GHG emissions, the annualised project related GHG emissions for the Quignamanger subsection equate to 0.0008% of Ireland's 2022 GHG emissions.

Table 14.8: Construction Phase Greenhouse Gas Assessment – Quignamanger Subsection

Source	Carbon Emissions (tCO_2e)	% of total
Pre-Construction	0.43	0.1%
Embodied Carbon	429.30	91.0%
Construction Activities	41.36	8.8%
Construction Waste	0.71	0.2%
Total	**472**	**100.0%**
Total annualised emissions over construction period	**472**	
2030 Sectoral Emissions Ceiling (Industry Sector)	4,000,000	

Source	Carbon Emissions (tCO_2e)	% of total
Total annualised project carbon as % of sectoral ceiling	0.012%	

14.4.1.1.3 Bunree

Table 14.9 details the embodied carbon emissions associated with each category within the Carbon Tool for the Bunree subsection of the Proposed Scheme. The embodied carbon associated with construction materials is the largest contributor to GHG emissions during the construction phase at 89.2% of the total.

The embodied carbon of the construction activities is the second highest source of carbon emissions at 10.6% of the total. Pre-construction activities and construction wastes makes up the remainder of the carbon emissions.

The results of the assessment have been compared against the 2030 sectoral emissions ceiling of 4 $MtCO_2e$ for the Industry sector. The Bunree subsection of the Proposed Scheme will result in total annualised construction phase emissions of 427 tonnes CO_2e over the approximate 1.5-year construction period as calculated using the TII Carbon Tool. The predicted embodied carbon is averaged over the full construction phase to give the predicted annual emissions to allow for a direct comparison with annual emissions and targets. When averaged over the c.1.5-year construction period the total embodied carbon amounts 0.011% of the Industry Sector emissions ceiling for 2030. In the context of total national GHG emissions, the annualised project related GHG emissions for the Bunree subsection equate to 0.0007% of Ireland's 2022 GHG emissions.

Table 14.9: Construction Phase Greenhouse Gas Assessment – Bunree Subsection

Source	Carbon Emissions (tCO_2e)	% of total
Pre-Construction	0.83	0.1%
Embodied Carbon	570.71	89.2%
Construction Activities	67.82	10.6%
Construction Waste	0.76	0.1%
Total	**640**	**100.0%**
Total annualised emissions over construction period	**427**	
2030 Sectoral Emissions Ceiling (Industry Sector)	4,000,000	
Total annualised project carbon as % of sectoral ceiling	0.011%	

14.4.1.1.4 Brusna

Table 14.10 details the embodied carbon emissions associated with each category within the Carbon Tool for the Brusna subsection of the Proposed Scheme. The embodied carbon associated with construction materials is the largest contributor to GHG emissions during the construction phase at 65.6% of the total.

The embodied carbon associated with pre-construction and construction activities are the second and third highest source of carbon emissions at 19.2% and 15.2% of the total respectively. Construction wastes makes up the remainder of the carbon emissions.

The results of the assessment have been compared against the 2030 sectoral emissions ceiling of 4 $MtCO_2e$ for the Industry sector. The Brusna subsection of the Proposed Scheme will result in total annualised construction phase emissions of 689 tonnes CO_2e over the approximate 1.5-year construction period as calculated using the TII Carbon Tool. The predicted embodied carbon is averaged over the full construction phase to give the predicted annual emissions to allow for a direct comparison with annual emissions and targets. When averaged over the c.1.5-year construction period the total embodied carbon amounts 0.011% of the Industry Sector emissions ceiling for 2030. In the context of total national GHG emissions, the annualised project related GHG emissions for the Brusna subsection equate to 0.0008% of Ireland's 2022 GHG emissions.

Table 14.10: Construction Phase Greenhouse Gas Assessment – Brusna Subsection

Source	Carbon Emissions (tCO_2e)	% of total
Pre-Construction	132.25	19.2%
Embodied Carbon	451.96	65.6%
Construction Activities	104.40	15.2%
Construction Waste	0.06	0.01%
Total	**689**	**100.0%**
Total annualised emissions over construction period	**459**	
2030 Sectoral Emissions Ceiling (Industry Sector)	4,000,000	
Total annualised project carbon as % of sectoral ceiling	0.011%	

14.4.1.1.5 Tullyegan

Table 14.11 details the embodied carbon emissions associated with each category within the Carbon Tool for the Tullyegan subsection of the Proposed Scheme. The embodied carbon associated with construction materials is the largest contributor to GHG emissions during the construction phase at 85.9% of the total.

The embodied carbon of the construction activities is the second highest source of carbon emissions at 13.8% of the total. Pre-construction activities and construction wastes makes up the remainder of the carbon emissions.

The results of the assessment have been compared against the 2030 sectoral emissions ceiling of 4 $MtCO_2e$ for the Industry sector. The Tullyegan subsection of the Proposed Scheme will result in total construction phase emissions of 150 tonnes CO_2e over the approximate 6-month construction period as calculated using the TII Carbon Tool. As the construction period is less than 1-year, no annualization of construction phase emissions was necessary for the Tullyegan subsection. The total embodied carbon amounts 0.004% of the Industry Sector emissions ceiling for 2030. In the context of total national GHG emissions, the annualised project related GHG emissions for the Tullyegan subsection equate to 0.0002% of Ireland's 2022 GHG emissions.

Table 14.11: Construction Phase Greenhouse Gas Assessment – Tullyegan Subsection

Source	Carbon Emissions (tCO_2e)	% of total
Pre-Construction	0.18	0.1%
Embodied Carbon	128.99	85.9%
Construction Activities	20.79	13.8%
Construction Waste	0.29	0.2%
Total	**150**	**100.0%**
Total annualised emissions over construction period	**150**	
2030 Sectoral Emissions Ceiling (Industry Sector)	4,000,000	
Total annualised project carbon as % of sectoral ceiling	0.004%	

14.4.1.1.6 Summary of GHG Assessment for Proposed Scheme

Table 14.12 shows the total predicted embodied GHG emissions for each subsection and the Proposed Scheme as a whole. The Proposed Scheme will result in total construction phase emissions of 3,576 tonnes CO_2e. The total embodied carbon amounts to 0.03% of the Industry Sector emissions ceiling for 2030 when annualised over the maximum 3-year construction period. In the context of total national GHG emissions, Ireland's national GHG emissions in 2022 were 60.76 Mt CO_2e (**Table 14.6**), the annualised project related GHG emissions equate to 0.002% of Ireland's 2022 GHG emissions.

Table 14.12: Summary of Construction Phase Greenhouse Gas Assessment

Subsection	Carbon Emissions (tCO_2e)	% of total
Moy	1,625.52	45%
Quignamanger	471.80	13%
Bunree	640.12	18%
Brusna	688.68	19%
Tullyegan	150.24	4%
Total GHG Emissions for Proposed Scheme	**3,576**	**100%**

14.4.1.2 Climate Change Risk Assessment

Examples of potential climate impacts are included in Annex D (Climate proofing and environmental impact assessment) of the *Technical Guidance on the Climate Proofing of Infrastructure* (European Commission, 2021). Potential impacts to the Proposed Scheme as a result climate change include:

- Flood risk due to increased precipitation, and intense periods of rainfall. This includes fluvial and pluvial flooding.
- Increased temperatures potentially causing drought, wildfires and prolonged periods of hot weather.
- Reduced temperatures resulting in ice or snow.
- Geotechnical impacts.
- Major Storm Damage – including wind damage.

Each of these potential risks are considered with respect to the operational phase of the Proposed Scheme as detailed in **Section 14.2.7.1**. During the construction phase no assessment is required; however, consideration will be given to the project's vulnerability to climate impacts. During construction, the Contractor will be required to mitigate against the effects of extreme rainfall / flooding through site risk assessments and method statements. The Contractor will also be required to mitigate against the effects of extreme wind / storms, temperature extremes through site risk assessments and method statements. All materials used during construction will be accompanied by certified datasheets which will set out the limiting operating temperatures. Temperatures can affect the performance of some materials, and this will require consideration during construction.

During construction, the Contractor will be required to mitigate against the effects of fog, lighting and hail through site risk assessments and method statements.

14.4.2 Operational Phase

14.4.2.1 Greenhouse Gas Assessment

There will be some GHG emissions during the operation of the Proposed Scheme associated with removal of organic waste vegetation as part of embankment control measures. In addition, there may be some minor wastes associated with ongoing maintenance works, if required. The total embodied GHG emissions associated in the operational wastes and disposal, including associated vehicle movements, in a typical year was quantified within the TII Carbon Tool. Information on operational GHG emissions was provided by RPS. **Table 14.13** outlines the operational phase GHG emissions associated with each subsection of the Proposed Scheme as well as the total for the overall scheme. There are no other sources of operational phase GHG emissions associated with the Proposed Scheme. It is estimated that the required vegetation removal will be relatively minor in scale and will be carried out on a quarterly basis. Vegetation removal will be of the magnitude of 1 tonne for the Moy, Quignamanger, Bunree and Tullyegan subsections; this may increase to 4 tonnes for the Brusna subsection.

As per **Table 14.13**, the total operational phase embodied GHG emissions associated with the Proposed Scheme in a typical year are relatively minor, amounting to 47 tonnes CO_2e. This equates to 0.001% of the

2030 Industry sector emissions ceiling of 4 Mt CO_2e or 0.0001% of Ireland's National GHG emissions in 2022.

Table 14.13: Summary of Operational Phase Greenhouse Gas Emissions

Subsection	Carbon Emissions (tCO_2e)	% of total
Moy	3.09	7%
Quignamanger	19.82	43%
Bunree	19.82	43%
Brusna	2.99	6%
Tullyegan	0.83	2%
Total Operational GHG Emissions for Proposed Scheme	**47**	**100%**
Total Operational GHG Emissions as % of 2030 ceiling	0.001%	
Total Operational GHG Emissions as % of 2022 National GHG emissions	0.0001%	

14.4.2.2 Climate Change Risk Assessment

The purpose of the Proposed Scheme is to create a resilient flood relief system that will reduce the vulnerability of the area to future flood events. Climate modelling predictions indicate that flooding events are likely to increase in future years as a result of increased rainfall and altered weather patterns (see **Section 14.3.1.2**). While the purpose of the scheme is to adapt to climate change in the area with respect to flooding, there is also the potential for elements of the scheme to be susceptible to future climate change, for example, extreme heat or cold may impact building materials used in the Proposed Scheme. The vulnerability of the scheme to future climate change has been assessed below with the results detailed in **Table 14.14**.

In order to determine the vulnerability of the Proposed Scheme to climate change the sensitivity and exposure of the development to various climate hazards must first be determined. The following climate hazards have been considered in the context of the Proposed Scheme: flooding (coastal, pluvial, fluvial); extreme heat; extreme cold; wildfire; drought; extreme wind; lightning, hail, landslides and fog.

The sensitivity of the Proposed Scheme to the above climate hazards is assessed irrespective of the project location. **Table 14.14** details the sensitivity of the Proposed Scheme on a scale of high (3), medium (2) and low (1). Once the sensitivity has been established the exposure of the Proposed Scheme to each of the climate hazards is determined, this is the likelihood of the climate hazard occurring at the project location and is also scored on a scale of high (3), medium (2) and low (1). The product of the sensitivity and exposure is then used to determine the overall vulnerability of the Proposed Scheme to each of the climate hazards as per **Table 14.4**.

Table 14.14: Climate Change Vulnerability Assessment

Climate Hazard	Sensitivity	Exposure	Vulnerability
Flooding (coastal)	1 (Low)	1 (Low)	1 (Low)
Flooding (fluvial)	1 (Low)	1 (Low)	1 (Low)
Flooding (pluvial)	1 (Low)	2 (Medium)	2 (Low)
Extreme Heat	1 (Low)	2 (Medium)	2 (Low)
Extreme Cold	1 (Low)	2 (Medium)	2 (Low)
Drought	1 (Low)	1 (Low)	1 (Low)
Extreme Wind	1 (Low)	1 (Low)	1 (Low)
Lightning & Hail	1 (Low)	1 (Low)	1 (Low)
Fog	1 (Low)	1 (Low)	1 (Low)

Climate Hazard	Sensitivity	Exposure	Vulnerability
Wildfire	1 (Low)	1 (Low)	1 (Low)
Landslides	1 (Low)	1 (Low)	1 (Low)

The sensitivity and exposure of the area was determined with reference to a number of online tools and with input from the various discipline specialists on the project team, where necessary. It was concluded that Proposed Scheme does not have any significant vulnerabilities to the identified climate hazards as described in the below sections. All vulnerabilities are classified as low.

Flooding

The purpose of the Proposed Scheme is to provide a resilient flood relief scheme for the area, thereby, reducing the vulnerability of the area to flood impacts, specifically from coastal and fluvial flooding. There is the potential for increased pluvial related flood events in future years due to increased rainfall, therefore the exposure to pluvial related flooding has been categorised as medium. However, the scheme is designed to withstand flood events due to its nature. Therefore, flooding is not considered a risk to the Proposed Scheme and has been identified as low vulnerability.

Extreme Wind, Fog, Lightning & Hail

Extreme wind, lightning, hail and fog are not predicted to significantly affect the various elements of the Proposed Scheme due to the nature of the scheme and its design.

Wildfires

In relation to wildfires, the *Think Hazard!* tool developed by the Global Facility for Disaster Reduction and Recovery (GFDRR) indicates that the wildfire hazard is classified as medium for the Mayo area (GFDRR, 2023) (see **Figure 14-2**). This means that there is between a 10% to 50% chance of experiencing weather that could support a problematic wildfire in the project area that may some risk of life and property loss in any given year. Future climate modelling indicates that there could be an increase in the weather conditions which are favourable to fire conditions, these include increases in temperature and prolonged dry periods. However, due to the project location in a predominantly built-up area the risk of wildfire is significantly lessened, and it can be concluded that the Proposed Scheme is of low vulnerability to wildfires.

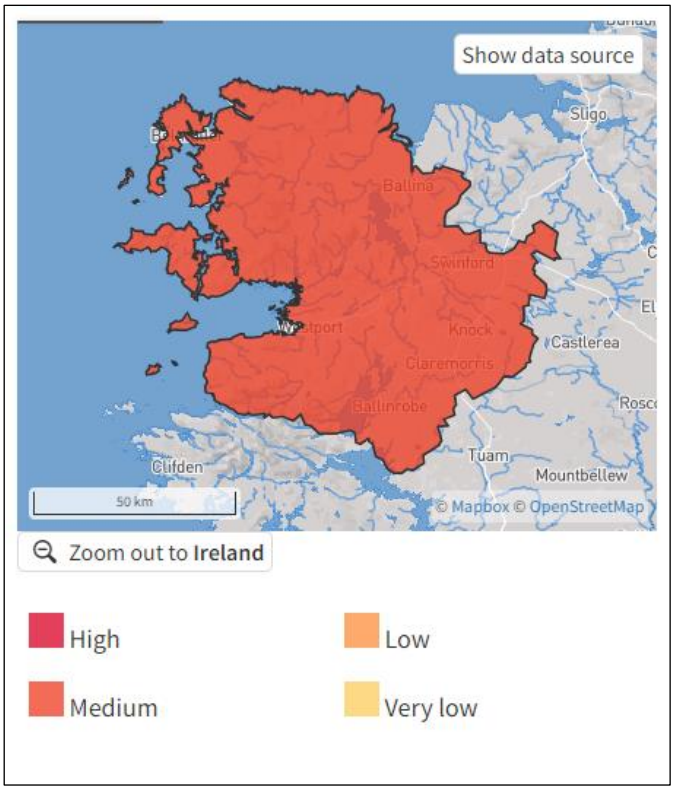


Figure 14-2: GFDRR Wildfire Risk for Mayo Area (GFDRR, 2023)

Landslides

Landslide susceptibility mapping developed by the Geological Survey Ireland (GSI, 2023) indicates that the Proposed Scheme location is not within an area that is susceptible to landslides and there are no recorded historical landslide events at the project location (see **Figure 14-3**). It can be concluded that landslides are not a risk to the Proposed Scheme area.

Figure 14-3: Landslide Susceptibility Classification for Proposed Scheme Area (GSI, 2023)

Extreme Temperatures (Heat & Cold)

At the detailed design stage chosen building materials will be high quality, durable and hard-wearing and chosen to withstand increased variations in temperature in the future as a result of climate change. For example, the use of ground granulated blast furnace slag (GGBS) in concrete or a similar material has been proposed. GGBS inclusion increases the strength and durability of the concrete and GGBS does not produce carbon dioxide, sulfur dioxide of nitrogen oxides therefore making it a preferable choice in terms of climate GHG impacts.

Overall, the Proposed Scheme has at most low vulnerabilities to the identified climate hazards and therefore no detailed risk assessment is required. The Proposed Scheme will help to reduce the vulnerability of the area to potential future climate change related flooding which will be beneficial in the long-term.

14.5 Mitigation Measures

14.5.1 Construction Phase

The projected emissions from the construction phase are presented using traditional methods and materials and result in a minor adverse impact. The need to mitigate these impacts is clearly signalled in national policy such as CAP24 (Box 10.2, Target 3.5.1: *Specify low carbon construction methods and low carbon cement material as far as practicable for directly procured or supported construction projects from 2023*). There has been ongoing interaction between the climate team and the design team to assess the potential pathways for mitigation during construction of the Proposed Scheme.

Embodied carbon in the materials employed in the construction phase dominate the impact. As such, to mitigate these impacts the use of the following will be required:

- As a replacement for traditional precast concrete materials made with Portland cement mixes, the Proposed Scheme will use 50% ground granulated blast-furnace slag (GGBS) cement for all structural and non-structural precast structures;
- Similarly, all concrete poured in-situ for the Proposed Scheme will consist of 50% GGBS cement;
- All reinforcing steel employed on site will be 85% minimum recycled steel; and
- The use of these low embodied carbon materials in construction will reduce the construction phase emissions ad comply with the requirements of CAP23 (also a key message in CAP24).

In addition to the above mitigation regarding material choices, there are a series of additional construction mitigation measures that will also be adopted as follows:

- The use of non-concrete assets shall be optimised in the design e.g. gravel footpaths, grassed drains etc. to minimise the need for concrete.
- All aggregates shall be secondary aggregates. Virgin aggregates shall only be employed where it is demonstrated that secondary aggregates are unsuitable for structural reasons and/or they are unavailable.
- Wherever available, the contractor shall secure construction materials from local/regional sources or sources within the State to minimise material transport emissions and reduce life cycle carbon emissions associated with the construction materials.
- For electricity generation at the construction compounds, hydrogen generators or electrified plant shall be utilised over traditional diesel generators. This shall also apply to lower powered mobile plant, as appropriate.
- A regular maintenance schedule for all construction plant machinery shall be undertaken to maintain optimum machinery efficiency.
- Sustainable timber post fencing will be specified over steel in boundary treatments where possible.
- Engines will be turned off when machinery is not in use.
- The use of private vehicles by construction staff to access the site will be minimised through the encouragement of use of public transport, encouragement of car sharing, and maximising use of local labour to reduce transport emissions.

The measures outlined within this chapter will reduce the impact to climate during the construction of the Proposed Scheme.

These measures will be tracked through the development of Project Carbon Management Plan (PCMP) which will be prepared in accordance with PAS 2080 (Carbon Management in Infrastructure). This Plan will be devised by Mayo County Council at detailed design stage and then transferred for ownership to the Contractor for construction and handover. The Plan will be used to monitor and report on the above committed carbon management measures and all other measures adopted during the design, procurement and construction phases.

14.5.2 Operational Phase

The following measures shall be implemented during the operational phase to reduce GHG emissions from ongoing maintenance of the scheme and vegetation removal.

- Prevention of on-site or delivery vehicles from leaving engines idling, even over short periods.
- Ensure all plant and machinery are well maintained and inspected regularly.
- The Project Carbon Management Plan handed over by the Contractor post construction will be maintained through the operation and maintenance phase.

14.6 Residual Impacts

The IEMA guidance (2022) on which the TII guidance (2022a) and associated significance criteria in **Table 14.3** are based states that "*The significance of a project's emissions should be based on its net impact over its lifetime, which may be positive, negative or negligible*". Therefore, the impact and significance of the Proposed Scheme has been assessed on this basis.

TII (2022a) states that professional judgement must be taken into account when contextualising and assessing the significance of a project's GHG impact. In line with IEMA Guidance (IEMA, 2022),TII state that the crux of assessing significance is "*not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050*". Additionally. The IEMA guidance (2022) states, where the fundamental reason for a proposed project is to combat climate change and this beneficial effect drives the project need, then the impact of the project is likely to be significant.

The purpose of the Proposed Scheme is to provide for a resilient flood relief scheme to reduce the vulnerability of the area to future flood events. Flood events are likely to increase in the future as a result of climate change and altered weather patterns.

No significant risk as a result of climate change vulnerability were identified as a part of the assessment. The Proposed Scheme has only low vulnerabilities to the identified climate hazards. The Proposed Scheme is not significant in relation to climate change vulnerability.

While the Proposed Scheme will result in some GHG emissions during construction and more minor GHG emissions during operation, these GHG emissions must be considered in the context of the overall scheme and the purpose of the scheme. The Proposed Scheme will not off-set any GHG emissions which would be beneficial to climate in the long-term, e.g. such as a generation of renewable electricity from a windfarm development. However, the Proposed Scheme will implement a number of best practice mitigation measures to reduce GHG emissions which will reduce the impact to climate. Overall, when taking the purpose of the scheme into consideration, along with the predicted GHG emissions, the impact to climate is considered long-term, neutral, minor and not significant.

14.7 Monitoring

14.7.1 Construction Phase

No monitoring is required for the construction phase.

14.7.2 Operational Phase

No monitoring is required for the operational phase.

14.8 Interactions and Cumulative Effects

Inter-relationships are the impacts and associated effects of different aspects of the Proposed Scheme on the same receptor. The potential for cumulative effects has been considered for the construction and operation of the Proposed Scheme cumulatively with other projects. Please see **Chapter 20 Interactions and Cumulative Effects** for further details on the potential interactions and cumulative effects for Climate.

14.9 Schedule of Environmental Commitments

Please see **Chapter 22 Schedule of Environmental Commitments** which sets out all the mitigation and monitoring commitments to minimise the potential impacts for Climate during the construction and operational phase of the Proposed Scheme.

14.10 Chapter References

BSI, 2016. *Publicly Available Specification (PAS) 2080:2016 on Carbon Managment in Infrastructure,* s.l.: s.n.

CESSM, 2013. *Carbon and Price Book Database,* s.l.: Civil Engineering Standard Method of Measurement.

CIF, 2021. *Modern Methods of Construction (MMC),* s.l.: Construction Industry Federation.

Climate Ireland, 2023. *Climate data explorer.* [Online]
Available at: www.climateireland.ie/#!/tools/climateDataExplorer
[Accessed 2023].

Department of the Taoiseach, 2022. *Carbon Budgets.* [Online]
Available at: www.gov.ie/en/publication/9sf1b-carbon-budgets/
[Accessed 2023].

EPA, 2015. *Advice Notes for Preparing Environmental Impact Statements -Draft,* s.l.: Environmental Protection Agency.

EPA, 2020. *Research 339: High-resolution Climate Projects for Ireland - A Multi-model Ensemble Approach,* s.l.: Environmental Protection Agency.

EPA, 2020. *State of the Irish Environment Report (Chapter 2: Climate Change),* s.l.: Environmental Protection Agency.

EPA, 2021. *Critical Infrastructure Vulverabilty to Climate Change Report No. 369,* s.l.: Environmental Protection Agency.

EPA, 2021. *What Impact will Climate Change have for Ireland?,* s.l.: Environmental Protection Agency.

EPA, 2022. *Guidelines on Information to be Contained in Environmental Impact Assessment Reports ,* s.l.: s.n.

EPA, 2023. *Ireland's Greenhouse Gas Emissions 1990-2022,* s.l.: Environmental Protection Agency.

European Commission , 2013. *Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment,* s.l.: European Commission.

European Commission, 2017c. *Environmental Impact Assessment of Projects - Guidance on the Preparation of the Enviromental Impact Assessment Report,* s.l.: s.n.

European Commission, 2021. *Forging a Climate-resilient Europe - The New EU Strategy on Adaptation to Climate Change,* s.l.: European Commission.

European Commission, 2021. *Technical Guidance on the Climate Proofing of Infrastructure in the Period 2021-2027,* s.l.: European Commission.

GFDRR, 2023. *ThinkHazard! online tool.* [Online]
Available at: https://thinkhazard.org/en/
[Accessed 2023].

Government of Ireland , 2015. *Climate Action and Low Carbon Development Act,* s.l.: Government of Ireland.

Government of Ireland , 2021. *Climate Action and Low Carbon Development (Amendment) Act 2021 (No. 32 of 2021),* s.l.: Government of Ireland.

Government of Ireland, 2019. *Climate Action Plan 2019,* s.l.: Government of Ireland.

Government of Ireland, 2020. *Draft General Scheme of the Climate Action (Amendment) Bill 2019,* s.l.: Government of Ireland.

Government of Ireland, 2021. *Climate Action Plan 2021,* s.l.: Government of Ireland.

Government of Ireland, 2023. *Climate Action Plan 2023,* s.l.: Government of Ireland.

Government of Ireland, 2023. *Long-term Strategy on Greenhouse Gas Emissions Reductions,* s.l.: Department of the Environment, Climate and Communications.

GSI, 2023. *Maps Arcgis.* [Online]
Available at: https://dcenr.maps.arcgis.com/apps/webappviewer/idex.html
[Accessed 2023].

IEMA, 2017. *Assessing Greenhouse Gas Emissions and Evaluating their Significance,* s.l.: Institute of Environmental Management & Assessment.

IEMA, 2020. *EIA Guide to Climate Change Resilience and Adaptation,* s.l.: Institute of Environmental Management & Assessment.

IEMA, 2020. *GHG Managment Hierarchy - Assessing Greenhouse Gas Emissions and Evaluating their Significance,* s.l.: Institute of Environmental Management & Assessment.

IEMA, 2022. *Assessing Greenhouse Gas Emissions and Evaluating their Significance,* s.l.: Institute of Environmental Management & Assessment.

Met Eireann, 2023. *TRANSLATE.* [Online]
Available at: https://www.met.ie/science/translate
[Accessed 2023].

RPS, 2022a. *Ballina Flood Relief Scheme Options Report ,* s.l.: s.n.

TII, 2021. *Sustainability Implementation Plan - Our Future,* s.l.: Transport Infrastructure Ireland.

TII, 2022. *GE-ENV-01106: TII Carbon Assessment Tool for Road adn Light Rail Projects and User Guidance Document,* s.l.: Transport Infrastructure Ireland.

TII, 2022. *PE-ENV-01104: Climate Guidance for National Roads, Light Rail and Rural Cycleways (Offline & Greenways) - Overarching Technical Document,* s.l.: Transport Infrastructure Ireland.