Chapter 19

Climate

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19.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) identifies, describes and presents an assessment of the likely significant effects of the N2 Slane Bypass and Public Realm Enhancement Scheme (hereafter referred to as 'the Proposed Scheme') on climate and also the vulnerability of the Proposed Scheme to climatic factors. This chapter will also assess the consistency of the Proposed Scheme with the provisions of the Climate Action and Low Carbon Development Acts 2015 to 2021.

The assessment presented is informed by the following key chapters of the EIAR: **Chapter 4 – Description of the Proposed Scheme** and **Chapter 5 – Description of Construction Phase**. Other aspects relevant to climate are addressed in the specific chapters of the EIAR, namely:

- **Chapter 7 – Traffic and Transport:** Predicted traffic, transport and mobility effects;
- **Chapter 10 – Air Quality:** Impacts on air quality from the Proposed Scheme and in particular road traffic emissions;
- **Chapter 15 and Chapter 16 –** Biodiversity: Sensitivity and vulnerability of natural habitats and species to climate change;
- **Chapter 17 – Water:** Aspects relating to hydrology and flood risk. Refer also to the Flood Risk Assessment (FRA) Report prepared for the Proposed Scheme (refer to **Appendix 17.2 – Flood Risk Assessment**);
- **Chapter 23 – Material Assets: Resource and Waste Management:** Emissions arising from resource use and transport and waste management; and
- **Chapter 24 – Risk of Major Accidents and/or Disasters:** Vulnerability of the Proposed Scheme and/or the surrounding area to risk of major accidents and/or disasters.

19.2 Methodology

The Climate assessment has followed the overall methodology and guidance relating to the EIA process and preparation as set out in **Section 1.3.3** of **Chapter 1 Introduction**.

Specifically in relation to the climate impact assessment, the methodology adopted is based on the following guidance:

- Transport Infrastructure Ireland (TII) Climate Assessment of Proposed National Road Projects – Standard PE-ENV-01105 (December 2022) (TII, 2022a);
- TII Climate Guidance for National Roads, Light Rail, and Rural Cycleways (Offline and Greenways) – Overarching Technical Document PE-ENV-01104 (December 2022) (TII, 2022b);
- TII Road Emissions Model (REM): Model Development Report GE-ENV-01107 (December 2022) (TII, 2022c); and
- TII Carbon Tool for Road and Light Rail Projects: User Guidance Document GE-ENV-01106 (December 2022) (TII, 2022d).

The TII Standard Document PE-ENV-01105 requires that the climate impact assessment must report the project's impact on greenhouse gas emissions and the project's risk and resilience to climate change through a climate assessment through the following separate assessments:

- Greenhouse Gas Emissions (GHG) assessment: the assessment of GHG emissions identifies the impact of GHGs arising from a proposed national road development during its lifetime and addresses how the project will affect the ability of the Government to meet its carbon reduction targets.
- Climate Change Risk (CCR) Assessment: The CCR assessment identifies the vulnerability of a proposed national road development to climate change and considers adaptation measures to increase the resilience of the project.

The GHG assessment has been undertaken for the construction and operational maintenance phases by considering the GHG emissions associated with materials (embodied carbon), import and transport of construction materials to site, on site plant and equipment and management of materials arising. This assessment has been undertaken using the TII Carbon Tool for Road and Light Rail Projects. The Carbon Tool is a spreadsheet-based product with the goal of identifying, estimating and mitigating greenhouse gas emissions that accrue on large road and rail infrastructure projects. The carbon tool is developed on a modular structure for capturing and reporting carbon emissions according to lifecycle phase.

Emissions from road transport when the road is operational have been calculated using the TII Road Emissions Model (REM). The REM calculates road transport emissions integrating the traffic volumes/speeds for light and heavy vehicles on the Proposed Scheme, as presented in **Chapter 7**, with Irish fleet composition information.

The combined outputs of the Carbon Tool and the REM represent the GHG assessment of this chapter. The purpose of this assessment is quantified and then avoid or reduce, in so far as practicable, the adverse impacts of GHG emissions from the Proposed Scheme on the climate.

The Climate Change Risk (CCR) Assessment identifies the impact of a changing climate on the Proposed Scheme and receiving environment. The assessment considers the Proposed Scheme's vulnerability to climate change and identifies adaptation measures to accommodate climate change impacts. The CCR methodology is guided by the principles set out in the overarching best practice guidance documents which include:

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

The purpose of the CCR assessment is to reduce or manage the adverse impacts of climate change on the Proposed Scheme and develop the project resilient to climate change.

19.2.1 Legislation, Policy and Guidance

19.2.1.1 Legislation

In relation to climate, the following legislation is relevant for this chapter:

- Climate Action and Low Carbon Development Act 2015 ('the 2015 Act'); and
- Climate Action and Low Carbon Development (Amendment) Act 2021 ('the 2021 Amendment Act').

Section 15 of the Climate Action and Low Carbon Development Act, 2015 defines the duties of certain bodies under the Act. This section was amended by Section 17 of the 2021 Climate Action and Low Carbon (Amendment) Act which has replaced Section 15(1) of the 2015 Act to now read as follows:

> *15. (1) A relevant body shall, in so far as practicable, perform its functions in a manner consistent with—*
>
> *(a) the most recent approved climate action plan,*
>
> *(b) the most recent approved national long term climate action strategy,*
>
> *(c) the most recent approved national adaptation framework and approved sectoral adaptation plans,*
>
> *(d) the furtherance of the national climate objective, and*
>
> *(e) the objective of mitigating greenhouse gas emissions and adapting to the effects of climate change in the State.*

Meath County Council, as a body established by statute, is a public body and therefore a relevant body under the Act of 2015 and the above duties apply to Meath County Council. The primary obligation under the Acts for Meath County Council is to develop a Climate Action Plan for the county which is currently under preparation. In addition, consistency with the climate policy base is also assessment in developing the Proposed Scheme.

Each of the elements listed in Section 15(1) is described in **Section 19.2.1.2** with specific reference for the transport and other sectors relevant to this assessment. This assessment includes an analysis of the

consistency of the Proposed Scheme with these climate policies and if Meath County Council, in developing the Proposed Scheme, have, in so far as practicable, performed its functions in a manner consistent with this policy base.

The Climate Action and Low Carbon Development Acts 2015 to 2021 embed the process of setting binding and ambitious emissions-reductions targets in law. In addition, the Acts provide for a national climate objective, which commits the State to pursue and achieve no later than 2050, the transition to a climate resilient, biodiversity-rich, environmentally sustainable and climate-neutral economy. The Acts provide that the first two five-year carbon budgets, proposed by the Climate Change Advisory Council, should equate to a total reduction of 51% over the period to 2030, relative to a baseline of 2018. Further detail is provided in **Appendix 19.1**.

19.2.1.2 Policy

Consideration has been given to the following key policy in the preparation of this chapter:

- National Policy Position on Climate Action and Low Carbon Development (Department of the Environment, Climate and Communications [DECC], 2013);
- National Adaptation Framework (DECC, 2018);
- Climate Action Plan 2019 (DECC, 2019);
- Climate Action Plan 2021 (DECC, 2021);
- Climate Action Plan 2023 (DECC, 2022);
- Transport Climate Change Sectoral Adaptation Plan (Department of Transport Tourism and Sport [DTTAS], 2019);
- Meath County Council Development Plan 2021-2027 (MCC, 2021); and
- Meath County Council Climate Action Strategy 2019-2024 (MCC, 2019).

The key requirements of each of the main policy documents are summarised in the following sections and further detail is provided in **Appendix 19.1**.

The most recent approved climate action plan - Climate Action Plan 2023

The highest tier climate action policy is the Climate Action Plan 2023 (CAP23) launched in December 2022, which is the first national climate plan to be prepared under the Climate Action and Low Carbon Development (Amendment) Act 2021 and following the introduction of carbon budgets and sectoral emissions ceilings in 2022. CAP23 implements the carbon budgets and sectoral emissions ceilings and sets a roadmap for taking decisive action to halve national emissions by 2030 and reach net zero no later than 2050. There are a number of chapters in CAP23 with direct relevance to this chapter including:

- Chapter 10 Public Sector Leading by Example;
- Chapter 13 Industry; and
- Chapter 15 Transport.

Chapter 10 of CAP23 requires the public sector (including Meath County Council) to play a leadership role in driving far-reaching climate action across its buildings, transport, waste, and energy usage as well as wider society. A Key Performance Indicator for the public sector of relevance to this project is listed as follows:

> *By 2025 Public Bodies shall specify low carbon construction methods and low carbon cement material as far as practicable for directly procured or supported construction projects from 2023.*

This is relevant to the Proposed Scheme which, if granted, will be constructed as a directly procured or supported construction project by Meath County Council and this commitment to using low carbon construction methods and low carbon cement material must be recognised.

Chapter 13 of CAP23 relates to Industry and while not directly applicable to the operations of Meath County Council, this chapter does have relevance to the construction phase of the Proposed Scheme and the embodied carbon in construction materials. The relevant Chapter 13 CAP23 targets are listed as follows:

- Decrease embodied carbon in construction materials produced and used in Ireland by 10% by 2025; and

- Decrease embodied carbon in construction materials produced and used in Ireland by at least 30% by 2030.

While these indicators are placed on the industrial sector, local authorities such as Meath County Council, can support delivery through ensuring procurement of these materials on all construction project as per the Chapter 10 policy. This requirement is specifically listed as an action in Chapter 13 as follows:

> *Action EN/23/12: Specify low carbon construction methods and low carbon cement material as far as practicable for directly procured or supported construction projects from 2023.*

The above policy elements are specifically relevant to the construction phase of the project and these commitments will be used to inform the assessment of significance for this phase of the Proposed Scheme.

For the operation phase, the key impact is transport emissions and the relevant policy is listed in Chapter 15 of CAP23 relating to transport which includes the following actions relevant to the Proposed Scheme:

> *TR/23/29 Advance roll-out of 1,000 km walking/cycling infrastructure.*
>
> *TR/23/30 Advance roll-out of National Cycle and Greenway Networks.*

Note that CAP23 includes no specific actions in relation to the development of road infrastructure.

Chapter 15 also identifies the key performance indictors to track the transformational changes required for the transport sector to achieve the sectoral emissions ceilings and these indicators are listed in **Table 19-1**.

The relevant carbon budgets for the transport sector are presented in **Section 19.2.5.2** where these are used to establish assessment criteria for the Proposed Scheme operation phase.

Table 19-1: Key Metrics to deliver abatement in the Transport Sector (CAP23)

Theme	2025 Abatement/KPI	2030 Abatement/KPI
Vehicle Kilometres	n/a	20% reduction in total vehicle kms. 20% reduction in total car kms. 20% reduction in 'commuting' car kms.
Fuel Usage		50% reduction in fuel usage.
Sustainable Transport Trips	Additional 125,000 sustainable journeys Roll-out of sustainable demand management measures informed by National Demand Strategy	50% increase in daily active travel journeys. 130% increase in daily public transport journeys. 25% reduction in daily car journeys.
Daily Journeys Modal Share	Delivery of Pathfinder Programmes	Shift in Daily Mode Share 2018: 72% (car), 8% (PT), 20% (AT) 2030: 53% (car), 19% (PT), 28% (AT)
Escort to Education Journeys		30% shift of all E-to-E car journeys to sustainable modes.
Fleet Electrification	175,000 passenger EVs 20,000 commercial vans 700 low-emission HGV 300 EV buses in PSO bus fleet Expansion of electrified rail services	**Private Car Fleet** EV share of total passenger car fleet (30%) EV share of new registrations (100%) 845,000 Private EVs46 **Commercial Fleet** 20% EV share of total LGV fleet. 95,000 commercial EVs 30% ZE share of new heavy duty vehicle registrations 3,500 HGVs **PT Services** 1,500 EV buses in PSO bus fleet; Expansion of electrified rail services.
Biofuels Blend Rate	E10:B12	E10:B20

The most recent approved national long term climate action strategy – Long-term Strategy on Greenhouse Gas Emissions Reductions 2013

Ireland's current Long-term Strategy on Greenhouse Gas Emissions Reductions was approved by government in April 2023 and sets out indicative pathways, beyond 2030, towards achieving carbon neutrality for Ireland by 2050. The Strategy builds upon the decarbonisation pathways set by the carbon budgets, sectoral emissions ceilings and Climate Action Plan 2023, to ensure coherent and effective climate policy. The emission reduction measures and milestones to 2050 for the transport sector include:

> *Mobility in rural areas will see significant changes over the decades, driven by investment to provide greater accessibility of public transport alternatives to private cars as well as by digitalisation.*
>
> *For passenger cars, an environment fostering their placement of ICE cars after 2030 will be supported by various EV policy pathways relating to vehicles and charging infrastructure.*

The most recent approved national adaptation framework - National Adaptation Framework 2018

In January 2018, Ireland's first statutory National Adaptation Framework (NAF) was published in line with the Climate Action and Low Carbon Development Act 2015. The NAF sets out the national strategy to reduce the vulnerability of the country to the negative effects of climate change and to avail of positive impacts. The key actions of relevance to the Proposed Scheme include:

> *Action 2: Sectoral Ministers to prepare and submit a sectoral adaptation plan to the Government for approval.*
>
> *Action 11: Ensure climate proofing considerations are fully integrated into arrangements and reforms arising from the new Ireland 2040 – National Planning Framework including Guidelines, updated guidance on adaptation proofing of SEA and EIA and also in revisions of building standards.*

The 2015 Climate and Low Carbon Development Acts require that the NAF be reviewed at least every five years and a new NAP is being developed for publication later in 2023.

The most recent approved sectoral adaptation plan - Transport Climate Change Sectoral Adaptation Plan

In 2019, the Climate Change Adaptation Plan for Transport was published by the Department of Transport, Tourism and Sport (as per Action 2 above). This plan identifies the key vulnerabilities in the transport network and looks to promote greater resilience to safeguard its continued operation. The overarching goal of the plan is to ensure that the sector can fulfil its continuing economic, social and environmental objectives by ensuring that transport infrastructure is safeguarded from the impacts of climate change. This is achieved through a series of objectives and actions with those relevant to the Proposed Scheme listed as follows:

> *Objective 3: Ensure that resilience to weather extremes and longer-term adaptation needs are considered in investment programmes for planned future transport infrastructure.*
>
> *Action 17: Strengthen sectoral adaptation responses by ensuring that climate resilience is considered in appraisal guidance, including in the update to the Common Appraisal Framework, for all future transport infrastructure projects over appropriate timescales.*

On update of the NAF in 2023, it is anticipated that the sectoral adaption plans will be updated thereafter.

The furtherance of the national climate objective

The Climate Action and Low Carbon Development (Amendment) Act 2021 introduced the national climate objective which states:

> *The State shall, so as to reduce the extent of further global warming, pursue and achieve, by no later than the end of the year 2050, the transition to a climate resilient, biodiversity rich, environmentally sustainable and climate neutral economy.*

For the purpose of enabling the State to pursue and achieve the national climate objective the Act commits the development of budgets/ceilings, the CAP, the NAF and the long terms strategies as outlined in this report.

The objective of mitigating greenhouse gas emissions and adapting to the effects of climate change in the State

While not a specific policy document, this objective reflects the wider policy base addressing both climate mitigation and adaption as mandated through the policy documents listed in this section.

Meath County Development Plan 2021-2027

The Meath County Development Plan (CDP) 2021-2027 sets out the policies and objectives and the overall strategy for the development of the county over the plan period 2021-2027. Policies and Objectives relevant to Climate Change as set out in the Introduction Chapter are as follows:

- *Sustainable Development Policy INT POL1: It is the policy of the council to promote the UNs Sustainable Development Goals within Meath County Council for our customers and stakeholders through the actions and policies taken by the organisation.*
- *Climate Action Fund Policy INT POL 2: It is the policy of the council to utilise the Climate Action Fund established under the National Development Plan to facilitate public and private climate mitigation and adaptation projects in line with criteria set out by the fund at that time.*

Chapter 10 of the CDP outlines the approach to climate change adaptation and greenhouse gas mitigation and includes the following measures of relevance:

- *To support the implementation of the Climate Action Plan 2019 and to facilitate measures which seek to reduce emissions of greenhouse gases in the Electricity, Enterprise, Built Environment, Transport, Agriculture and Waste sector.*
- *To support the implementation of the Climate Action Plan 2019 and the National Climate Change Adaption Framework Building Resilience to Climate Change 2012 through the County Development Plan and through the preparation of a Climate Change Adaptation Plan in conjunction with all relevant stakeholders.*
- *To implement the Regional Spatial and Economic Strategy in regard to the following:*
  - *Compact development in locations served by public transport.*
  - *Control of speculative rural dwellings in the open countryside.*
  - *Increased residential densities adjacent to public transport nodes.*
  - *Provision of 'live work' communities.*

Specifically in relation to climate change mitigation and transport, the CDP states the following:

- *Through policies and objectives outlined in the relevant chapters of the CDP, the following areas of mitigation have been addressed in the County Development Plan:*
  - *Increasing the efficiency of the transport system and reducing the need for car ownership.*
  - *Promoting the development of 'live work' communities.*
  - *Focus on consolidation, brownfield, infill development close to public transport nodes.*
  - *Improving the infrastructure necessary for people to be able to work from home or from local technology hubs, to reduce the need for outbound commuting.*
  - *Encouraging greater uptake of public transport in the region.*
  - *Encouraging greater uptake of active transport in the region.*
  - *Encourage the uptake of electric vehicles.*

With regard to adaption, the CDP notes the climate change risk assessment which was undertaken for County Meath which examined specific impacts across a number of sectors. Policies and objectives that relates to transport address the risks identified in the risk assessment including:

- Increased damage to asphalt road surfaces in hotter temperatures.
- Sea level rise increasing the risk of flooding and erosion to coastal roads.
- Increase in magnitude and frequency of storm surges, increasing the risk of road damage and closure.
- The occurrence of more frequent flood events after heavy rainfall events damaging and closing roads across the county and damaging road infrastructure such as bridges. This could have significant knock-on implications for businesses and industry in the areas affected.
- Increase in disruption to public transport following floods and road closures and damage to public transport infrastructure, such as busses and bus terminals.

Each of the above policies has been used to inform the impact assessment presented within this chapter.

19.2.1.3 Guidance

The methodology and associated impact assessment has had regard to the general guidance regarding the undertaking of an EIA, as presented in **Section 1.3.3** of **Chapter 1 – Introduction**, and the following topic-specific guidance as follows:

- TII Climate Assessment of Proposed National Road Projects – Standard PE-ENV-01105 (December 2022) (TII, 2022a);
- TII Climate Guidance for National Roads, Light Rail, and Rural Cycleways (Offline and Greenways) – Overarching Technical Document PE-ENV-01104 (December 2022) (TII, 2022b);
- TII Road Emissions Model (REM): Model Development Report GE-ENV-01107 (December 2022) (TII, 2022c);
- TII Carbon Tool for Road and Light Rail Projects: User Guidance Document GE-ENV-01106 (December 2022) (TII, 2022d);
- EU (2021) Technical guidance on the climate proofing of Infrastructure in the Period 2021-2027 (European Commission, 2021) as noted in the TII CCR methodology guidance;
- The Institute of Environmental Management and Assessment, Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation (2nd Edition) (IEMA, 2020) as noted in the TII CCR methodology guidance;
- IEMA (2022) Guidance on 'Assessing Greenhouse Gas Emissions and Evaluating their Significance', 2nd Edition as noted in the TII GHG methodology guidance; and
- Green Construction Board Publicly Available Specification (PAS) 2080: Carbon Management in Infrastructure as noted in the TII GHG methodology guidance. [1]

19.2.2 Zone of Influence

The Zone of Influence (ZoI) for climate includes the national environment (Ireland), where the receptor is the climate and the global atmosphere. Effects arising from the potential impacts on climate are considered to impact on a national level. National, regional and local data has been considered where relevant and available. Carbon dioxide (CO_2) emissions have a global climate warming effect. This is regardless of their rate of release, location, or the weather when released into the atmosphere. This is unlike pollutants that affect local air quality where the rate of release, location, and prevailing weather, as well as the amount of pollutant, determines the local concentrations and the impact.

Local ambient concentrations of CO_2 are not relevant and there are no limits or thresholds that can be applied to particular sources of carbon emissions. Any amount of CO_2 released into the atmosphere will contribute to climate warming, the extent of which is determined by the magnitude of the release. Although CO_2 emissions are typically expressed as kilograms or tonnes per year, there is a cumulative effect of these emissions because CO_2 emissions have a warming effect which lasts for 100 years or more.

19.2.3 Sources of Information to Inform the Assessment

This analysis was undertaken by means of a desktop assessment based on available relevant guidance and information sources and other chapters of this EIAR. The following information sources have been consulted in relation to the assessment:

- Key materials, resources and cut/fill balance inputs from the description of the Proposed Scheme; see **Chapter 4 – Description of the Proposed Scheme** and **Chapter 5 – Description of the Construction Phase**;

[1] PAS (Publicly Available Specification) 2080, developed by the Construction Leadership Council's Green Construction Board (GCB), sets out the principles and components of a carbon management system and requirements on the whole value chain. A revised version of the standard is due to be published in 2023.

- Traffic data provided by the RPS Transport Team; see also **Chapter 7 – Traffic and Transport**;
- Estimates of likely waste volumes provided by the RPS Waste and Resources Team; see also **Chapter 23 – Material Assets: Resource and Waste Management**;
- Climate vulnerability and flood risk as identified in **Chapter 17 – Water**;
- Environmental Protection Agency (EPA) Greenhouse Gas Emissions Inventories and Projections;
- Global Facility for Disaster Reduction and Recovery 'Think Hazard!' tool (https://thinkhazard.org/en/);
- Met Éireann Major Weather Event Database (https://www.met.ie/climate/major-weather-events); and
- Climate Data Tool from Climate Ireland (https://www.climateireland.ie/#!/tools/climateDataExplorer).

Table 19-2 outlines the existing studies, datasets and information used to inform the assessment on climate that was collected through a detailed desktop review.

No site-specific baseline surveys were undertaken as part of the assessment for climate. The baseline data presented in this section is derived from EPA inventories and projections, and Met Éireann monitoring network, and may be taken as representative of the background conditions.

Table 19-2: Summary of Key Desktop Reports

Title	Source	Year
Ireland's Greenhouse Gas Emissions Inventory 1990-2021	EPA	2023
Ireland's Greenhouse Gas Emissions Projections 2022-2040	EPA	2023
30 Year Averages: Dublin Airport	Met Éireann	2022
Met Éireann Monthly Values for Dunsany and Dublin Airport	Met Éireann	2022
Climatological Note No. 14: A Summary of Climate Averages for Ireland 1981-2010	Met Éireann	2012

19.2.4 Key Parameters for Assessment

The following aspects of the Proposed Scheme are assessed in this chapter:

- GHG Assessment: Potential direct and indirect greenhouse gas (GHG) emissions associated with the construction and maintenance of the Proposed Scheme – this includes site clearance, embodied carbon, material transport, construction activities and waste management;
- GHG Assessment: Potential changes in GHG emissions associated with road transport during the operational phase of the Proposed Scheme; and
- CCR Assessment: Vulnerability of both the construction and operational phases of the Proposed Scheme to climate change.

A summary of the approach for each of the above aspects is provided in the following sections.

19.2.4.1 GHG Assessment: Construction and Maintenance Phase Climate Emissions

The TII Carbon Tool has been used to estimate the total GHG emissions associated with the construction of the Proposed Scheme. The tool is based on the requirements of Publicly Available Specification (PAS) 2080: Carbon Management in Infrastructure.

A review of **Chapter 5 – Description of Construction Phase** was undertaken to identify construction methods, materials and durations to allow for the collation of data to inform the Carbon Tool input data.

The following assumptions were made in the TII Carbon Tool where specific data was unavailable:

- Traditional construction methods and materials (virgin steel and other unrecycled materials and Portland cement mixes throughout) have been assumed to allow for quantification of the baseline GHG impact of the construction phase;

- Concrete (precast and poured *in-situ*) and other materials will be procured from a provider within 100 km from the Proposed Scheme;
- Earthworks volumes are based on information from **Chapter 5 – Description of Construction Phase**. The total cut volumes are used in each scenario which represent all excavation. These volumes represent the amount of excavated material on-site that can be directly used as fill. At this stage of the Proposed Scheme, all fill is assumed to be generic (i.e. no specific materials) and transported via rigid HGV for 50 km;
- Waste incurred during construction is based on the data presented in **Chapter 23 – Material Assets: Resource and Waste Management** and the primary waste stream (soil, stone, aggregate) will be transported to a suitably licensed was the facility circa 50 km from the Proposed Scheme; and
- The Proposed Scheme will not be decommissioned – estimate for decommissioning of the asset not applicable.

19.2.4.2 GHG Assessment: Operational Phase Emissions from Road Traffic

Traffic data has been supplied that quantifies the road traffic generated GHG from the Proposed Scheme. Traffic data has been supplied for all road links in the traffic study area as AADT, link length, average speed and %HGV for the baseline and future year scenarios both for Do-Minimum and Do-Something. The following scenarios are assessed in this analysis:

- 2019 baseline year;
- Opening Year 2026 Do-Minimum and Do-Something; and
- Design Year 2041 Do-Minimum and Do-Something.

Traffic data has been compiled from **Chapter 7 – Traffic and Transportation** and covers the wider road network between the M1 (east), M50 (south), N3 (west) up to the Ardee area in the north. Greenhouse Gas emissions from changes to traffic patterns as a result of traffic changes are quantified using the TII Road Emissions Model (REM). This tool includes the following traffic and fleet mix information:

- Traffic information from the TII National Transport Model which provides validated estimates of the volumes of light and heavy vehicles, and the speed at which they travel, on the National Roads Network.
- A Fleet Mix database developed by researchers in the Energy Policy and Modelling Group at University College Cork for cars based on economic projections, and for other light and heavy vehicles by AECOM. The Fleet Mix database is underpinned by the Central Statistics Office's goods vehicles registration data (both heavy and light goods vehicles).
- Emission Rate Database derived from the European Environment Agency's (EEA) COPERT Emissions Tool - the EU industry standard vehicle emissions calculator – published in the EMEP/EEA air pollutant emission inventory guidebook. These data were adjusted further using data published in the UK by DEFRA.

The REM calculates road transport emissions integrating traffic volumes/speeds for light and heavy vehicles on the national road network with Irish fleet composition information.

The traffic data for the Proposed Scheme have been input to the model to generate vehicle emissions for total national emissions. The tool does this by multiplying together the classified vehicles in the default Fleet Mix Database with the speed-based emission rates in the specified Emissions Rate Database and the Proposed Scheme traffic flows.

Under EU and national policy on electric vehicles and fuel and engine technology, the proportions of the different vehicle classifications (EURO classification) will change over time because it is expected the fleet will move towards increased adoption of newer and relatively lower emission vehicles in the future, including greater uptake of hybrid (HEV), battery-electric (BEV) and alternative fuelled vehicles. The extent of this change is unknown, so the results are generated for three separate Fleet Databased scenarios within the REM model as follows:

- Business as Usual (BaU) scenario, i.e. excluding strategic policy interventions for reduction of CO_2, etc, and based on existing trends in vehicle purchasing and turnover of vehicles out of the vehicle fleet;

- Climate Action Plan (CAP) based on achieving increases in EVs including 151,000 passenger car EV and PHEVs by 2025 and 840,000 passenger car EV and PHEVs by 2030; and
- An intermediate case using linear extrapolation to a central value between BaU and CAP for each vehicle sub-classification.

The BaU represents a scenario whereby there is no progression in reducing the average tailpipe GHG emissions per vehicle while the CAP scenario assumes a full implementation of current CAP policy and targets. Results for all three scenarios are presented within this assessment.

19.2.4.3 CCR Assessment: Vulnerability of the Proposed Scheme to Climate Change

The TII guidelines for CCR outlines an approach for undertaking a risk assessment where there is a potentially significant impact on the Proposed Scheme due to climate change. The risk assessment assesses the sensitivity and exposure of the impact occurring to a receptor, leading to the evaluation of the significance of the impact. This is also considered in **Chapter 24 – Risk of Major Accidents and/or Disasters**.

The assessment methodology is a two-stage process with the first stage is a climate vulnerability assessment and if the results of this first phase indicate the climate hazard is a vulnerability, then the second stage of the assessment is carried out and referred to as a climate change risk assessment.

The Stage 1 Vulnerability Analysis is a combination of sensitivity analysis and exposure analysis and is undertaken through the following methodology:

- In undertaking the sensitivity analysis, the asset categories and climate hazards to be considered in the climate screening must be identified and the list of asset categories and climate hazards include:
  - Asset categories - Pavements; drainage; structures; utilities; landscaping; signs, light posts, associated auxiliary buildings, and fences; and
  - Climate hazards - Flooding (coastal); flooding (pluvial); flooding (fluvial); extreme heat; extreme cold; wildfire; drought; extreme wind; lightning and hail; fog.
- Determine the sensitivity (low, medium, or high) of each asset category to each of the climate hazards by assigning a sensitivity score of 1 to 3.
- Using the historic climate data, assess the level of exposure for each climate hazard within the Proposed Scheme.
- Take the product of sensitivity and exposure, for each climate hazard and each asset category identified. Any climate hazards with vulnerabilities marked as high have been included in the Stage 2 detailed climate change risk assessment.

The Stage 2 climate change risk assessment is a combination of a likelihood analysis and impact analysis:

- The asset categories considered in the climate screening have formed the key project receptors in this assessment as well as any critical connecting infrastructure and significant parts of the surrounding environment.
- Define the climate baseline (historic extreme climate events) using historic climate conditions and gathering climate change projection data to understand future climate conditions.
- The probability levels of future climate projections are determined for the CCR Assessment using relevant resources such as Climate Ireland.[2]
- The climate data gathered is used to identify climate-related risks to the project to generate a comprehensive list of risks based on the climate change hazards that have been deemed relevant to the Proposed Scheme and location.

[2] Climate Data Tool from Climate Ireland. Available at: https://www.climateireland.ie/#!/

19.2.5 Assessment Criteria and Significance

19.2.5.1 National Targets and Objective

On 14th May 2018, the European Council adopted a regulation (EU 2018/842 – the Effort Sharing Regulation) on greenhouse gas emission reductions. The regulation sets out binding emission reduction targets for member states in sectors falling outside the scope of the EU emissions trading system for the period 2021-2030.

In April 2023 the Effort Sharing Regulation was amended (EU 2023/857) and Ireland's new 2030 target under the Effort Sharing Regulation is to limit its greenhouse gas emissions by at least 42% by 2030. New binding annual emission limits for 2023 to 2030 for the 42% reduction will be set by the EU later in 2023.

19.2.5.2 Carbon Budgets

Ireland's national emission reduction objectives, as set in the Climate Action and Low Carbon Development (Amendment) Act 2021, are to achieve a 51% emissions reduction by 2030 compared to 2018 and achieve a climate neutral economy by no later than the end of 2050.

The Climate Action and Low Carbon Development (Amendment) Act 2021 provides for the establishment of carbon budgets in support achieving Ireland's climate ambition. The carbon budget programme, comprising three 5-year budgets came into effect on 6 April 2022 for the following periods:

- Budget 1 from 2021-2025 has been set at 295 Mt CO_2e representing an average of 4.8% reduction per annum for the first budget period;
- Budget 2 from 2026-2030 has been set at 200 Mt CO_2e representing an average of 8.3% reduction per annum for the second budget period; and
- Budget 3 from 2031-2035 has been set at 151 Mt CO_2e representing an average of 3.5% reduction per annum for the third provisional budget.

To deliver these targets, in July 2022 the government has established Sectoral Emissions Ceilings which set maximum limits on greenhouse gas emissions for each sector of the Irish economy to the end of the decade. For transport, the 2030 ceiling is 6 Mt CO_2e which represents a 50% reduction on 2018 levels (12 Mt CO_2e). Further details were provided in the September 2022 Sectoral Emissions Ceilings Summary Report[3] and these are summarised in **Table 19-3** for the transport sector.

Table 19-3: Transport Sectoral Emissions Ceilings

Period	GHG (Mt CO_2e)
2018 Baseline	12
Sectoral Emission Ceilings for 2021-2025 (for the 5-year period)	54
Sectoral Emission Ceilings for 2026-2030 (for the 5-year period)	37
Indicative Emissions in Final Year of 2021-2025 carbon budget period (Mt CO_2e)	10
Indicative Reduction in Emissions in Final Year of 2021-2025 budget period compared to 2018	~20%
Emissions in final year of 2026-20230 carbon budget period (Mt CO_2e)	6
Reduction in Emissions final year of 2026-2030 carbon budget period compared to 2018	~50%
Agreed CAP21 Ranges	40-50%

19.2.5.3 Assessment Criteria for GHG Assessment

The 2022 TII guidelines state that the climate assessment is not solely based on whether a project emits GHG emissions alone but how it makes a relative contribution towards achieving a science based 1.5°C aligned transition towards net zero (as recommended in the 2022 IEMA guidance). The guidance states that

[3] Link: https://www.gov.ie/en/publication/76864-sectoral-emissions-ceilings/

the impact assessment must give regard to two major considerations when assessing the significance of a project GHG emissions including:

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

The TII criteria for defining magnitude in this chapter for the GHG Assessment are outlined in **Table 19-4**.

Ireland's national sectoral carbon budgets (refer **Table 19-3**) are used to contextualise the magnitude of GHG emissions from the operation phase of the Proposed Scheme in order to demonstrate the level of impact of additional transport related GHG emissions on Ireland's ability to meet its reduction targets.

For the operational phase transport emissions, the target to achieve a 50% reduction in emissions by 2030 relative to 2018 will be used to inform the significance analysis for this phase.

It is noted that the TII guidance does not differentiate between the assessment criteria presented for the construction phase (materials, transport and plant use) and operation phase (traffic related). However, the context for impact varies between both phases as while the operational transport impacts may be directly assessed against the State's transport emission ceilings, these ceilings do not relate to construction activities. A CAP23 target with greater relevance to the construction phase is the commitment to decrease embodied carbon in construction materials produced and used in Ireland by at least 30% by 2030.

As such, the impacts of both phases are compared against the criteria in **Table 19-4** but against separate CAP23 targets for emissions reductions.

Table 19-4: TII Significance Matrix for the GHG Assessment

Effects	Magnitude of Impact	Definition
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 provide reductions required by local or national policies; and • 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; and • 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; and • 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; and • 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; and • Well 'ahead of the curve' for Ireland's trajectory towards net zero, provides a positive climate impact.

19.2.5.4 Assessment Criteria for CCR Assessment

The CCR Assessment is undertaken in two phases with an initial climate screening phase followed by a more detailed analysis. The detailed analysis is subject to the outcome of the screening phase, which helps ensure that the cost and effort associated with climate proofing is proportional to the benefits. The climate screening is intended to provide an indication of the project's vulnerability to climate change. The screening is broken down into three steps: a sensitivity analysis; an exposure analysis; and when combined make up the vulnerability assessment.

To undertake the sensitivity analysis, a score is applied for each asset category (pavements, drainage, structures, earthworks, etc.) against each climate hazard (flooding, extreme temperature, etc.). **Table 19-5** provides the definitions and scoring used when assessing sensitivity.

Table 19-5: Sensitivity Definition and Scoring

Level	Definition	Scoring
High sensitivity	The climate hazard will or is likely to have a major impact on the asset category.	**3**
Medium sensitivity	It is possible or likely the climate hazard will have a moderate impact on the asset category.	**2**
Low sensitivity	It is possible the climate hazard will have a low or negligible impact on the asset category.	**1**

The aim of the exposure analysis is to identify which climate hazards are relevant to the planned project location e.g. flooding could represent a significant hazard for a project located next to a river in a floodplain. Therefore, whilst sensitivity analysis focuses on the type of project, exposure focuses on location. The hazards assessed are the same as those used for the sensitivity analysis.

To undertake the exposure analysis, an exposure score is applied for each climate hazard at the project location. The allocation of exposure level is informed by the high-level climate data collected. **Table 19-6** shows the exposure definitions and scoring.

Table 19-6: Exposure Definition and Scoring

Level	Definition	Scoring
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.	**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.	**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.	**1**

The vulnerability assessment combines the outcomes of the sensitivity and exposure analysis with the aim to identify the key vulnerabilities and the potentially significant climate hazards associated with the Proposed Scheme. To complete the vulnerability assessment, the product of sensitivity and exposure for each climate hazard and each asset category identified and mapped as per **Table 19-7**.

Table 19-7: Vulnerability Matrix

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

Any high vulnerabilities (score >5) are then subjected to the second stage - a climate risk assessment using a combination of likelihood analysis and impact analysis. The likelihood analysis looks at how likely the identified climate hazards are to occur within a given timescale. **Table 19-8** presents the likelihood analysis key used for this assessment.

Table 19-8: Likelihood Analysis Key

Term	Qualitative	Quantitative
Rare	Highly unlikely to occur	5%
Unlikely	Unlikely to occur	20%
Moderate	As likely to occur as not	50%
Likely	Likely to occur	80%
Almost certain	Very likely to occur	95%

The impact analysis investigates the consequences of the climate hazards and also refers to the severity and magnitude. **Table 19-9** provides guidance to ranking the risk areas and this table was taken from the European Commission (2021) technical guidance on the climate-proofing of infrastructure in the period 2021-2027.

Table 19-9: Consequence Analysis Key

Risk areas	Insignificant	Minor	Moderate	Major	Catastrophic
Asset damage, engineering, operational	Impact can be absorbed through normal activity	Adverse event that can be absorbed by taking business continuity actions	A serious event that requires additional emergency business continuity actions	A critical event that requires extraordinary / emergency business continuity action	Disaster with the potential to lead to shut down or collapse or loss of the asset / network
Health and safety	First aid case	Minor injury, medical treatment	Serious injury or lost work	Major or multiple injuries, permanent injury or disability	Single or multiple fatalities
Environment	No impact on baseline environment. Localised in the source area. No recovery required	Localised within site boundaries. Recovery measurable within one month of impact	Moderate harm with possible wider effect Recovery in one year	Significant harm with local effect Recovery longer than one year. Failure to comply with environmental regulations / consent	Significant harm with widespread effect. Recovery longer than one year. Limited prospect of full recovery
Social	No negative social impact	Localised, temporary social impacts	Localised, long-term social impacts	Failure to protect poor or vulnerable groups. National, long- term social impacts	Loss of social license to operate. Community protests
Financial	x % internal rate of return (IRR) < 2% of turnover	x % IRR 2-10% of turnover	x % IRR 10-25% of turnover	x % IRR 25-50% of turnover	x % IRR > 50% of turnover
Reputational	Localised, temporary impact on public opinion	Localised, short-term impact on public opinion	Local, long-term impact on public opinion with adverse local media coverage	National, short- term impact on public opinion. negative national media coverage	National, long-term impact with potential to affect the stability of the government
Cultural Heritage and cultural premises	Insignificant impact	Short-term impact. Possible recovery or repair	Serious damage with a wider impact to tourism industry	Significant damage with national and international impact	Permanent loss with resulting impact on society

Table 19-10 presents summary outcome of the assessment of likelihood and consequence of each climate hazard in the form of a climate risk matrix.

Table 19-10: Climate Risk Matrix

Likelihood	Magnitude of Consequence					
		Insignificant	Minor	Moderate	Major	Catastrophic
	Rare	Low	Low	Medium	High	Extreme
	Unlikely	Low	Medium	Medium	High	Extreme
	Moderate	Low	High	High	Extreme	Extreme
	Likely	Medium	High	High	Extreme	Extreme
	Almost Certain	High	High	Extreme	Extreme	Extreme

19.2.6 Data Limitations

Certain difficulties were encountered during the quantification of materials at the design stage in order to assess the embodied construction carbon. The exact volumes of materials, location of waste disposal sites, sourcing of products and technical specification for materials are finalised during the detailed design phase and by the appointed contractor. Throughout the assessment, efforts have been made to provide the most likely scenario of the embodied carbon assessment. Where it is required to make assumptions as the basis of the assessment presented here, these assumptions are based on advice from competent project designers and are clearly outlined within the chapter. It is considered that the volumes of materials, locations, specifications and other estimates contained in this chapter are robust and that same represent the likely figures, locations, specifications and volumes which will result from the development herein.

19.3 Description of Existing Environment

19.3.1 Current Environment and climate change

19.3.1.1 Macroclimate

The Climate Ireland website (https://www.climateireland.ie/#!/) provides the most up-to-date information on Ireland's changing climate for a wide range of variables and across atmospheric, terrestrial and oceanic domains. This website collates the latest research on historic and projected climate trends in Ireland and is used as the reference for the macroclimate within the State.

In particular, the EPA Research Report No. 386 'The Status of Ireland's Climate, 2020' (Walther C.A. Cámaro García and Ned Dwyer) is used as a reference and this report notes the following:

Atmosphere

- Measurements of the main greenhouse gases – carbon dioxide, methane and nitrous oxide – at Mace Head, Co. Galway, show continued increases in levels, and those measured in 2019 are the highest observed since measurements began.
- Background carbon dioxide concentrations are now at 413 parts per million (ppm), which is estimated to be 50% higher than those of the pre-industrial era, while those of methane are at 1,940 parts per billion (ppb), representing an approximately 170% increase compared with pre-industrial levels. Nitrous oxide concentrations are now above 330 ppb, which is a 20% increase compared with pre-industrial levels.
- Concentrations of chlorofluorocarbons (CFCs) have been dropping since 2004, following the implementation of the Montreal Protocol in 1989, banning the production and use of CFCs.
- The annual average surface air temperature in Ireland has increased by approximately 0.9 °C over the last 120 years, with a rise in temperatures being observed in all seasons. This compares with a global average temperature estimated to be 1.1 °C above pre-industrial levels.
- The number of warm spell days has increased slightly over the last 60 years, with very little change in cold spell duration. This is in line with what has been observed in many regions of the world.

- Annual precipitation was 6% higher in the period 1989–2018, compared with the 30-year period 1961–1990, and the decade 2006–2015 has been the wettest on record. An overall increase in precipitation has been observed across northern hemisphere mid-latitude land areas during the last 70 years.
- Analysis of wet and dry spells demonstrates an increase in the length of wet spell days across the country. No trend is apparent in dry spell days.

Ocean

- Satellite observations indicate that the sea level around Ireland has risen by approximately 2–3 mm per year since the early 1990s, and analysis of sea level data from Dublin Bay show a rise of approximately 1.7 mm per year since 1938, consistent with global average rates.
- The average sea surface temperature measured at Malin Head was 0.47 °C higher over the last 10 years compared with the period 1981–2010.
- Measurements in the surface waters to the west of Ireland between 1991 and 2013 indicate an increase in ocean acidity that is comparable to the rate of change in other global ocean time series.
- Observations of some potentially harmful phytoplankton species since 1990 show an expansion of their growth season, with their presence being observed in almost all winter months since 2010.

Terrestrial

- River flows are generally increasing, although, when more recent data for a shorter period have been analysed, there are indications that flows may be decreasing in the south and east of the country.
- Land cover observations since 1990 show increases in the areas covered by artificial surfaces and forest, while there is a decrease in wetland areas. The volume of growing stock in forests increased by 38% over the period 2006–2017, thereby increasing the amount of carbon sequestered in forests. Long-term carbon storage in forests will be determined by the dynamic balance between growth and harvesting rates.
- The area of burned vegetation is generally in the range of between 4000 and 6000 ha annually, although over 10,000 ha is estimated to have been burned in 2017, with the bulk of fire activity taking place between March and June each year.
- In 2018, carbon dioxide emissions were almost 18% higher than in 1990, primarily due to increased fossil fuel combustion in transport and energy industries; emissions of methane were just over 5% lower, although emissions from agriculture increased by 1.6% over the same period. Nitrous oxide emissions decreased by 10% over the period, mainly because of reductions in the use of synthetic fertiliser and animal manure in agriculture.

The climate projections for the next century indicate that observed climate trends will continue and intensify over the coming decades including the following:

- Changes in wind speeds and storm tracks;
- Increased likelihood of river and coastal flooding;
- Changes in distribution of plant and animal species and in the phenology (the timing of lifecycle events) of native species;
- Water stress for crops, pressure on water supply and adverse impacts on water quality; and
- Negative impacts on human health and wellbeing.

These changes are well established with the extent of the relative changes having been accurately predicted by the climate scientists for all parts of the country. The design of the Proposed Scheme has accounted for these predicted changes in flooding, extreme weather etc. to ensure that the Proposed Scheme remains resilient to these changes.

19.3.1.2 Microclimate

The World Meteorological Organisation (WMO) defines climate as the average weather over an extended period of 30 years. This period is used as it is considered long enough to account for year-to-year variations. Therefore, the existing climate for the environs around Slane is estimated using 30-year (1981-2010) average meteorological data from Met Éireann.

The Proposed Scheme is situated close to the east coast, with Slane village situated along the River Boyne, approximately 20 km inland from the coast of the Irish Sea. The nearest Met Éireann meteorological station to the Proposed Scheme which records monthly data is the station located at Dunsany, County Meath, which lies approximately 19 km south-west of Slane and approximately 30 km inland from the east coast. No 30-year averages are available for Dunsany.

The nearest Met Éireann meteorological station to the scheme in terms of 30-year averages for climate and weather data which would be representative of climate in the vicinity of the Proposed Scheme is the station situated at Dublin Airport, which lies approximately 35 km south-east of Slane and approximately 10 km from the east coast. The 30-year average meteorological data[4] from the station at Dublin Airport is presented in **Table 19-11** for each of the past three 30-year average periods. The data shows limited variation for temperature, humidity and sunshine but there is a trend of increasing rainfall (circa 3% increase) and average wind speed (circa 4% increase) in the period 1981-2010 relative to 1961-1990.

Table 19-11: 30 Year Average Meteorological Data from Dublin Airport

Parameter	30-Year Average		
	1961-1990	1971-2000	1981-2010
Mean Temperature (°C)	9.6	9.8	9.8
Mean Relative Humidity at 09:00 UTC* (%)	82.0	82.4	83.0
Mean Daily Sunshine Duration (Hours)	3.9	3.9	3.9
Mean Annual Total Rainfall (mm)	732.7	734.7	758.0
Mean Wind Speed (knots)	9.9	10.0	10.3

Source: *Met Éireann. Available at: https://www.met.ie/climate-ireland/1981-2010/dublin.html (Accessed March 2022)*

** UTC: International abbreviation for 'Coordinated Universal Time', the successor to Greenwich Meantime (GMT).*

Note that the data presented in **Table 19-11** is the latest data published by Met Éireann and no data to 2020 is available at this point. In the interim, the EPA has noted a number of observed climate change impacts nationally including the observation that last five-year (2015–2019) and ten-year (2010–2019) average temperatures are the warmest on record and 2019 was the ninth consecutive year with temperatures above normal in Ireland.

At Dublin Airport, the 30-year record for temperature presented in **Table 19-12** shows that the average daily temperature across a calendar year is 9.8 °C with an average maximum of 13.3 °C and an average minimum of 6.4 °C. Across the calendar year the average number of days with air frost[5] is 29.4.

Table 19-12: 30-Year Average Data for Temperature at Dublin Airport (Annual Values from 1981-2010)

Temperature (°C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean Daily Max.	8.1	8.3	10.2	12.1	14.8	17.6	19.5	19.2	17.0	13.6	10.3	8.3	**13.3**
Mean Daily Min.	2.4	2.3	3.4	4.6	6.9	9.6	11.7	11.5	9.8	7.3	4.5	2.8	**6.4**
Mean Temperature	5.3	5.3	6.8	8.3	10.9	13.6	15.6	15.3	13.4	10.5	7.4	5.6	**9.8**
Mean No. of Days with Air Frost	6.4	6.5	3.8	2.4	0.3	0.0	0.0	0.0	0.0	0.5	3.0	6.4	**29.4**

Source: *Met Éireann. Available at: https://www.met.ie/climate-ireland/1981-2010/dublin.html (Accessed March 2022)*

Table 19-13 shows the monthly values for temperature across a calendar year at Dunsany for 2019 through to the end of May 2022. The yearly long-term average (LTA) temperature for this period is 9.3 °C with a highest average maximum temperature of 9.9 °C seen in 2021, and a lowest average minimum temperature of 9.6 °C seen in 2020.

[4] Met Éireann is due to release updated 30-year average meteorological data in 2022 (yet to be published at time of writing) - https://www.met.ie/climate/30-year-averages

[5] Defined by the UK Met Office as: "*An air frost is usually defined as the air temperature being below freezing point of water at a height of at least one metre above the ground*." Available at: https://www.metoffice.gov.uk/weather/learn-about/weather/types-of-weather/frost-and-ice/frost

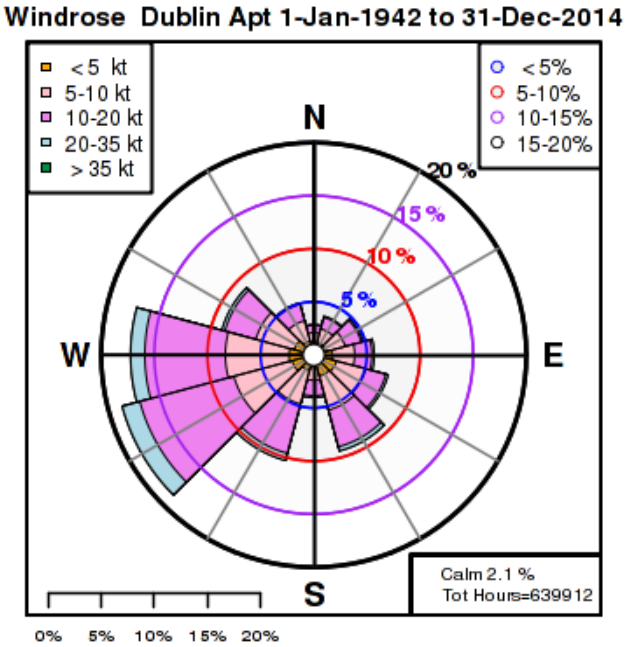
At Dublin Airport for the period 2019 through to the end of May 2022, the yearly LTA temperature is 9.7°C with a highest average maximum of 9.8 °C recorded in 2021, and a lowest average minimum of 9.6 °C recorded in 2019 and 2020.

Table 19-13: Monthly Values for Mean Temperature for Dunsany and Dublin Airport (2019-2022)

Temperature (°C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Dunsany													
2022	5.1	6.3	7.0	7.9	12.1	–	–	–	–	–	–	–	**7.7**
2021	3.5	6.1	7.4	6.4	9.4	13.9	16.9	14.9	14.7	11.5	7.6	6.6	**9.9**
2020	5.8	5.5	6.0	9.2	11.7	13.6	14.3	14.9	12.9	9.3	7.9	4.5	**9.6**
2019	5.0	7.0	6.9	8.4	10.5	12.8	16.2	15.4	13.0	9.0	5.9	5.6	**9.7**
LTA	4.6	4.9	6.2	7.8	10.5	13.0	15.2	14.7	13.0	9.6	6.7	5.1	**9.3**
Dublin Airport													
2022	5.4	6.7	6.6	7.6	11.9	–	–	–	–	–	–	–	**7.6**
2021	3.9	6.2	7.2	5.6	9.2	13.7	16.1	14.7	14.7	11.9	7.6	6.5	**9.8**
2020	6.3	5.8	5.8	8.5	10.9	13.4	14.4	14.7	12.8	9.5	8.2	4.9	**9.6**
2019	5.1	7.0	7.3	8.0	10.2	12.5	15.9	15.4	13.0	9.1	6.0	5.9	**9.6**
LTA	5.3	5.3	6.7	8.1	10.7	13.4	15.4	15.1	13.1	10.3	7.3	5.6	**9.7**

Source: *Met Éireann. Available at: https://www.met.ie/climate/available-data/monthly-data (Accessed March 2022)*

The prevailing wind direction for the area is between north-west and south-west (5-20%) as presented in the wind-rose for Dublin Airport Meteorological Station for 1942-2014 in **Figure 19.1**. North and north-easterly winds tend to be very infrequent (less than 5%), with easterly and south-easterly winds more frequent (5-9%).



Source: *Met Éireann. Available at: https://www.met.ie/climate/what-we-measure/wind*

Figure 19.1: Wind-rose for the Dublin Airport Meteorological Station (1942-2014)

Wind characteristics are typically moderate with relatively infrequent gales with an average of 8.2 days with gales per annum and an average maximum wind gust of 80 knots during the period as illustrated in **Table 19-14**.

The highest levels of gales and gusts were both recorded on average in the month of January, with an average of 2.3 days of gales recorded, and an average maximum wind gust of 80 knots.

Table 19-14: 30-Year Average Data for Wind at Dublin Airport (Annual Values from 1981-2010)

Wind	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean Monthly Speed (Knots)	12.5	12.0	11.6	9.9	9.2	8.6	8.7	8.7	9.2	10.4	11.0	11.3	**10.3**
Max. Gust (Knots)	80	73	66	59	58	53	54	56	59	69	66	76	**80**
Mean No. of Days with Gales	2.3	1.5	1.1	0.1	0.1	0.1	0.1	0.1	0.2	0.5	0.8	1.3	**8.2**

Source: *Met Éireann. Available at: https://www.met.ie/climate-ireland/1981-2010/dublin.html (Accessed March 2022)*

The 30-year average rainfall for Dublin Airport is 758.0 mm. This is further broken down into monthly averages in **Table 19-15**, with the highest monthly total average for the period recorded in October (79.0 mm). The greatest daily average total of rain is recorded per year for the period is 73.9 mm, with greatest daily average for rainfall generally observed in the month of June (also noted as 73.9 mm) with moderately frequent days with ≥ 5.0 mm rainfall recorded per annum (42 days).

Table 19-15: 30-Year Average Data for Rainfall at Dublin Airport (Annual Values from 1981-2010)

Rainfall (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean Monthly Total	62.6	48.8	52.7	54.1	59.5	66.7	56.2	73.3	59.5	79.0	72.9	72.7	**758.0**
Greatest Daily Total	27.1	28.1	35.8	30.4	42.1	73.9	39.2	72.2	40.6	53.2	62.8	42.4	**73.9**
Mean No. Days with ≥ 5.0 mm	4	3	3	3	3	3	3	4	4	4	4	4	**42**

Source: *Met Éireann. Available at: https://www.met.ie/climate-ireland/1981-2010/dublin.html (Accessed March 2022)*

Table 19-16 shows the monthly values for rainfall (mm) across a calendar year at both Dunsany and Dublin Airport for 2019 through to the end of May 2022. The long-term average (LTA) rainfall for this period at Dunsany is 869.7 mm with an average maximum of 952.6 mm observed in 2019 and an average minimum of 815.8 mm observed in 2021. The LTA rainfall for this period at Dublin Airport is 757.9 mm with an average maximum of 886.1 mm observed in 2019 and an average minimum of 666.6 mm observed in 2021.

Table 19-16: Monthly Values for Total Rainfall for Dunsany and Dublin Airport (2019-2022)

Rainfall (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Dunsany													
2022	29.5	118.1	38.2	35.3	63.8	–	–	–	–	–	–	–	**284.9**
2021	104.7	100.4	46.0	11.8	106.7	12.6	96.1	53.3	37.7	101.7	30.2	114.6	**815.8**
2020	55.1	157.1	47.1	19.3	14.2	76.9	130.9	99.2	69.0	86.1	73.4	89.0	**917.3**
2019	38.2	34.5	109.4	73.1	39.8	78.1	35.3	123.9	125.0	75.0	154.0	66.3	**952.6**
LTA	80.2	59.7	63.4	61.1	65.1	71.5	61.4	77.7	71.8	90.6	84.0	83.2	**869.7**
Dublin Airport													
2022	14.4	88.5	45.6	28.1	48.4	–	–	–	–	–	–	–	**225.0**
2021	115.1	55.0	32.1	10.8	83.5	12.6	72.9	65.3	42.0	79.8	11.7	85.8	**666.6**
2020	36.0	130.4	31.8	12.8	9.3	69.6	98.9	87.1	60.9	80.6	48.1	83.1	**748.6**
2019	26.8	30.5	92.5	74.6	33.4	82.9	41.0	91.9	104.6	77.2	173.0	57.7	**886.1**
LTA	62.6	48.8	52.6	54.1	59.5	66.7	56.2	73.3	59.5	79.0	72.9	72.7	**757.9**

Source: *Met Éireann. https://www.met.ie/climate/available-data/monthly-data (Accessed March 2022)*

The scheme must consider weather events relating to extreme temperatures, wind, rain and events (storms, snow etc.) that may disrupt operations. **Table 19-17** displays the mean number of days per annum on average across the 30-year average a weather event occurs. Snow lying at 09:00 UTC is most infrequent, occurring on average 3.4 days per annum, posing a low risk to operations. Fog is the most frequent weather event observed at the Dublin Airport monitoring location during the 30-year average records, occurring on average 41.5 days per annum.

Table 19-17: 30-Year Average Data for Weather Events at Dublin Airport (Annual Values from 1981-2010)

Weather (mean No. of days with)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Snow or Sleet	4.6	4.2	2.8	1.2	0.2	0.0	0.0	0.0	0.0	0.0	0.8	2.9	**16.6**
Snow lying at 09:00 UTC	1.6	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.9	**3.4**
Hail	1.2	1.5	2.0	1.9	1.3	0.1	0.2	0.1	0.1	0.3	0.3	0.7	**9.7**
Thunder	0.3	0.2	0.3	0.2	0.9	0.8	0.8	0.9	0.3	0.3	0.2	0.2	**5.5**
Fog	3.3	3.1	3.6	3.6	3.4	2.8	3.3	3.8	4.2	3.2	3.1	4.1	**41.5**

Source: *Met Éireann. Available at: https://www.met.ie/climate-ireland/1981-2010/dublin.html (Accessed March 2022)*

19.3.1.3 Existing Carbon Sources in the Area (Baseline National Emissions)

Greenhouse Gases (GHG) in the atmosphere are rising as a result of human activity, largely emanating from the agricultural, transport, energy and residential sectors. The main existing sources of GHG in the vicinity of the Proposed Scheme and the ZoI (local and national extents) are from existing road traffic, rail, shipping, agriculture, energy, residential space heating, commercial and industrial activity and waste facilities.

At a national level, according to Ireland's Final Greenhouse Gas Emissions 1990-2021 report (EPA, 2023), emissions of GHGs in Ireland in 2021 are 62.11 million tonnes (Mt) carbon dioxide equivalents (CO_2e). This is 5.2% higher than emissions in 2020 and 1.5% higher than pre-pandemic 2019 figures. Increased emissions in 2021 compared to 2020 were observed in the largest sectors including agriculture (3.6%), transport (6.7%) and energy (17.6%).

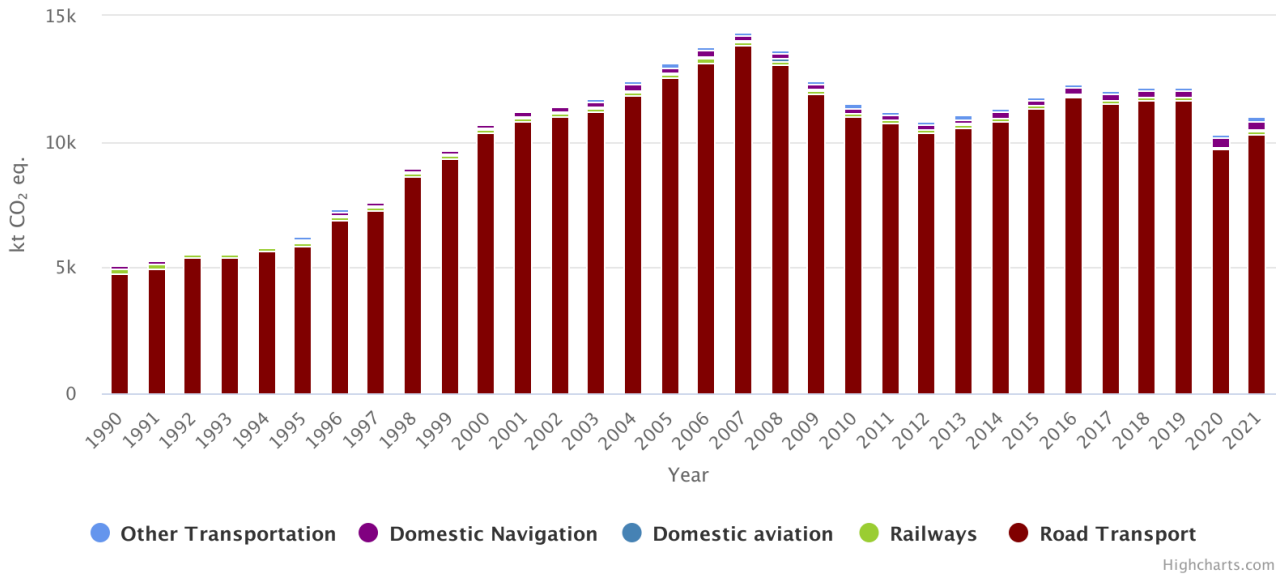
The greenhouse gas emission inventory for 2021 is the first of ten years over which compliance with targets set in the European Union's Effort Sharing Regulation (EU 2018/842) will be assessed. This Regulation sets 2030 targets for emissions outside of the Emissions Trading Scheme (known as ESR emissions) and annual binding national limits for the period 2021-2030. Ireland's target is to reduce ESR emissions by 30% by 2030 compared with 2005 levels, with a number of flexibilities available to assist in achieving this target.

Ireland's ESR emissions annual limit for 2021 is 43.48 Mt CO_2e. Ireland's 2021 greenhouse gas ESR emissions are 46.77 Mt CO_2e. This is 3.29 Mt CO_2e more than the annual limit for 2021. This indicates that Ireland is not in compliance with its 2021 Effort Sharing Regulation annual limit, exceeding the allocation by 1.38 Mt CO_2e after using the ETS flexibility.

Greenhouse gas emissions from the Transport sector increased by 6.7% or 0.69 Mt CO_2e in 2021 relative to 2020. This increase was largely driven by ending COVID travel restrictions on passenger car and public transport usage. By the end of 2021 there were 47,000 electric vehicles in Ireland, ahead of the Climate Action Plan trajectory. The trend in transport emissions from 1990 to 2021 are shown in **Figure 19.2**. The figures shows that the emissions are dominated by road transport and levels have largely stabilised in the past decade with no meaningful reduction observed.

The dynamics of this trend is a balance between the total kilometres travelled on the national road (dictated by the number of cars and the distances travelled) along with other factors such as improved vehicle fuel efficiency, the increased use of biofuels and a significant decrease in fuel tourism in recent years.

The EPA report that at the end of 2021, there were just under 47,000 battery electric (BEVs) and plug-in hybrid electric (PHEVs) vehicles in Ireland, approximately 24% (compared to 14% in 2020) of the 2025 policy target of 195,300 or <5% of the 2030 policy target of 945,000 vehicles.



Source: *EPA, Greenhouse gas emissions (GHG) – Transport. Available at:* *https://www.epa.ie/our-services/monitoring--assessment/climate-change/ghg/transport/#:~:text=Between%201990%20and%202021%2C%20Transport,road%20transport%20increasing%20by%20115.7%25*

Figure 19.2: Transport Emissions 1990-2021

19.3.1.4 Road Traffic GHG from the Existing Road Network

Existing traffic data for the Proposed Scheme has been compiled from **Chapter 7** of the EIAR. The traffic model is a wide area model and covers the wider road network between the M1 (east), M50 (south), N3 (west) up to the Ardee area in the north. As such, the calculated emissions capture the macro-scale levels of GHG emissions in the north-east of the country. Using the TII Road Emissions Model the estimated emissions for 2019 baseline traffic is presented in **Table 19-18.**

Table 19-18: 2019 Baseline GHG Emissions from Road Transport

Scenario	Total Emissions (tonnes CO_2e)
2019 Baseline	997,369

19.3.1.5 Climate Vulnerability

Details of current climate hazards impacting the area have been derived from the Global Facility for Disaster Reduction and Recovery 'Think Hazard!' tool[6] with data specific to County Meath extracted from the tool. This data is supplemented as required with information from the Office of Public Works (OPW) FloodInfo.ie resource. This data is summarised in **Table 19-19** to illustrate the current climate hazard threat to the area of the Proposed Scheme. A more detailed appraisal of flood risk for the Proposed Scheme is presented in **Chapter 17 – Water** and in **Appendix 17.2 – Flood Risk Assessment**.

Table 19-19: Observed Hazard Level in the area of the Proposed Scheme

Hazard Type	Hazard Level
Coastal Flood	High - potentially-damaging waves are expected to flood the coast at least once in the next 10 years. This is confirmed by the CFRAM mapping for the area which shows the Boyne as a High Probability coastal flood even risk, i.e. approximately a 1-in-a-10 chance of occurring or being exceeded in any given year.

[6] Global Facility for Disaster Reduction and Recovery 'Think Hazard!' tool. Available at: https://thinkhazard.org/en/

Hazard Type	Hazard Level
Pluvial Flood	The CFRAM mapping for the area indicates no risk from pluvial flooding.
Fluvial Flood	Low - that there is a chance of more than 1% that potentially damaging and life-threatening river floods occur in the coming 10 years (return period of c. 1 in 1000 years). However, the CFRAM mapping for the area indicates that the Boyne has a high probability of localised river flooding, i.e. approximately a 1-in-a-10 chance of occurring or being exceeded in any given year. There is documented previous flooding incidents from the River Boyne in the vicinity of the Proposed Scheme in February 1990 and in November 2002. Flood Mapping from Meath County Council also predicts flooding at the Mooretown Stream.
Extreme Heat	Low - there is between a 5% and 25% chance that at least one period of prolonged exposure to extreme heat, resulting in heat stress, will occur in the next five years.
Wildfire	Medium - there is between a 10% and 50% chance of experiencing weather that could support a hazardous wildfire that may poses some risk of life and property loss in any given year.
Landslide	Very Low - this area has rainfall patterns, terrain slope, geology, soil and land cover that make localized landslides a rare hazard phenomenon.

In addition to the hazard types listed in **Table 19-19**, this analysis also has due regard for past major weather events which are used to inform future potential hazards and adaption. **Table 19-20** presents a list of historically recorded extreme weather events recorded nationally which have been derived from the Met Éireann Major Weather Events database.

Table 19-20: Major Weather Events

Year	Event	Climate Hazard
2022	Highest Temperature Recorded in Ireland since 1887 (July 2022)	High Temperature
2022	Storm Eunice	Strong Wind
2021	Storm Barra	Strong Wind
2020	Storm Ellen	Strong Wind
2018	Heatwaves and Drought	High Temperature
2018	Snowstorm Emma & Beast from the East	Snowfall
2018	Storm Doris	Strong Wind
2018	Storm Eleanor	Strong Wind
2017	Storm Dylan	Strong Wind
2017	Storm Ophelia	Strong Wind
2017	Heavy Rain	Extreme Rainfall
2016	Storm Jake	Strong Winds
2015	Storm Frank	Strong Winds
2015	Storm Eva	Strong Winds
2015	Storm Desmond	Flooding
2015	Storm Darwin	High Temperature
2013/14	Winter Storms	Cold snaps
2011	Tropical Storm Katia	Strong winds
2010	Winter Cold Spell	Cold snaps
2009/10	Winter Cold Spell	Cold snaps/ Frost
2009	Severe Flooding	Flooding
2008	Heavy Rain and Flooding	Extreme Rainfall
2006	High Temperature/ Heatwave	High Temperature
2003	Heavy Rainfall/ Cloud Burst	Extreme Rainfall
2002	Severe Flooding in Eastern Areas	Flooding
2002	Coastal flooding along the eastern and southern coasts	Flooding

Year	Event	Climate Hazard
2000	Severe flooding in east and southern coasts	Flooding
1998	Hurricane-force winds over north and northeast	Strong Wind
1997	Windstorm	Strong Wind
1986	Hurricane Charley	Strong Wind

Source: *Met Éireann, Major Weather events. Available at: https://www.met.ie/climate/major-weather-events*

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

19.3.2.1 Climate Change in County Meath

The Climate Data Tool from Climate Ireland provides a detailed dataset of observed and projected climate data at national and county level. Observed data is based on the period 1981 to 2010 (i.e. the latest 30-year average data) and projections are provided for the period 2041 to 2060. Projections are presented for two climate scenario a most likely scenario and a worst-case scenario and the range of impacts from both are employed in this analysis.

The results of the data compiled for County Meath and the Slane area is presented in **Table 19-21**. In short, the results predict increasing average temperatures leading to increased frequency of heatwave and reduced frequency of frost and ice. Average precipitation is predicted to decrease but the number of wet and very wet days are projected to increase suggesting more intense rainfall events.

Table 19-21: Predicted Climate Data in the area of the Proposed Scheme

Climate Variable	Observed Climate at Project Location
Average Temperature	For the period 1981 to 2010, the area of the Proposed Scheme experienced average annual temperature of 9.9 °C. For the period 2041 to 2060, the area of the Proposed Scheme is predicted to experienced average annual temperatures of 1.2-1.6 °C higher than the current averages. In addition, the number of dry days in this period is projected to increase by 16.4 to 17.2%.
Average precipitation	For the period 1981 to 2010, the area of the Proposed Scheme experienced average annual precipitation of 872 mm. For the period 2041 to 2060, average annual precipitation is projected to decrease by 1.1-4.1% but the number of wet days (>20 mm rain) will increase by 7.6-16.3% and the number of very wet day (>30 mm rain) will increase by 6.4-34.2%.
Maximum Temperature	For the period 1981 to 2010, the maximum annual average temperature in the area of the Proposed Scheme was 13.7 °C. For the period 2041 to 2060, there is a projected increase of four to seven heatwaves in this period relative to baseline.
Minimum Temperature	For the period 1981 to 2010, the minimum annual average temperature in the area of the Proposed Scheme was 6.1 °C. For the period 2041 to 2060, there is a projected decrease in annual frost days of the order of 42.8-55.6% and a similar decrease in the number of ice days of the order of 69.3-82.9%.

19.3.2.2 National Predicted Trends in GHG Emissions

In the event that the Proposed Scheme does not progress, an assessment of the future baseline conditions has been considered here.

Under the 2023 Climate Action Plan, Ireland is committed to achieving a net zero carbon energy systems goal for Irish society and in the process, is aiming to create a resilient and sustainable country. The Climate Action Plans have a target that 100% of all new cars and vans will be electric by 2030, and one third of all vehicles on the road are to be electric vehicles (EV) or hybrid by 2030 with a view to full decarbonisation by 2050. If this target is achieved there will be a gradual reduction in petrol/diesel fuelled vehicles on the future network and an associated reduction in vehicle tailpipe emissions at source.

With the successful implementation of this policy and associated targets, the baseline emissions levels for all sectors (including transport) will decrease in future years. In terms of transport, this will be largely due to the electrification of the national fleet and the removal of direct tailpipe emissions. It is important to note that this scenario is predicted under the Climate Action Plan 2023 regardless of the development of the Proposed Scheme.

The EPA undertake emissions projections and the latest projections are presented in Ireland's Greenhouse Gas Emissions Projections 2022-2040 (EPA, 2023). The EPA report that Ireland is not on track to meet the 51% emissions reduction target (by 2030 compared to 2018) based on these projections which include most 2023 Climate Action Plan measures. Further measures still need to be identified and implemented to achieve this goal. In addition, the following predictions are included in the EPA report:

- The first two carbon budgets (2021-2030), which aim to support achievement of the 51% emissions reduction goal, are projected to be exceeded by a significant margin of between 24% and 34%.
- Sectoral emissions ceilings for 2025 and 2030 are projected to be exceeded in almost all cases, including Agriculture, Electricity, Industry, and Transport.
- It is projected that Ireland can meet its original EU Effort Sharing Regulation target of a 30% emission reduction by 2030 (compared to 2005) if all measures and flexibilities, including the and use, land use change and forestry (LULUCF) flexibility, are used. Reaching the new 42% EU emission reduction target will require full and rapid implementation of Climate Action Plan 2023 measures and further measures to be implemented.
- Emissions in the Additional Measures scenario are projected to be 29% lower in 2030 (compared with 2018) whereas in the Existing Measures scenario the emissions reduction is projected to be 11%. Faster implementation of measures will be required to meet both National and EU targets.

In terms of the transport sector, the main source of emissions is road transport, accounting for approximately 94% of transport emissions in 2021. Various factors influence emissions from this sector, including the economy, employment, and fuel costs. For example, energy demand associated with freight transport is significantly influenced by commercial activity in the economy, energy demand associated with personal transport is strongly influenced by employment levels and oil prices. The Transport Sector also includes combustion of fuel associated with rail, navigation, domestic aviation and pipeline gas transport (EPA, 2023).

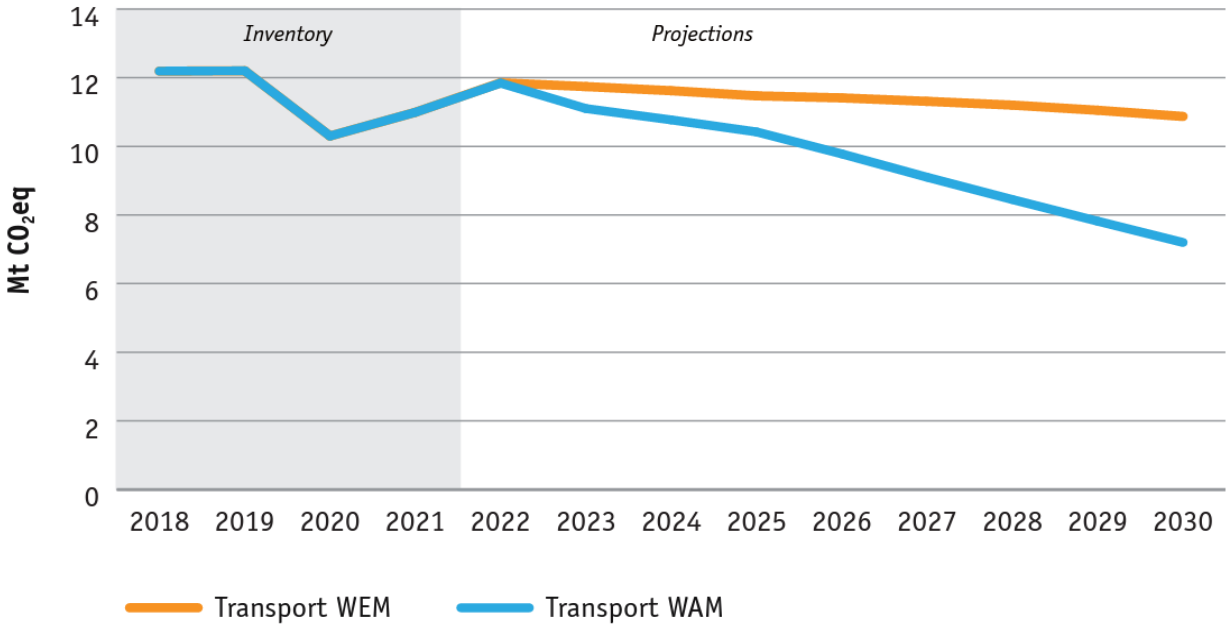
Transport emissions are projected to decrease by 1 to 35% over the period 2021-2030 depending on the success of the two key scenarios assessed by the EPA which include the following:

- **With Existing Measures (WEM) scenario**
  - Under the WEM scenario, transport emissions are projected to decrease by 1% over the period 2021-2030 from 10.9 to 10.8 Mt CO_2e.
  - The Biofuel Obligation Scheme places an obligation on fuel suppliers to blend an increasing percentage of biofuel with their fuel. For road transport in the WEM scenario a 10% blend for petrol and a 12% blend for diesel at the pumps by 2030 is assumed. A statutory target of approximately 12% biofuel applies from 1 January 2020.
  - In terms of the uptake of Electric Vehicles, the WEM scenario assumes approximately 554,000 electric vehicles on the road by 2030. This includes approximately 404,000 passenger battery electric vehicles and 89,000 passenger plug in hybrid electric vehicles.
  - The WEM scenario includes an additional 500,000 public transport and active travel journeys by 2035 and the impact of transport infrastructure projects such as the DART Expansion and BusConnects programmes.
- **With Additional Measures (WAM) scenario**
  - Under the WAM scenario, transport emissions are projected to decrease by 35% over the period 2021 to 2030 from 10.9 to 7.2 Mt CO_2e.
  - For the WAM scenario, it is assumed that incremental increases will occur in the Biofuel Obligations Scheme with 10% blend for petrol and a 20% blend for diesel at the pumps by 2030.
  - This scenario assumes 943,500 electric vehicles on the road by 2030, as a result of the implementation of the Climate Action Plan 2023. This includes 845,000 private electric vehicles, and 95,000 commercial electric vehicles.

- This scenario also includes a 20% reduction in total vehicle kilometres to be achieved by behavioural and sustainable policies and measures outlined in the Climate Action Plan 2023, such as a 50% increase in daily active travel journeys and a 130% increase in daily public transport journeys.
- The impact of transport infrastructure projects such as the DART Expansion and BusConnects programme is also included in the WAM scenario.

The latest EPA projections indicate that the share of total road transport CO_2e emissions from Heavy Duty Vehicles (HDVs) and Light Goods Vehicles (LGVs) is projected to increase from approximately 35% pre-COVID to up to 57% by 2030, and 74% by 2040 in the WAM Scenario. This is as a result of continued projected growth in demand for freight transport services as well as faster mitigation of passenger transport emissions.

Future predicted trends in transport emissions under the WEM and WAM scenarios are presented in **Figure 19.3**.



Source: *EPA, Greenhouse gas emissions (GHG) – Transport. Available at:*
https://www.epa.ie/publications/monitoring--assessment/climate-change/air-emissions/irelands-greenhouse-gas-emissions-projections-2022-2040.php

Figure 19.3: Greenhouse Gas Emissions Projections from the Transport Sector under the With Existing Measures and With Additional Measures scenarios out to 2030 (source; EPA)

With the projected decreases in emissions there will be some stabilisation in the baseline macroclimate and microclimate. However, there will be some residual climate change as a result of the emissions released to date globally.

In the absence of the Proposed Scheme, the existing road network will continue to function. However, as the Proposed Scheme will form part of overall regional and national sustainable mobility strategies, should the Proposed Scheme not go ahead, opportunities will be lost in terms of sustainable mobility and the predicted benefits of this in terms of climate. In general, some improvement in baseline conditions may be experienced due to legislation-driven measures and mitigation. The predicted GHG emissions associated with the Proposed Scheme will not occur, as well as any potential GHG reductions and increased local benefits with regard to sustainable mobility targets and potential vehicle emissions reductions associated with the use of the proposed bypass and public realm enhancements will not be contributed to by this scheme.

19.3.2.3 Regional Predicted Trends in GHG Emissions

The traffic model for the Proposed Scheme predicts future traffic levels across the wider northeast road network in the absence of the Proposed Scheme (i.e. the Do-Minimum scenarios). The predicted emissions for operational traffic under the following scenarios are presented in **Table 19-22**:

- 2026 Do-Minimum i.e. opening year without the Proposed Scheme in 2026; and
- 2041 Do-Minimum i.e. design year without the Proposed Scheme in 2041.

Results are presented for each of the three REM scenarios i.e. the Business as Usual scenario with no progression on climate policy, a Climate Action Plan scenario assuming full implementation and an intermediate scenario.

The results of all scenarios indicate in 2026, without the Proposed Scheme in operation, the levels of transport related GHG emissions will increase over baseline by circa 12-13%. This is as a result of projected growth in traffic numbers exceeding the expected reductions in average tailpipe emissions (through fuel regulation and the electrification of the fleet) leading to a net increase in emissions.

In 2041, the three scenarios show greater variety as expected with greater policy implementation whereby the CAP scenario shows an increase of 16% while the BaU scenario shows an increase of 36%. Again, the increase is anticipated as a result of increasing vehicle numbers which exceeds the gains associated with traffic reductions.

As noted earlier, the REM model is highly conservative and typically overpredicts the traffic emissions to ensure a conservative analysis. This is the reason for the projected future increases in the regional analysis where the national predictions suggest the emissions are projected to decrease by 5.2% over the period 2021 to 2030 (CAP scenario). The inherent conservatism in the REM model and the predictions should be viewed in this regard and predicted future increases in emissions are likely a worst-case scenario where the more refined EPA national model shows the likely significant effect being a net decrease in traffic emissions with full CAP implementation.

Table 19-22: Predicted Annual GHG Emissions from Road Transport in the absence of the Proposed Scheme

Scenario	BaU Scenario (tonnes CO_2e)	Intermediate Scenario (tonnes CO_2e)	CAP Scenario (tonnes CO_2e)
Do-Minimum 2026	1,131,458	1,122,743	1,111,093
Change relative to 2019 baseline (%)	**+13%**	**+13%**	**+12%**
Do-Minimum 2041	1,353,456	1,241,352	1,151,559
Change relative to 2019 baseline (%)	**+36%**	**+25%**	**+16%**

19.4 Description of Likely Significant Effects

Sections 19.4.1 and **19.4.2** provide a description of the likely significant effects of the Proposed Scheme on climate in cumulation with other existing development in the area. A description of the likely significant effects in cumulation with other approved development i.e. development not yet built, is presented in **Section 19.4.3** based on the detailed methodology for CIA included in **Chapter 25**.

The impact interactions between climate and other environmental factors are identified and described in **Chapter 26** and assessed throughout **Sections 19.4.1** to **19.4.3**.

The impacts of the construction and operational phases of the Proposed Scheme have been assessed in terms of climate. The full extent of activities to be carried out during the Construction Phase are described in **Chapter 5**. The predominant aspects of the construction phase will be the construction of the proposed bypass, including construction of the bridge over the River Boyne, followed by the proposed public realm enhancement works in Slane village once the bypass is in place and operational. This will involve activities which are likely to impact climate directly and indirectly.

The principal activities associated with the operational phase will be the use of the new bypass and elements of the public realm enhancement, and associated maintenance activity required over the course of the Proposed Scheme's lifetime.

19.4.1 Construction Phase

19.4.1.1 Climate Mitigation

Consideration is given in this section to aspects of the Proposed Scheme and the GHG emissions that may arise during the construction phase, notably:

- Embodied emissions in the imported materials required for the Proposed Scheme relative to other materials. Embodied emissions are the carbon footprint of a material i.e. the total emissions released throughout the supply chain of the material. This includes the energy required for extraction, processing, operation and disposal of a material. For some materials, such as steel, the use of recycled materials has lower embodied GHG emissions than the use of virgin material;
- Direct emissions from plant machinery and equipment used during the construction phase; and
- Transport emissions from vehicles importing and exporting material to and from the construction site(s).

As outlined in **Chapter 5**, construction of the Proposed Scheme includes design elements and activity which will result in direct and indirect GHG emissions including:

- Site enabling works;
- Construction of the proposed River Boyne Bridge and other structures;
- Utility diversions;
- Sediment and erosion controls and drainage;
- Earthwork movements;
- Demolitions and breaking out of hard materials including pavement, walls etc.;
- Road construction;
- Public realm enhancements;
- Haulage, traffic movements, traffic management, movement of site staff;
- Movement and use of plant and machinery;
- Removal of materials off-site and the importation of materials to site;
- Removal of the surface layers of road tarmac/ paving from footpaths; and
- Structures and materials including manufacture and transport of these (i.e. embodied carbon footprint).

GHG emissions for the construction phase have been estimated using the TII Carbon Tool and using traditional construction materials (virgin steel, Portland cements, hot rolled asphalt etc.) and traditional construction methods. A summary of the results from the carbon calculation exercise are detailed in **Table 19-23** and are described in more detail in the following sections.

Overall, the results indicate that the primary source of GHG emissions from the construction phase of the Proposed Scheme is from emissions associated with the embodied carbon from the materials used in the construction of the Proposed Scheme. The total estimated carbon generated during the construction phase is 31,896 tonnes CO_2e. Embodied carbon in the materials required for construction is the largest component of emissions at circa two thirds of the total with virgin steel, Portland cement mixes and hot rolled asphalt the main contributory materials. Construction activities is circa one fifth of the emissions and his largely consists of diesel use for mobile and fixed plant for the construction phase.

Table 19-23: Estimated Carbon associated with the Construction Phase of the Proposed Scheme

Source	Total GHG (tonnes CO_2e)
Pre-construction	114
Embodied Carbon (including transport of materials)	22,821

Source	Total GHG (tonnes CO_2e)
Construction Activities	7,354
Construction Waste (including transport of waste)	1,607
Total	**31,896**

Pre-Construction

The pre-construction stage of the Proposed Scheme includes the following activities:

- Demolition works;
- General site clearance; and
- Land use change and vegetation loss.

For the Proposed Scheme, most of the pre-construction activities were determined to comprise 'general site clearance' on land primarily occupied by agriculture which is determined to be carbon-neutral owing to agricultural activities that would alternatively be taking place on the site. Some carbon losses would be experienced for natural grasslands and hedgerows removed as part of site clearance. The estimated carbon generated during the pre-construction phase is 114 tonnes CO_2e.

Embodied Carbon

The embodied carbon aspects of this Proposed Scheme consist of the following elements and traditional construction materials have been assumed throughout:

- Steel (including reinforcing steel and structural steel);
- Concrete (including both precast and concrete poured *in-situ* using traditional Portland cement mixes);
- Earthworks;
- Road pavements (binder and base layers);
- Road pavements (asphalt and surface treatments assumed as Hot Rolled Asphalt);
- Kerbs, footways and paved areas for footpaths; and
- Traffic signs, noise barriers, road markings.

The estimated embodied carbon during the construction phase is 21,483 tonnes CO_2e broken down by material type in **Table 19-24**. Of the materials used, bituminous materials (14%), concrete (35%) and steel (42%) make up a combined 91% of all embodied emissions across the Proposed Scheme.

Table 19-24: Estimated Embodied Carbon associated with the Construction Phase of the Proposed Scheme

Material	Total GHG (tonnes CO_2e)
Reinforcing Steel	4,112
Structural Steel	4,988
Precast Concrete	4,133
Poured Concrete	3,334
Asphalt	2,907
Total Other Embodied	2,009
Total Embodied	**21,483**

The overall climate impacts from embodied carbon also considers the material transport to site which has been estimated at 1,338 tonnes CO_2e. Combining embodied emissions of materials and the transport of these materials results in a total of 22,821 tonnes CO_2e.

Construction Activities

The emissions of greenhouse gases from construction activities on the Proposed Scheme largely relate to the following activities:

- Excavation activities for materials such as rock, peat or topsoil;
- Construction activities through generator use or fuel use for fixed and mobile plant; and
- Construction worker transport to site via private car, bus, etc.

The total estimated emissions from this phase equates to 7,354 tonnes CO_2e and this is largely dominated by fuel use from construction activities.

The full list of estimated plant for each of the phases on the mainline, main bridge over the Boyne, other overbridges and the public realm have been compiled in collaboration with the design team and the acoustics team. Note that road vehicles delivering material and/or removing waste have been omitted from these inventories as these are addressed elsewhere under the embodied and waste elements.

Fuel efficiency data has been collated from plant specifications and industry standards. Normal working times will be 07.00 to 19.00 hours Monday to Friday and 08.00 to 16.30 hours on Saturdays (68.5 hours per week) and the total fuel use is assumed at 68.5 hours per week for the duration of the phase of works. Note that this is highly conservative as plant operation is more typically intermittent but a conservative approach is adopted in line with the precautionary principle.

Fuel use throughout is assumed to be diesel fuel and the total estimated use for the duration of the works is 2,199m^3. As a consequence, the estimated carbon generated from diesel use for construction activities is calculated to be 5,866 tonnes CO_2e.

Construction Waste

Construction waste emissions are based on the types of waste being produced from all stages of the Proposed Scheme and the distance to transport this waste. The TII Carbon Tool also considers the processes in disposing the material (incinerated, recycled or landfill) and the transport required for these waste materials. The list of anticipated waste streams generated by the Proposed Scheme are presented in **Chapter 23 – Material Assets: Resource and Waste Management**. These have been used to inform this analysis. The estimated carbon generated from construction waste emissions is 1,607 tonnes CO_2e.

Overall Construction Phase Impact Significance

The total estimated carbon generated during the construction phase is 31,896 tonnes CO_2e assuming traditional construction materials and methods. Some mitigation is inherent in the design through managing the cut fill balance to reuse as much excavated material on the site as possible and to try to use suppliers within the region.

As such, it is considered that the following criteria apply:

- The project's GHG impacts are partially mitigated through the cut fill balance;
- The project has partially complied with do-minimum standards set through regulation but has not fully complied with local or national policies (e.g. CAP23 requirement for low carbon cement); and
- The project has falls short of full contribution to Ireland's trajectory towards net zero.

In this regard and in line with the assessment criteria in **Table 19-4**, the impact on climate of the construction phase emissions is classed as **moderate adverse impact** which is significant.

19.4.1.2 Climate Adaption

Sensitivity Analysis

As per the TII Guidance, a sensitivity analysis was carried out on all construction elements (construction compounds, processing areas, etc.) as well as asset categories including pavements; drainage; structures; utilities; landscaping; signs, light posts and fences. The sensitivity analysis was used to identify which climate hazards are relevant to the construction phase of the Proposed Scheme. **Table 19-25** presents the sensitivity analysis and the rationale for the sensitivity score for the construction of the project.

Table 19-25: Sensitivity Analysis of Climate Hazards to the Construction of the Proposed Scheme

Climate Hazard	Sensitivity	Sensitivity Score
Flooding (Coastal)	High sensitivity to coastal flooding for works around the Boyne given the known high risk in the area. Coastal flooding may damage or flood works, delay construction and result in damage to the environment from carrying construction materials downstream. In addition, worker safety may be impacted by such an event for works on abutments or other bankside operations.	3
Flooding (Pluvial)	Medium sensitivity to pluvial flooding given the absence of any existing significant risks but such flooding can damage or flood works, delay construction and impact worker safety.	2
Flooding (Fluvial)	High sensitivity to fluvial flooding. In particular, the proposed bridge structure will traverse the River Boyne and will have piers within the predicted 1 in 100 year event (1% Annual Exceedance Probability (AEP)) and 1 in 1,000 year event (0.1% AEP) floodplains.	3
Extreme heat	Medium sensitivity to extreme heat. Extreme heat can cause concrete to crack, difficulties in managing bitumen or other materials, and can delay works through cessation or works to protect outdoor workers.	2
Extreme cold	Generally moderate sensitivity to the assets under construction. Extreme cold can cause concrete to crack, pipes to burst impacting the integrity of pavements and structures. Extreme cold can result in cessation or delay in construction works such as for pouring concrete.	2
Wildfire	All assets are considered to have a high sensitivity to wildfires. Such fires can cause significant asset damage, cease construction and impact on the health of workers and the community. Drainage assets have a medium direct sensitivity to wildfires but may be impacted by firefighting water and a high sensitivity is also assigned.	3
Drought	Low sensitivity to extreme wind on all assets with the exceptions of landscaping works which has a high sensitivity to drought.	2
Extreme wind	Low sensitivity to extreme wind on most assets with the exceptions of cranes or other elevated operations which have a high sensitivity to extreme winds.	2
Lightning and hail	Low sensitivity to lightning and hail for all assets. Potential for short term interruptions to works.	1
Fog	Low sensitivity to fog for all assets. May have short term impacts on cranes or other elevated operations but not significant.	1

Exposure Analysis

An exposure analysis was also carried out on the construction phase of the Proposed Scheme based on the known climate hazards presented in **Section 19.3.1.5**. Given that the construction phase is anticipated to take place within the medium term, the analysis focusses on the current climate hazards but the long-term future climate hazards are also considered as appropriate. **Table 19-26** presents the rational for the exposure scoring for the construction phase.

Table 19-26: Exposure Analysis based on Past and Predicted Climate Events

Climate Event	Detail	Exposure Score
Flooding (Coastal)	High exposure as the CFRAM mapping for the area which shows the Boyne as a High Probability coastal flood even risk	3
Flooding (Pluvial)	Pluvial flooding is rated as medium exposure. While pluvial flooding has occurred in the area, there is always a potential for impact in Ireland.	2
Flooding (Fluvial)	High exposure, the CFRAM mapping for the area indicates that the Boyne has a high probability of localised river flooding, i.e. approximately a 1-in-a-10 chance of occurring or being exceeded in any given year.	3
Extreme heat	Extreme heat is rated as low exposure as per **Table 19-19** but classed as medium for this project as per **Table 19-6**. Extreme heat events do occur in Ireland, such as in 2022 when temperatures reached 33.0 °C. In 2018 temperatures were high causing	2

Climate Event	Detail	Exposure Score
	heatwaves and drought. 2006 was warmest summer ever recorded since 1995. The maximum temperature recorded between 1979 – 2010 was 28.7 °C.	
Extreme cold	Extreme cold spells are rated medium exposure. While extreme cold spells do occur in the area these are generally rare. In Ireland in 2018 there was heavy snowfall and in 2010 there was snow and a severe cold spell.	2
Wildfire	Medium exposure to wildfires as per **Table 19-19**. No wildfires have been recorded in the area.	2
Drought	Drought is rated as medium exposure. Only one recorded drought has been recorded nationally in 2018.	2
Extreme wind	Extreme wind is rated as high exposure. Storms occur in the area regularly. Between 1981-2010 there were an average of 8.2 days with gales (circa 2% of the year).	3
Lightning and hail	Lightning and hail are rated as high exposure. Between 1981-2010 there were 9.7 days of hail and the mean number of thunder days was 5.5 days equating to circa 3% of the year on average.	3
Fog	Fog is rated as high exposure. Between the years 1981-2010 there were 41.5 days of fog on average per annum equivalent to 11% of the year.	3

Based on the estimated sensitivity and exposure the vulnerability of the construction phase may be assessed and is summarised in **Table 19-27**. The analysis indicates that coastal and fluvial flooding represent the highest vulnerabilities for the construction phase followed by extreme wind and wildfire. These elements are considered in more detail under the climate risk assessment.

Table 19-27: Vulnerability Analysis for the Construction Phase

		Exposure		
		Low	**Medium**	**High**
Sensitivity	**Low**			Lightning/Hail, Fog
	Medium		Flooding (Pluvial) , Extreme Heat, Extreme Cold, Drought	Extreme Wind
	High		Wildfire	Flooding (Coastal and Fluvial)

Climate Risk Assessment

The TII guidance presents a sample risk framework to assess climate risks based on the framework detailed in the EU Technical Guidance on climate proofing (2021). This sample framework has been adopted for this project to evaluate the risk associated with the hight risk hazards on the construction phase of the project. This risk register is presented in **Table 19-28**.

The register shows that with the detailed controls in place (as identified in **Chapter 5**) with regard to the construction of the bridge and accompanying infrastructure around the Boyne, the risk to the works from flooding has been mitigated to reduce the likelihood of such an event having a significant adverse impact. As such, the risk of flooding (both fluvial and coastal) has been suitably mitigated through good working practice to reduce the risk of climate change to not significant.

Similarly, the working practices around standard emergency response and weather informed work planning reduce any potential significant risk for wildfires and extreme winds to reduce the risk of climate change to not significant.

In short, the vulnerability of the works to climate change has been suitably mitigated and the potential impact is considered to be **minor adverse** for the short-term construction phase.

Table 19-28: Risk Register (Construction Phase)

Risk Identification					Risk Assessment				
						Initial Risk Rating			
Risk ID	Climate Variable	Risk Statement	Project Receptors	Impact Type	Planned Controls	Likelihood	Consequence	Risk Rating	Significance
1	Flooding (Coastal)	Damage to infrastructure, flooding of works or excavations, damage to the environment and worker safety.	All assets under construction within the floodplain of the Boyne.	Asset damage, human health, environment and financial (project delays).	An early warning system will be implemented to monitor rainfall and upstream river levels in real-time. Once set thresholds are exceeded all materials, plant and equipment must be removed from the platform and the cofferdams.	Unlikely	Moderate	Medium	Not Significant
2	Flooding (Fluvial)	Damage to infrastructure, flooding of works or excavations, damage to the environment and worker safety.	All assets under construction within the floodplain of the Boyne.	Asset damage, human health, environment and financial (project delays).	Remobilisation onto the platform will not be permitted until such time flood waters have receded and there is a favourable weather window ahead. No compounds or deposition areas within the floodplain. Access tracks from the upper bank constructed down to temporary working platforms (TWPs) in the floodplain. Platforms constructed on reno mattress to facilitate the passage of water in the event of flooding. Cofferdams to be constructed around foundation excavations to prevent water and sediment from entering or escaping.	Unlikely	Moderate	Medium	Not Significant
3	Wildfire	Fires can cause significant asset damage, cease construction and impact on the health of workers and the community.	All assets under construction and construction compounds and processing areas.	Asset damage, human health, environment and financial (project delays).	Prior to commencing works, the contractor shall prepare an Environmental Emergency Response Plan/Contingency Plan.	Rare	Moderate	Medium	Not Significant

Risk Identification					Risk Assessment				
Risk ID	Climate Variable	Risk Statement	Project Receptors	Impact Type	Planned Controls	Initial Risk Rating			Significance
						Likelihood	Consequence	Risk Rating	
4	Extreme Wind	Cranes or other elevated operations which have a high sensitivity to extreme winds.	Cranes, jibs, masts or other elevated working operations.	Asset damage, human health and financial (project delays).	Lifting operations will be programmed in advance of a favourable weather window of sufficient duration to complete the works.	Unlikely	Moderate	Medium	Not Significant

19.4.2 Operational Phase

19.4.2.1 Operational and Maintenance Phase Emissions

The operational phase of the Proposed Scheme includes maintenance of the infrastructure as outlined in **Chapter 4**. During the operational phase there is a requirement for ongoing sources of operational and embodied emissions associated with the following calculated over the life of the scheme (60 years):

- Provision of road lighting in accordance with DN-LHT-03038 Design of Road Lighting for the National Road Network. The lighting will be provided by energy efficient light emitting diode lanterns (LED). The emissions from this source is estimated at approx. seven tonnes CO_2e per annum or 360 tonnes CO_2e over the lifetime of the project; and
- Maintenance of the road surface which is based on the construction phase inputs for asphalt to cover full and periodic replacement which equates to 4,112 tonnes CO_2e over the lifetime of the Proposed Scheme.

Combined these maintenance and operational emissions equate to approx. 75 tonnes CO_2e per annum and as these measures have been somewhat mitigated through design, this is considered a **minor adverse** impact.

19.4.2.2 Operational Phase Traffic Emissions

Active Travel and Modal Shift

There are a number of operational measures included in the Proposed Scheme to promote active travel in the area including the following:

- Provision of enhanced footway access along the existing N51 between the village and the bypass;
- Provision of a footway from the northern end of the Proposed Scheme along the southbound side of the existing N2 extending as far as the entrance to Grassland Agro;
- Shared use cycle/ pedestrian facilities along the proposed bypass and linking to the existing canal tow path;
- The Public Realm proposals provide for enhanced pedestrian facilities by the reallocation of existing road space to more sustainable modes;
- The Public Realm includes a new shared pedestrian/cyclist facility extending from Chapel Street to St Patrick's National School;
- Within Slane, raised tables/ ramps with pedestrian crossings are included to create safe and regular pedestrian crossing points and tightening of the carriageway as traffic calming measures;
- Inclusion of designated areas for bicycle parking within Slane;
- It is proposed to provide a shared use two-way cycle/ pedestrian facility located in the northbound verge adjacent to the proposed bridge structure across the River Boyne; and
- The Shared Use Cycle & Pedestrian Bridge (ST02) will link the existing Boyne Canal towpath to the Shared Use Cycle & Pedestrian facility of the proposed N2 Slane Bypass.

The provision of these features presents the opportunity for appealing pedestrian and cycling routes in line with Action TR/23/29 of CAP23 (Advance roll-out of 1,000 km walking/cycling infrastructure).

Meath County Council is also advancing a greenway project along the River Boyne from Navan to Drogheda. Should this project receive planning, it is expected that this greenway may incorporate the existing towpath alongside the canal to the south of the River Boyne. The Proposed Scheme includes for a link to be provided from the bypass cycling facility to the canal tow path, which requires a crossing of the existing canal. This would enhance Slane as a cycling destination. This proposal is consistent with Action TR/23/30 of CAP23 (Advance roll-out of National Cycle and Greenway Networks).

In relation to modal shift, the Proposed Scheme includes for the enhancement of public transport facilities such as improved provision and access for bus stops within Slane.

The above measures are aligned with the Sustainable Transport Trips metrics for the Transport sector in CAP23 (**Table 19-1**). Each of the above has the potential to reduce the operational transport emissions but these elements have not been quantified in the operational traffic model and therefore have not been factored into the climate analysis presented for operational traffic.

Road Traffic

Road traffic predictions with the Proposed Scheme in operation have been modelled and are summarised in **Chapter 7**. These predicted changes in traffic have been employed to estimate the future generation of transport related GHG. The predicted emissions for operational traffic under the following scenarios are presented in **Table 19-29**:

- 2026 Do-Something i.e. opening year with the Proposed Scheme in 2026; and
- 2041 Do-Something i.e. design year with the Proposed Scheme in 2041.

The results of both scenarios are presented for each of the three REM scenarios depending on climate policy intervention. Like the Do-Minimum Scenario (**Table 19-22)** the CAP Scenario is only marginally (2%) below the BaU scenario in 2026 but more significantly lower (15%) in 2026 with greater CAP implementation.

When the Do-Something predictions for each scenario in each year are compared with the corresponding Do-Minimum scenarios (**Table 19-22**) there is negligible change in total GHG emissions. These results suggest that the Proposed Scheme will not increase or decrease traffic on the road network but will redistribute traffic around the network with no net change in impact over the Do-Minimum impact.

Table 19-29: Predicted Annual GHG Emissions from Road Transport from the Proposed Scheme

Scenario	BaU Scenario (tonnes CO_2e)	Intermediate Scenario (tonnes CO_2e)	CAP Scenario (tonnes CO_2e)
Do-Something 2026	1,131,486	1,122,801	1,111,186
Change relative to 2026DM (%)	**0%**	**0%**	**0%**
Do-Something 2041	1,353,531	1,241,664	1,152,053
Change relative to 2041DM (%)	**0%**	**0%**	**0%**

Employing the significance criteria in **Table 19-4**, the following considerations apply to the operational road traffic emissions for the Do Something CAP scenario relative to the Do-Minimum Scenario (**Table 19-22**):

- The project's GHG impacts have been mitigated through 'good practice' measures – in the case of the modelled emissions under the CAP scenario, this includes national measures such as the electrification of the fleet and the biofuels blend as per CAP23 (refer to the WAM details in **Section 19.3.2.2**). These national mitigation measures are inherent in the calculations presented through the CAP implementation scenario presented;
- The project complies with existing and emerging policy requirements, again through the implementation of CAP policy measures such as EV and biofuels in the CAP scenario modelled; and
- While the regional predictions using the REM model suggest that all future scenarios (Do-Minimum and Do-Something) will increase and therefore are not fully in line to achieve Ireland's trajectory towards net zero, the inherent conservatism in the REM model suggests this is a worst case outcome. The EPA national projections show a net decrease in traffic emissions with CAP implementation (of the order of 35% relative to 2018 – refer **Section 19.3.2.2**) and this net decrease is also anticipated for traffic associated with the Proposed Scheme despite the increase predicted by the very conservative REM model.

With these factors considered, the net impact on climate of the operational phase traffic emissions is classed as **minor adverse** in the long term. While projected emissions are negligible relative to the Do-Minimum scenario any emissions of GHG represents an adverse impact.

It is noted that the potential for induced traffic is considered and addressed in **Chapter 7**. Induced traffic may be considered to be new trips or changes to existing trips (e.g., change a trip destination) that could arise as a result of a particular transport intervention such as the Proposed Scheme. The sensitivity test for induced traffic showed a potential 1.5% increase in the traffic volumes using the bypass which was not considered significant in traffic terms. Similarly, a sensitivity test for climate emissions from traffic was undertaken and

showed negligible change over and above the levels presented in **Table 19-29**. As such, the potential for additional climate impact from induced traffic during the operation phase is considered negligible.

19.4.2.3 Climate Vulnerability of the Operational Phase

The approach to assessing the climate risk associated with the operation phase is analogous to that presented for the construction phase in **Section 19.4.1.2**. While the sensitivity of the operation phase has slight variation to the construction phase and is revised in this section, the exposure criteria apply to both phases and the exposure data presented in **Table 19-26** is also applied for the operation phase. **Table 19-30** presents the sensitivity analysis and the rationale for the sensitivity score for the operation phase of the Proposed Scheme.

Table 19-30: Sensitivity Analysis of Climate Hazards to the Operation of the Proposed Scheme

Climate Hazard	Sensitivity	Sensitivity Score
Flooding (Coastal)	High sensitivity for damage of infrastructure or assets around the Boyne from coastal flooding given the known high risk in the area.	3
Flooding (Pluvial)	Low sensitivity to pluvial flooding given the absence of any existing significant risks and given that the drainage systems for the Proposed Scheme are designed to meet best practice standards.	1
Flooding (Fluvial)	High sensitivity to fluvial flooding as per coastal flooding with known risk around the Boyne.	3
Extreme heat	Low sensitivity to extreme heat. Potential to cause some deterioration in road surfaces but only if occurring over long periods.	2
Extreme cold	Moderate sensitivity to extreme cold whereby the asset suffers limited impact but icy, or snow may result in road closures or other economic or social impacts.	2
Wildfire	All assets are considered to have a moderate sensitivity to wildfires. Can cause some surface damage to the asset band may lead to road closures impacting with economic or social impacts. Sensitivity for fires in the public realm as a result of higher population exposure in this area.	2
Drought	Low sensitivity to drought on all assets with the exceptions of landscaping works which has a high sensitivity to drought.	2
Extreme wind	Low sensitivity to extreme wind on most assets with the exceptions of lighting or signposts which have a moderate sensitivity to extreme winds.	2
Lightning and hail	Low sensitivity to lightning and hail for all assets.	1
Fog	Low sensitivity to fog for all assets. Potential to affect road safety.	1

Based on the estimated sensitivity and exposure, the vulnerability of the operation phase is summarised in **Table 19-31**. The analysis indicates that coastal and fluvial flooding represent the highest vulnerabilities for the operation phase followed by extreme wind. These elements are considered in more detail under the climate risk assessment.

Table 19-31: Vulnerability Analysis for the Operation Phase

		Exposure		
		Low	**Medium**	**High**
Sensitivity	**Low**		Flooding (Pluvial)	Lightning/Hail, Fog
	Medium		Extreme Heat, Extreme Cold, Drought, Wildfire	Extreme Wind
	High			Flooding (Coastal and Fluvial)

This risk register for the operation phase is presented in **Table 19-32** and shows that with the committed design measures in place (as identified in **Chapter 4**), the risk of adverse climate change impact on the

Proposed Scheme is low. In short, the vulnerability of the operational phase to climate change has been suitably mitigated and the potential impact is considered to be **minor adverse** in the long-term.

Table 19-32: Climate Risk Register (Operational Phase)

Risk Identification					Risk Assessment				
						Initial Risk Rating			Significance
Risk ID	Climate Variable	Risk Statement	Project Receptors	Impact Type	Planned Controls	Likelihood	Consequence	Risk Rating	
5	Flooding (Coastal)	Damage to infrastructure.	All assets within the floodplain of the Boyne.	Asset damage.	The proposed bridge will be located across the River Boyne and will have its piers within Flood Zone A and B. The lowest soffit level of the bridge is at least 3m above the predicted 0.1% AEP event (1 in 1,000-year water level) hence the proposed mainline bypass will not be at risk of flooding from the River Boyne. The flood risk assessment for concluded that the impact on flood risk due to the addition of the proposed bridge and other hydraulic structures during operational stage is expected to be negligible.	Unlikely	Minor	Low	Not Significant
6	Flooding (Fluvial)	Damage to infrastructure.	All assets within the floodplain of the Boyne.	Asset damage.		Unlikely	Minor	Low	Not Significant
7	Extreme Wind	Damage to utilities and infrastructure.	Lighting masts and or elevated road signs.	Asset damage.	Road lighting will be mounted on galvanised steel lighting columns up to a maximum of 12 m high above finished road level. The lighting will be designed to the appropriate Lighting Class in compliance with BS 5489-1: Code of Practice for the Design of Road Lighting.	Rare	Minor	Low	Not Significant

19.4.3 Cumulative Impact

A cumulative impact assessment (CIA) has been undertaken to consider potential for cumulative impact of the Proposed Scheme with other approved development. The detailed methodology for the CIA is described in **Chapter 25 – Cumulative Effects**. The assessment has considered cumulative sources and impact pathways which could impact on climate.

The projects listed in **Appendix 25.2** have been assessed. Each project has been considered on a case-by-case basis for screening in or out of this chapter's assessment based upon data confidence, effect-receptor pathways and the spatial/ temporal scales involved. Projects have been screened-in to the CIA where there is potential for significant impacts (positive or negative) to GHG emissions are assessed in this chapter for determination of climate impact. The projects that were screened-in to the climate CIA are listed in **Table 19-33**. It is noted at the outset that all projects/developments will generate greenhouse gases (GHGs) from construction (via materials, operations and transport) and therefore there is a cumulative net adverse impact for climate from the construction of all projects on the CIA list. The more significant projects that have been considered for the Climate CIA are listed in **Table 19-33**.

Table 19-33: Projects Screened-in for Potential Cumulative Effects on Climate

Project Code	Project Location	Project Type	Potential for Cumulative Effect
PR 1	Stanley Hill, Slane, Co. Meath	Wastewater Treatment Tank	Potential construction phase impacts – significant material inputs required and therefore potential for cumulative adverse impact from embodied carbon in materials and construction methods.
PR 7	Slane Wastewater Treatment Plant, Castle Hill, Navan Road, Slane, Co. Meath	Wastewater Treatment Plant	
PR 10	Painestown, Seneschalstown, Dollardstown, Hayestown-Carnuff Little & Ardmulchan, Navan, Co. Meath	Wastewater Treatment Plant	
PR 11	Painestown, Beauparc, Navan, Co. Meath	Wastewater Treatment Plant	
PR 13	Harlinstown, Slane, Co. Meath	Road works	
PR 17	Grangegeeth, Slane, Co Meath	Solar Panels	Potential construction phase impacts – significant material inputs required and therefore potential for cumulative adverse impact from embodied carbon in materials and construction methods. However, contributes to the reduction of GHG emissions from the energy generation sector and potentially a net positive climate impact over the lifetime of the project.
PR 18	Grangegeeth, Slane, Co. Meath	Solar Farm	
PR 21	Broomfield, Collon, Co Meath	Solar Panels	
PR 22	Knockharley, Brownstown, Navan, Co. Meath (townlands of Knockharley, Flemingstown and Tuiterath)	Solar Farm	
PR 38	Longford, Duleek, Co Meath A92 K162	Solar Panels	
PR 57	Towlands of Rathdrinagh Sicily Thomastown, Rahill Drumman & Knockcommon, near the town of Duleek Co Meath	Solar Farm	
PR 44	Drogheda IDA Business and Technology Park, Donore Road, Drogheda, Co. Meath	Data storage facility	Potential for adverse impact through construction from the use of materials, operation and transport as per other developments.
PR 45	Indaver Waste to Energy Facility, Carranstown, Duleek, Co Meath, Eircode A92 EP23	Waste To Energy Facility	Limited construction impacts as the site infrastructure is largely in place but some adverse impact from the construction of a hydrogen generation unit.
PR 55	N52 Ardee Bypass, Ardee, Co Louth	Road Works	Potential for impact is analogous to the construction and operational impacts predicted for the Proposed Scheme.

For projects PR 1 PR 7, PR 10, PR 11 and PR 13, each of these projects requires significant inputs of materials with a potentially high embodied carbon including concretes, aggregates and/or steel and therefore have the potential for the generation of GHG emissions at construction stage. In addition to the construction

impacts predicted by the Proposed Scheme, this is considered a significant cumulative adverse climate impact of these projects and the Proposed Scheme combined.

Each of the solar projects PR 17, PR 18, PR 21, PR 22 and PR 57 will generate some GHG emissions through construction but not to the scale of the projects PR 1 to PR 13. In addition to the construction impacts predicted by Proposed Scheme, this is considered a significant adverse climate impact. However, during the operational phases, each of these projects will aid in the mitigation of GHG emissions from the energy sector as a whole through renewable infrastructure and will help deliver on the Electricity Sectoral Carbon Budget with a net beneficial impact for each project. Cumulatively, these renewable energy projects will be required to deliver the predicted carbon reduction for the EV fleet for the transport sector resulting in a cumulative beneficial climate impact in line with CAP23.

PR 44 has potential for adverse impact through construction from the use of materials, operation and transport as per the other projects. Data storage facilities have a significant energy requirement and the EIAR for this development notes that no on-site GHG generation will occur but electricity use will lead to net indirect GHG emissions at 473,040 tonnes per annum which is a significant adverse impact and will impact the Energy Sector Sectoral Budget. Cumulatively with this project, the impact remains a significant cumulative adverse impact for climate but is dominated by the data centre emissions.

For PR 45, it is considered there are limited construction impacts as the site infrastructure is largely in place, but some adverse impact from the construction of a hydrogen generation unit. Operationally, combustion of waste to generate energy is a lower emission option than landfilling but is generally poor compared to recycling or reuse/repair. In this regard, the facility will generate GHG emissions and will result in a significant adverse climate impact cumulatively with the Proposed Scheme. Should the hydrogen plant generate ‘clean’ hydrogen, the potential for a reduced emissions profile exists and therefore a lower operational impact.

For PR 55, impacts from the Ardee Bypass are similar to the Proposed Scheme. Construction impacts are considered a significant adverse in the absence of committed mitigation such as for the Proposed Scheme ion material choices. Operational phase impacts are dependent on the levels of active travel, modal shift and EV infiltration that are delivered. However, these potential positives are couched against the potential for increased traffic volumes thereby increasing traffic emissions. As noted, emissions in the transport sector will be largely delivered through EV infiltration to the fleet and are unrelated to the cumulative performance of these road schemes. In this regard, the cumulative impact is minor adverse assuming the Climate Action Plan 2023 targets for EVs are achieved.

The impact assessment of the Proposed Scheme for climate identified no significant net change in emissions over the Do-Minimum scenario (i.e. without the road scheme in place). However, given the ongoing challenge for the Irish State to meet climate targets, any increase is considered negative. The direct climate impacts associated with the operational phase traffic emissions are negligible in the long-term.

19.5 Mitigation Measures

19.5.1 Construction Phase

The projected emissions from the construction phase are presented using traditional methods and materials and result in a moderate adverse impact. The need to mitigate these impacts is clearly signalled in national policy such as CAP23 (*Action EN/23/12: 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 mandatory 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, kerbs, drains, etc with the only exception being the prestressed concrete bridge beams to be employed on the overbridges which cannot meet this commitment at present;
- 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

- As a combined noise and climate mitigation, Stone Mastic Asphalt (SMA) will be used as an alternative to Hot Rolled Asphalt (HRA). Stone Mastic Asphalt is a low carbon alternative to HRA.
- Research has shown that the carbon intensity of SMA can be further reduced if Recycled Asphalt Pavement (RAP) is employed in the mix. The Proposed Scheme will use SMA with a minimum RAP content of 20%.
- MCC will revisit this mix during detailed design to achieve greater embodied reductions if possible, based on industry practices available at the time.

The impacts of the use of these low carbon materials is presented in **Table 19-34** which shows the baseline levels of embodied carbon relative to the mitigated levels of embodied carbon. The total embodied carbon saved by these measures equates to 5,038 tonnes of CO_2e. This saving is equivalent to 23% of the total embodied carbon estimated for the Proposed Scheme (21,483 tonnes CO_2e as per **Table 19-24**).

Table 19-34: Mitigation of Embodied GHG in Construction Materials

Material	Total Baseline GHG (tonnes CO_2e)	Mitigation Material	Total GHG after Mitigation (tonnes CO_2e)
Non-structural precast concrete structures, kerbs, drains, etc. using Portland cement.	4,133	50% GGBS cement mix	2,438
Poured concrete using Portland cement.	3,334	50% GGBS cement mix	2,134
Reinforcing steel using virgin steel	4,112	Recycled steel	2,467
Hot Rolled Asphalt	2,907	Road Pavements - Bituminous Materials using Stone Mastic Asphalt	2,326
Total	**14,486**		9,365
	Total Embodied Carbon Mitigated		**5,038**

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 required for pavement materials 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. To implement this, the contractor shall prepare a Mobility Management Plan for site staff.

19.5.2 Operational Phase

Future mitigation of transport emissions will be driven by EU and national policy on fuel and engine technology, improved walking/cycling facilities, a modal shift to public transport and a transition to low emission vehicles. For mitigation of other sources of emissions, the following will apply:

- The level of public lighting on the Proposed Scheme will be limited to the minimum required for safety. Public lighting installations will use photocells to ensure they are only operational when required.
- Lighting fixtures will be enhanced where possible with the addition of a Central Management System (CMS) to actively manage the required level of lighting for the circumstance, e.g. dimming, reduced night-time scouting. This will be particularly useful in the public realm element of the scheme.
- The road surfacing and horizontal gradients shall be optimised during detailed design for greater vehicle efficiency throughout the design life of the Proposed Scheme. This will allow for a smoother journey throughout the length of the Proposed Scheme and require less sudden acceleration or braking to negotiate hills or tight bends.
- Sheltered and accessible bus stops at suitable locations such as village nodes shall be provided.
- Tree planting, in line with the mitigation proposals in **Chapter 12 – Landscape and Visual**, shall be integrated into the Proposed Scheme to provide carbon sequestration potential.

19.6 Residual Impacts

19.6.1 Construction Phase

The projected emissions from the construction phase are presented using traditional methods and materials and result in a moderate adverse impact. The need to mitigate these impacts is clearly signalled in national policy such as CAP23 (Action EN/23/12). A series of engagements between the climate team and the design team have been undertaken 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 and to mitigate these impacts, the design team commit the contractor to the mandatory use of low carbon materials. The total embodied carbon saved by these measures equates to 5,038 tonnes of CO_2e. This saving is equivalent to 23% of the total embodied carbon estimated for the Proposed Scheme.

As previously noted, Chapter 13 of CAP23 sets the following industry target for embodied carbon in materials:

- Decrease embodied carbon in construction materials produced and used in Ireland by 10% by 2025; and
- Decrease embodied carbon in construction materials produced and used in Ireland by at least 30% by 2030.

The commitment to reduce embodied emissions on the Proposed Scheme is fully aligned with the targets and trajectory of CAP23. As such, employing the significance criteria in **Table 19-4**, the residual impact on climate of the construction phase emissions, with this mitigation commitment, is classed as **minor adverse** over the construction phase.

The climate change risk register for the construction phase shows that with the detailed construction controls in place (as identified in **Chapter 5**), the risk of adverse climate impact on the Proposed Scheme has been suitably mitigated to reduce the likelihood of such an event having a significant adverse impact. In short, the vulnerability of the works to climate change has been suitably mitigated and the potential impact is considered to be **minor adverse** for the short-term construction phase.

19.6.2 Operational Phase

Maintenance and operational emissions equate to circa 75 tonnes CO_2e per annum and as these measures have been somewhat mitigated through design. Employing the significance criteria in **Table 19-4**, the impact on climate of the maintenance phase emissions is classed as **minor adverse**.

Total transport emissions associated with the operation of the Proposed Scheme are estimated to have no net change over the Do-Minimum scenario. This is true even under the conservative business as usual scenario as well as the scenario assuming the successful implementation of the Climate Action Plan measures. With these factors considered, the net impact on climate of the operational phase traffic emissions is classed as **minor adverse** in the long term. While projected emissions are negligible relative to the Do-Minimum scenario, any emissions of GHG represent an adverse impact.

Overall, the risk of climate change impact on the operational phase of the Proposed Scheme will be **minor adverse** for each of the main climate threats.

19.6.3 Consistency with Climate Policy

As noted in **Section 19.2.1.1**, Meath County Council is required under Section 15 of the Climate Action and Low Carbon Development Act 2015, as amended to perform its functions in a manner consistent with the following:

- The most recent approved climate action plan;
- The most recent approved national long term climate action strategy;
- The most recent approved national adaptation framework and approved sectoral adaptation plans;
- The furtherance of the national climate objective; and
- The objective of mitigating greenhouse gas emissions and adapting to the effects of climate change in the State.

This climate policy base is summarised in **Section 19.2.1.2**, supported by further information in **Appendix 19.1** and has been referenced throughout this assessment **Table 19-35** presents a summary of the relevant policy objectives and actions and provides an overview of the consistency of the Proposed Scheme to these policies.

In short, the analysis shows that in developing the Proposed Scheme, Meath County Council is consistent with the requirements of Section 15 of the Climate Action and Low Carbon Development Act 2015, as amended. For policies relating to the construction phase, the Proposed Scheme is fully aligned with the requirements, while the active travel, modal shift and electric vehicle enhancements in the operation phase will all contribute to the national targets and measures for these elements in the policy base. In addition, the national and sectoral climate adaptation requirements of the Proposed Scheme and this assessment are fully consistent with the required policy base.

The only variation is in relation to consistency in achieving the national target for a 20% reduction in total vehicle kilometres. While the Proposed Scheme aids in relieving congestion in the town of Slane (with resultant air, noise and health benefits), the traffic analysis shows no net change in kilometres travelled in the northeast of the country as a result of the Proposed Scheme. In this regard, the Proposed Scheme does not contribute to or detract from this national target.

In summary, Meath County Council have devised the Proposed Scheme to be consistent, in so far as practicable, with the relevant climate policy base as required by Section 15 of the Climate Action and Low Carbon Development Act 2015, as amended.

Table 19-35: Consistency with Climate Policy

Section 15(1) Criteria	Policy	Policy Requirement	Consistency of the Proposed Scheme
The most recent approved climate action plan	CAP23 Chapter 10 (KPI)	By 2025 Public Bodies shall specify low carbon construction methods and low carbon cement material as far as practicable for directly procured or supported construction projects from 2023.	As per **Section 19.5.1**, Meath County Council commits to the use of low carbon cements, concrete products, steel and asphalt with a carbon reduction of 23% over baseline. Fully consistent with Section 15 of the Act.
	CAP23 Chapter 13 (Action)	Action EN/23/12: Specify low carbon construction methods and low carbon cement material as far as practicable for directly procured or supported construction projects from 2023.	As above, fully consistent with Section 15 of the Act.
	CAP23 Chapter 15 (Action)	TR/23/29 Advance roll-out of 1,000 km walking/cycling infrastructure.	As per **Section 19.4.2.2**, there are a number of pedestrian and cycling infrastructural developments and enhancements included in the Proposed Scheme that will contribute locally to the national target of a roll-out of 1,000 km walking/cycling infrastructure. Fully consistent with Section 15 of the Act.
		TR/23/30 Advance roll-out of National Cycle and Greenway Networks.	As per **Section 19.4.2.2**, Meath County Council is advancing a greenway project along the River Boyne from Navan to Drogheda and the Proposed Scheme will link and integrate with this project to enhance the accessibility of Slane to the greenway. Fully consistent with Section 15 of the Act.
	CAP23 Chapter 15 KPI on Vehicle Kilometres	20% reduction in total vehicle kms. 20% reduction in total car kms. 20% reduction in 'commuting' car kms.	**Section 19.4.2.2** of this chapter illustrates that there is no net change in emissions (and by extension vehicle kilometres) between the Do-Minimum Scenario without the Proposed Scheme and with the Proposed Scheme. The Proposed Scheme helps to reduce congestion in Slane by redistributing traffic on the transport network in the northeast of the country (wider area model covering Meath, Louth and Fingal). However, there is no net increase or decrease in total vehicle kms and no contribution to, or deviation from, these national targets. As such, the Proposed Scheme is only consistent with Section 15 of the Act in so far as practicable given that there is not net increase in vehicle kilometres and the Proposed Scheme does not conflict with the target for a net reduction.
	CAP23 Chapter 15 KPI Sustainable Transport Trips	50% increase in daily active travel journeys. 130% increase in daily public transport journeys. 25% reduction in daily car journeys.	As per **Section 19.4.2.2**, there are a number of active travel and modal shift infrastructural developments and enhancements included in the Proposed Scheme that will contribute locally to these national targets. Fully consistent with Section 15 of the Act.

Section 15(1) Criteria	Policy	Policy Requirement	Consistency of the Proposed Scheme
The most recent approved national long term climate action strategy	Emission reduction measures and milestones to 2050 for the transport sector	Mobility in rural areas will see significant changes over the decades, driven by investment to provide greater accessibility of public transport alternatives to private cars as well as by digitalisation.	As per **Section 19.4.2.2**, there are a number of modal shift enhancements included in the Proposed Scheme that will contribute locally to this measure. Fully consistent with Section 15 of the Act.
		For passenger cars, an environment fostering their placement of ICE cars after 2030 will be supported by various EV policy pathways relating to vehicles and charging infrastructure.	The Proposed Scheme includes for a series of proposed electric vehicle charging points as part of the off-street parking design for the Public Realm. This infrastructure will support delivery of this measure. Fully consistent with Section 15 of the Act.
The most recent approved national adaptation framework and approved sectoral adaptation plans	National Adaptation Framework 2018	Action 11: Ensure climate proofing considerations are fully integrated into arrangements and reforms arising from the new Ireland 2040 – National Planning Framework including Guidelines, updated guidance on adaptation proofing of SEA and EIA and in revisions of building standards.	TII guidance that has informed this assessment requires that a Climate Change Risk assessment is undertaken at planning stage to identify the vulnerability of the development to climate change and to consider adaptation measures to increase the resilience of the project. This has been fully documented within this chapter to ensure a climate resilient scheme. Fully consistent with Section 15 of the Act.
	Climate Change Adaptation Plan for Transport 2019	Objective 3: Ensure that resilience to weather extremes and longer-term adaptation needs are considered in investment programmes for planned future transport infrastructure.	As above, assessed in detail in this chapter and in the flood risk assessment and fully consistent with Section 15 of the Act.
		Action 17: Strengthen sectoral adaptation responses by ensuring that climate resilience is considered in appraisal guidance, including in the update to the Common Appraisal Framework, for all future transport infrastructure projects over appropriate timescales.	As above, assessed in detail in this chapter and in the flood risk assessment and fully consistent with Section 15 of the Act.

19.7 Monitoring

No project specific monitoring is proposed for climate during the construction or operational phases of the Proposed Scheme.

19.8 Chapter References

Climate Ireland (2023) Climate Data Tool from Climate Ireland. Available at: https://www.climateireland.ie/#!/tools/climateDataExplorer.

DECC (2023) Ireland's Long-term Strategy on Greenhouse Gas Emissions Reduction.

DECC (2022) Climate Action Plan 2023.

DECC (2021) Climate Action and Low Carbon Development (Amendment) Act 2021.

DECC (2019) Climate Action Plan 2019.

DECC (2018) National Adaptation Framework.

DECC (2015) Climate Action and Low Carbon Development Act 2015.

DECC (2013) National Policy Position on Climate Action and Low Carbon Development

Department of Transport Tourism and Sport (2019) Transport Climate Change Sectoral Adaptation Plan.

EC (2021) EU Technical guidance on the climate proofing of Infrastructure in the Period 2021-2027.

EPA (2023) Ireland's Greenhouse Gas Emissions Projections 2021-2040. Environmental Protection Agency, June 2023.

EPA (2022) Ireland's Final Greenhouse Gas Emissions 1990-2021. Environmental Protection Agency, April 2022.

ICE (2023) Carbon Management in Infrastructure as noted in the TII GHG methodology guidance.

IEMA (2022) Guidance on 'Assessing Greenhouse Gas Emissions and Evaluating their Significance', 2nd Edition as noted in the TII GHG methodology guidance.

IEMA (2020) Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation (2nd Edition).

MCC (2022) Slane Public Realm Plan.

MCC (2021) Meath County Council Development Plan 2021-2027.

MCC (2019) Meath County Council Climate Action Strategy 2019-2024.

Met Éireann (2023) Major Weather Event Database. Available at: https://www.met.ie/climate/major-weather-events

Met Éireann (2012) Climatological Note No. 14: A Summary of Climate Averages for Ireland 1981-2010.

Nolan, P. and Flanagan, J. (2020) EPA Research Report 339: High-resolution Climate Projections for Ireland – A Multi-model Ensemble Approach.

ThinkHazard! (2023) Global Facility for Disaster Reduction and Recovery 'Think Hazard!' tool. Available at: https://thinkhazard.org/en/

TII (2022a) Climate Assessment of Proposed National Road Projects – Standard PE-ENV-01105

TII (2022b) Climate Guidance for National Roads, Light Rail, and Rural Cycleways (Offline and Greenways) – Overarching Technical Document PE-ENV-01104.

TII (2022c) Road Emissions Model (REM): Model Development Report GE-ENV-01107.

TII (2022d) Carbon Tool for Road and Light Rail Projects: User Guidance Document GE-ENV-01106.