3FMProject

Bringing
Dublin Port
To 2040

Environmental Impact Assessment Report

Appendix 11.1

Volume 3 Part 6

COMHLACHT CHALAFORT ÁTHA CLIATH
DUBLIN PORT COMPANY

RPS
A TETRA TECH COMPANY

Third & Final
Masterplan
Project

DUBLIN PORT 3FM PROJECT

Climate Impact Assessment

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Abbreviations

3FM	Third and Final Masterplan
BER	Building Energy Rating
BSI	British Standards Institute
CAP	Climate Action Plan
CARO	Climate Action Regional Office
CCR	Climate Change Risk
CDP	County Development Plan
CDM	Clean Development Mechanism
CO_2	Carbon Dioxide
CO_{2e}	Carbon Dioxide Equivalent
COP	Conference of Parties
CSO	Central Statistics Office
DCC	Dublin City Council
DEFRA	Department for Environment, Food & Rural Affairs (UK)
DPC	Dublin Port Company
EGD	European Green Deal
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
ESR	European Union's Effort Sharing Regulation (EU 2018/842)
ETS	Emissions Trading Scheme
EU	European Union
EVs	Electric Vehicles
GGBS	Ground Granulated Blast-Furnace Slag
GHG	Greenhouse Gas
HGVs	Heavy Goods Vehicles
HML	High Mast Lights
HRA	Hot Rolled Asphalt
IEMA	Institute of Environmental Management and Assessment
IMO	International Maritime Organisation
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
LAP	Local Area Plan
LCA	Life Cycle Assessment
LEA	Local Electoral Area
LED	Light Emitting Diode
Lo-Lo	Load on-Load off
LULUCF	Land Use, Land Use Change and Forestry
MARPOL	International Convention for the Prevention of Pollution from Ships

Mt CO_{2e}	Million Tonnes Carbon Dioxide Equivalent
MRV	Monitoring, Reporting and Verification
MTL	Marine Terminals Limited
N_2O	Nitrous Oxide
NAF	National Adaptation Framework
NDCs	Nationally Determined Contributions
NDP	National Development Plan
NGO	Non-Governmental Organisations
NPF	National Planning Framework
NPOs	National Policy Objectives
NSOs	National Strategic Outcomes
PAS	Publicly Available Specification
REM	Road Emissions Model
Ro-Ro	Roll on-Roll off
RSES	Regional Spatial and Economic Strategy
SDG	Sustainable Development Goals
SECAP	Sustainable Energy and Climate Action Plans
SFC	Specific Fuel Consumption
SI	Sustainable Infrastructure
SID	Strategic Infrastructure Development
SPAR	Southern Port Access Route
SSFRA	Site Specific Flood Risk Assessment
SuDS	Sustainable Drainage Systems
TEU	Twenty-foot Equivalent Units
TII	Transport Infrastructure Ireland
UNFCCC	United Nations Framework Convention on Climate Change
WMA	Warm Mix Asphalt

1 INTRODUCTION

1.1 Scope and Purpose of this Report

This report presents the Climate Impact Assessment of the Dublin Port 3FM Project and has been devised to inform the iterative Environmental Impact Assessment (EIA) process for the project. In particular, this report has been used to inform the preparation of **Chapter 11 Climate** of the EIAR.

Annex IV to the 2014 EIA Directive includes direct reference to climate and climate change with the emphasis placed on two distinct aspects of the climate change issue:

- Climate change mitigation: this considers the impact the Project will have on climate change, through greenhouse gas emissions primarily; and
- Climate change adaptation: this considers the vulnerability of the Project to future changes in the climate, and its capacity to adapt to the impacts of climate change, which may be uncertain.

This assessment identifies and presents an assessment of the likely significant effects of the 3FM Project (hereafter the 'proposed development') on climate (mitigation) and also the vulnerability of the project to climatic factors (adaptation).

This report will also assess the consistency of the proposed development with the provisions of the Climate Action and Low Carbon Development Acts 2015 to 2021.

1.2 Methodology

This chapter has been prepared in accordance with the following legislation and guidance documents:

- Directive 2011/92/EU, as amended by Directive;
- The European Commission Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (2017);
- The Climate Action and Low Carbon Development Act 2015;
- The Climate Action and Low Carbon Development (Amendment) Act 2021;
- The Government of Ireland's Climate Action Plan 2024;
- The European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018);
- Guidelines on information to be contained in Environmental Impact Assessment Reports (EPA, 2022);
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment, (DHPLG, August 2018); and
- Circular PL 05/2018 -Transposition into Planning Law of Directive 2014/52/EU amending Directive 2011/92/EU on the effects of certain public and private projects on the environment (the EIA Directive).

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

- Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment (2013);
- European Commission, Directorate-General for Environment, *Guidance on integrating climate change and biodiversity into environmental impact assessment*, Publications Office, 2013, https://data.europa.eu/doi/10.2779/11735;
- Institute of Environmental Management & Assessment (IEMA, 2022): Assessing GHG Emissions and Evaluating their Significance;
- British Standards Institution (BSI, 2023): PAS 2080 Carbon Management Infrastructure;
- European Commission (2021): Technical guidance on the climate proofing of Infrastructure in the Period 2021-2027; and

- Institute of Environmental Management and Assessment (IEMA, 2020): Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation (2nd Edition).

Transport Infrastructure Ireland (TII) have used these international and EU standards to devise national climate impact assessment guidelines for national roads, light rail and greenways entitled: Climate Guidance for National Roads, Light Rail, and Rural Cycleways (Offline and Greenways) – Overarching Technical Document PE-ENV-01104 (December 2022). In the absence of any specific port related guidance, the framework of the TII guidance will be applied for this assessment.

As per the EU Directive, the TII guidance requires that the climate impact assessment must report the project impact on greenhouse gas emissions (GHGs) and the project risk and resilience to climate change through a climate assessment through the following separate assessments:

- GHG Assessment: the assessment of GHG emissions identifies the impact of GHGs arising from a project 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 project to climate change and considers adaptation measures to increase the resilience of the project.

The GHG assessment of the 3FM Project has been undertaken for the construction phase 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 PAS 2080 Carbon Management Infrastructure standard using detailed design information from the design team and calculated via the One Click Life Cycle Assessment (LCA) software tool.

Emissions from road transport of freight/passengers to and from the port when the proposed development 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 project to assess the change in emissions associated with road traffic on the road network.

Shipping emissions associated with the operation of the proposed development have been quantified using the emission factors presented in the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

GHG emissions from on-site energy use during the operational phase of the development are assessed through a review of the proposed changes to operations and energy demands at the site to determine the potential for significant impact.

The combined outputs of the above represent the GHG assessment of this report. The purpose of this assessment is to quantify emissions and then seek measures to avoid or reduce, in so far as practicable, the GHG emissions from the project.

The CCR Assessment identifies the impact of a changing climate on the project and receiving environment. The assessment considers the project's vulnerability to climate change and identifies adaptation measures to minimise climate change impacts. The purpose of the CCR assessment is to reduce or manage the adverse impacts and risks of climate change on the proposed development and develop the project resilient to climate change.

1.3 Structure of this Report

This report has been structured to provide the relevant background, policy, and legislation to inform the impact assessment process undertaken in **Chapter 11** of the EIAR and the structure of this report is laid out as follows:

- **Chapter 2 Legislation and Policy** defines the current climate policy/legislative framework for the impact assessment;
- **Chapter 3 Baseline Climate** provides an overview of current emissions and climate resilience at Dublin Port;
- **Chapter 4** is a **Climate Assessment of Alternatives** that provides technical analysis to support the findings of Chapter 4 of the EIAR on Alternatives;
- **Chapter 8** presents the GHG **Construction Phase Emissions** in terms of methodology, results and mitigation;

- **Chapter 6** presents the GHG **Operation Phase Emissions** in terms of methodology, results and mitigation;
- **Chapter 7** relates to **Climate Adaptation/Climate Change Risk** in the construction and operation phases;
- **Chapter 8** presents details on **Cumulative Impact and Interactions** of climate with other EIA disciplines; and
- **Chapter 9** presents the **Conclusions** of this assessment in terms of residual impact and compliance with the Climate Acts.

The context for the climate impact assessment is based on Chapter 5 Project Description of the EIAR.

2 LEGISLATION AND POLICY

2.1 Legislation

2.1.1 International Legislation

Ireland is a signatory to both the United Nations Framework Convention on Climate Change (UNFCC 1992) and the Kyoto Protocol (UNFCC 1997). The Paris Agreement (UNFCC 2015), which was implemented in 2016, is an integral milestone concerning international climate change accords. Its overarching goal is to hold '*the increase in the global average temperature to well below 2°C above pre-industrial levels'* and pursue efforts '*to limit the temperature increase to 1.5°C above pre-industrial l*evels.' The aim is to confine global GHG emissions to 40 gigatonnes per year expeditiously, in addition to recognising that decreasing GHG emissions will be prolonged in developing countries.

The Paris Agreement works on a five-year cycle of increasingly ambitious climate action carried out by nation governments. Since 2020, governments have been submitting their national climate action plans, known as Nationally Determined Contributions (NDCs).

2.1.2 European Legislation

Accomplishing the commitments of the Paris Agreement spurred the European Union (EU) to enforce 'Regulation (EU) 2018/842' on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action. Another Directive, 'Regulation (EU) No. 525/2013' was amended to procure realising EU climate goals (European Parliament and Council of Europe 2018). That regulation amendment intends to frugally deliver reductions in EU GHG emissions of 43% from the Emission Trading Scheme (ETS) and 30% from non-ETS sectors by 2030 relative to 2005.

The ETS is an EU-wide scheme which regulates the GHG emissions of larger industrial emitters which encompass electricity generation, cement manufacturing and heavy industry. Since January 2024, the ETS has been extended to cover CO_2 emissions from all large ships (of 5,000 gross tonnage and above) entering EU ports, regardless of the flag they fly. The system covers:

- 50% of emissions from voyages starting or ending outside of the EU (allowing the third country to decide on appropriate action for the remaining share of emissions); and
- 100% of emissions that occur between two EU ports and when ships are within EU ports.

The EU ETS covers CO_2 (carbon dioxide), CH_4 (methane) and N_2O (nitrous oxide) emissions, but the two latter only as from 2026.

The non-ETS sectors includes all domestic GHG emitters which do not fall under the ETS scheme and thus constitutes GHG emissions from transport, residential, commercial and agriculture. Essentially, Ireland is required under the Effort Sharing Regulation (Regulation (EU) 2023/857) to attain a 42% decrease in non-ETS GHG emissions by 2030 compared to 2005 levels.

2.1.3 National Legislation

In 2015, the Climate Action and Low Carbon Development Act (the 2015 Act) was enacted by the Oireachtas. The function of the 2015 Act was to facilitate Ireland's just-transition to a low carbon, climate resilient and environmentally sustainable economy, and this was cited as the 'national transition objective'.

In June 2020, the Government published the current Programme for Government – Our Shared Future (Government of Ireland 2020). Regarding climate, there is a pledge to an average 7% per annum decrease in total GHG emissions from 2021 to 2030. This would result in 51% reduction by the end of the decade, and ultimately obtaining net zero emissions by 2050.

In 2021 the Climate Action and Low Carbon (Amendment) Act (the 2021 Act) was enacted, giving statutory effect to the core objectives stated within the Climate Action Plan (CAP)[1]. The 2021 Act established carbon budgets and sectoral emissions limits and outlines the carbon budget as the total greenhouse gas emissions that are allowed during the budget period.

Section 6B(12) of the 2021 Act requires the Minister for the Environment, Climate and Communications to publish the approved carbon budget programme. In May 2022 the budgets were published and the total emissions allowed under each budget is set out below, as well as the average annual reduction for each five-year period:

- 2021-2025: 295 Mt CO_{2e} - this represents an average reduction in emissions of 4.8% per annum for the first budget period;
- 2026-2030: 200 Mt CO_{2e} - this represents an average reduction in emissions of 8.3% per annum for the second budget period; and
- 2031-2035: 151 Mt CO_{2e} - this represents an average reduction in emissions of 3.5% per annum for the third provisional budget.

To deliver these budgets, in July 2022 the government-established Sectoral Emissions Ceilings which set maximum limits on greenhouse gas emissions for each sector of the Irish economy to 2030 and these are summarised in **Table 2-1**. The table shows ambitious targets for electricity and transport with more modest targets for industry and agriculture.

Table 2-1: Sectoral Emissions Ceilings

Sector	Reduction	2018 Baseline	2030 Ceiling
Electricity	75%	10.5 $MtCO_2e$	3 $MtCO_2e$
Transport	50%	12 $MtCO_2e$	6 MtCO2e
Buildings (Commercial and Public)	45%	2 $MtCO_2e$	1 $MtCO_2e$
Buildings (Residential)	40%	7 $MtCO_2e$	4 $MtCO_2e$
Industry	35%	7 $MtCO_2e$	4 $MtCO_2e$
Agriculture	25%	23 $MtCO_2e$	17.25 $MtCO_2e$
Other (F-gases, Petroleum Refining and Waste)	50%	2 $MtCO_2e$	1 $MtCO_2e$

Section 15 of the 2015 Act, as amended, defines the duties of certain bodies under the Act.

An Bord Pleanála is a relevant body under section 15 and must perform its functions in a manner consistent with the policy base listed in section 15(1). Each of the policy elements listed in Section 15(1) is described in **Section 2.2** and this assessment includes an analysis of the consistency of the 3FM Project with these climate policies and whether ABP, in considering and granting the application for development consent, has in so far as practicable, performed its functions in a manner consistent with this policy base.

> *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.*

[1] Climate Actions Plans (CAP) had been prepared prior to the legislation in both 2019 and 2021. CAP23 was the first to be published under the new legislation which has now been superseded by CAP24 in May 2024.

2.2 Policy

2.2.1 International Policy

2.2.1.1 The United Nations Framework Convention on Climate Change (UNFCCC) 1994

The UNFCCC[2] entered into force on 21 March 1994. Today, it has near universal membership. The 198 countries that have ratified the convention are called Parties of the Convention. Preventing dangerous human interference with the climate system is the aim of the UNFCCC and has the ultimate objective of stabilising GHG concentrations around the globe. The annual conference of the parties (COP) reviews the implementation of the convention and adopts decisions and protocols to further develop and implement the convention such as the Kyoto Protocol and the Paris Agreement.

2.2.1.2 The Kyoto Protocol 1997

Following on from the ratification of the UNFCCC, the Kyoto Protocol[3] was adopted in 1997 and came into force in 2005. The Kyoto Protocol operationalises the UNFCCC by committing industrialised countries and economies in transition to limit and reduce greenhouse gas emissions in accordance with agreed individual targets. The convention asks those countries to adopt policies and measures on mitigation and to report on them periodically. Ireland met its Kyoto Protocol targets under the EU burden-sharing agreement. A major feature of the Kyoto Protocol was the establishment of flexible market mechanisms such as Emissions Trading, Clean Development Mechanism (CDM) and Joint Implementation (JI). These allowed for cost-effective trading in the marketplace. This is the basis of the European Union Emissions Trading Scheme (ETS) of which Ireland is part.

2.2.1.3 The Paris Agreement 2015

In 2015, 196 countries that are party to the UNFCCC, including Ireland, adopted the Paris Agreement[4], a legally binding international treaty on climate change with the goal to limit global warming to well below 2º C, preferably to 1.5º C compared to preindustrial levels. It aims to ensure that parties to the Agreement peak their GHG emissions as soon as possible. This landmark international agreement includes commitments from all countries to reduce their emissions and calls on countries to strengthen their commitments over time. These include commitments to reduce GHG emissions, enhance adaptation actions, finance, and capacity building.

2.2.1.4 United Nations Sustainable Development Goals 2015

In 2015, Ireland was one of the 193 UN member countries to sign UN Resolution A/RES/70/1 2030, Transforming our World: the 2030 Agenda for Sustainable Development[5]. The 17 Sustainable Development Goals (SDGs) are a non-binding universal call to action to end poverty, protect the planet and improve the lives and prospects of everyone, everywhere. The UN Secretary-General has called on all sectors of society to mobilize for a decade of action to 2030 on three levels: global action, local action, and people action.

The non-binding goals, in Ireland, have been linked to policy documents rather than written into legislation. For example, the objectives of the National Planning Framework are closely aligned with the UN Sustainable Development Goals. In addition, reference to sustainable development and the SDGs are found across the hierarchy of planning policy from the Regional Spatial and Economic Strategy (RSES) to the County Development Plan (CDP), to the local area plan (LAP).

Most of the sustainable development goals are relevant to decarbonisation zones for example, Goal 3 Good Health and Well Being, Goal 6 Clean Water and Sanitation, Goal 7 Affordable and Clean Energy, Goal 8

[2] What is the United Nations Framework Convention on Climate Change? | UNFCCC

[3] What is the Kyoto Protocol? | UNFCCC

[4] The Paris Agreement | United Nations

[5] Transforming our world: the 2030 Agenda for Sustainable Development | Department of Economic and Social Affairs (un.org)

Decent Work and Economic Growth, Goal 11 Sustainable Cities and Communities, Goal 12 Responsible Consumption and Reduction, Goal 13 Climate Action, Goal 14 Life Below Water, and Goal 15 Life on Land.

2.2.2 European Policy

2.2.2.1 European Green Deal 2019

In December 2019, the EU Commission introduced the European Green Deal[6] (EGD), setting out a blueprint for transformational change to make the EU the first climate neutral economy in the world. Framed as a new growth strategy and roadmap for making the EU's economy sustainable, the EGD enables the EU to achieve its commitment under the Paris Agreement. To get there, they pledged to reduce emissions by at least 55% by 2030, compared to 1990 levels.

The EGD provides a roadmap with actions to boost the efficient use of resources by moving to a clean, circular economy, restore biodiversity and cut pollution. Reaching this target will require action by all sectors of the economy, notably transport, energy, agriculture, buildings, and industries such as steel, cement, ICT, textiles, and chemicals. The EU will also provide financial support and technical assistance to help people, businesses and regions that are most affected by the move towards the green economy. To reach the intended climate and environmental ambition, the commission produced the European Climate Law which came into force in June 2021.

2.2.2.2 European Climate Law 2021

The European Climate Law[7] entered into force on 29 July 2021 and writes the goal set out in the EGD for Europe's economy and society to become climate neutral by 2050 into law. The law also sets the intermediate goal of reducing net GHG emissions by at least 55% by 2030 compared to 1990 levels. The Climate Law sets a legally binding target and requires EU Member States to take the necessary measures to meet this target.

In order to follow the pathway set in the European Climate Law and deliver this level of ambition for 2030, the Commission has reviewed the climate and energy legislation currently in place and produced a package of proposals to revise and update EU legislation known as the 'Fit for 55' package in July of 2021.

Legislative areas currently under review include:

- EU emissions trading system (amendment);
- Efforts sharing regulation (amendment);
- Land Use Land Use Change and Forestry (LULUCF) (amendment);
- Alternative Fuels Infrastructure (new regulation);
- Carbon Border Adjustment Mechanism (new regulation);
- Social Climate Fund (new fund);
- RefuelEU aviation and FuelEU maritime (new legislation);
- CO_2 emission standards for cars and vans (amendment);
- Energy taxation Directive (amendment);
- Renewable energy Directive (amendment);
- Energy efficiency (amendment); and
- Energy performance of buildings (amendment).

The inclusion of the shipping sector in the EU emissions trading system and the FuelEU maritime legislation are the policy developments of greatest relevance to the 3FM Project.

[6] Delivering the European Green Deal (europa.eu)

[7] European Climate Law (europa.eu)

2.2.3 National Policy

2.2.3.1 The Climate Action Plans

The Climate Action Plan 2019[8] (CAP19) was published by the Government in June 2019. CAP19 had 183 cross-sectoral targets and actions including for the electricity sector, enterprise, built environment, transport, agriculture, waste and the circular economy and the public sector. The plan sets out how Ireland will achieve its 2030 targets for carbon emissions and puts Ireland on a trajectory to achieve net zero carbon emissions by 2050.

Building on CAP19, the Climate Action Plan 2021[9] (CAP21) represents a more ambitious and detailed sectoral roadmap designed to deliver a 51% reduction in GHG emissions by 2030. CAP21 sets out almost 500 actions to support Ireland's journey towards a 51% reduction in GHGs by 2030 compared to the 2018 baseline as set out in the Climate and Low Carbon Development Act 2021. CAP21 envisages large-scale renewable electricity generation (wind and solar up to 80% by 2030), almost a million electric vehicles (EVs) on the road, retrofitting 500,000 homes to Building Energy Rating (BER) B2 or better, increasing the cost of emissions for industry and reducing chemical nitrogen usage on farms. It sets indicative ranges of emissions reductions for each sector of the economy.

Published in December 2022, the Climate Action Plan 2023[10] (CAP23) is the second update to Ireland's first Climate Action Plan 2019 and builds on the previous climate action plans and is the first plan to implement economy-wide carbon budgets and sectoral emissions ceilings agreed in July 2022. The updated Climate Action Plan focuses on how to achieve the required system change across society and the economy. The plan requires, by 2030, a 75% reduction in electricity sector emissions, 45% reduction in commercial/public buildings emissions, a 40% reduction in residential buildings emissions, 50% reduction in transport sector emissions, 35% reduction in industry emissions and 25% reduction in agricultural emissions.

The most recent approved climate action plan is Climate Action Plan 2024 (CAP24) which was adopted in May 2024. CAP24 builds upon CAP23 by refining and updating the measures and actions required to deliver the carbon budgets and sectoral emissions ceilings.

Chapter 10 of CAP24 requires the public sector to play a leadership role in driving far-reaching climate action across its buildings, transport, waste, and energy usage as well as wider society. As part of the Public Sector Climate Action Mandate, the following commitment is made for publicly funded projects:

> *3.5.1 Specify low carbon construction methods and low carbon cement material as far as practicable for directly procured or supported construction projects from 2023.*

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

Chapter 13 of CAP24 relates to industry and while not directly applicable to the operations of DPC, this chapter does have relevance to the construction phase of the project and the embodied carbon in construction materials. The relevant Chapter 13 targets are listed as follows:

- *2025 KPI: Decrease embodied carbon in construction materials produced and used in Ireland by 10% through product substitution; and*
- *2030 KPI: Decrease embodied carbon in construction materials produced and used in Ireland by at least 30% through product substitution for construction materials and reduction of clinker content in cement.*

While these indicators are placed on the industrial sector, DPC can support delivery through ensuring procurement of low carbon materials on all construction projects as per the Chapter 10 policy. The above policy elements are specifically relevant to the construction phase of the 3FM Project, and these commitments will be used to inform the assessment of significance for this phase of the proposed development.

[8] CAP19: gov.ie - Climate Action Plan 2019 (www.gov.ie)

[9] CAP21: gov.ie - Climate Action Plan 2021 (www.gov.ie)

[10] CAP23: gov.ie - Climate Action Plan 2023 (www.gov.ie)

Chapter 15 of CAP24 addresses transport emissions and while the focus is on road transport, there are policies and notes of direct relevance to this project. CAP24 acknowledges that ports are key to national connectivity as an island nation and act as key strategic delivery partners for other sectoral decarbonisation plans.

The Alternative Fuels Infrastructure regulation and the FuelEU Maritime regulations will require the development of on-shore electricity supply in Irish TEN-T ports and the increased take-up of renewable maritime fuels in larger vessels.

CAP24 notes that the planned update to the National Ports Policy will include the re-evaluation of the policy framework for the decarbonisation of ports as a key consideration, and take into account recommendations of the draft All-Island Strategic Rail Review with regard to enhanced rail connectivity to ports to improve and encourage greater integration of rail freight and rail passenger transport with seaports.

The only listed action for maritime transport in Chapter 15 is as follows:

> *TR/24/25 Re-evaluation of the policy framework for the decarbonisation of ports as part of the overall review of National Ports Policy.*

CAP24 acknowledges that a particularly difficult challenge for the decarbonisation of the transport sector has been in the haulage and heavy goods road freight sector. Two actions are listed in relation to transport of freight as follows:

> *PW/24/2 Establish structure(s) for evaluating further Modal Shift (Freight) and Sustainable Biofuels in Transport, for the purpose of addressing the currently unallocated emission savings.*
>
> *TR/24/14 (TF) Continue investment in passenger and freight rail, informed by outcomes of All Island Strategic Rail Review.*

In terms of developing the wider transport network within the State, CAP24 includes actions that support the development of active travel infrastructure such as:

> *JM/24/6 Support regeneration, repurposing and sustainable development of walking and cycling tracks and trails, and waterways.*
>
> *TR/24/11 (TF) Advance roll-out of walking/cycling infrastructure in line with National Cycle Network and CycleConnects plans.*

Each of these policies and actions has been employed in devising the project design and this assessment will include an analysis of the consistency of the 3FM Project with these actions.

2.2.3.2 Long Term Strategy on Greenhouse Gas Emissions Reductions

Ireland's current Long-term Strategy on Greenhouse Gas Emissions Reductions[11] 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 CAP23/CAP24, to ensure coherent and effective climate policy.

It is underpinned by analysis of transition options across each key sector of the economy and provides a crucial link between Ireland's 2030 climate targets and the long-term goal set by Ireland's National Climate Objective and the European Climate Law.

In relation to shipping and under the theme of transport, the Strategy notes the following:

> *As a small open economy on the periphery of Europe, the aviation and maritime sectors are critical for the movement of our goods and people. Action is being taken at EU and international levels to address emissions from these sectors, including through market-based measures such as the EU ETS and sustainable fuel mandating initiatives (through ReFuel EU Aviation, Fuel EU Maritime, and the Alternative Fuel Infrastructure Regulation, which will all include binding targets once adopted).*
>
> *Continued international collaboration through the International Maritime Organization and the International Civil Aviation Organization, will be key to achieving greater sustainability and preserving a*

[11] https://www.gov.ie/en/publication/e4e81-long-term-strategy-on-greenhouse-gas-emissions-reductions/#:~:text=The%20Long%2Dterm%20Strategy%20covers,enhancements%20of%20removals%20by%20sinks

level playing field in these global sectors. Ireland will support appropriate actions taken at EU and global levels to reduce emissions from the aviation and maritime sectors.

In terms of addressing Emission Reduction Measures and Milestones to 2050 for shipping, the Strategy notes the following:

The 2018 International Maritime Organisation (IMO) strategy on the reduction of greenhouse gas emissions from ships has the objective of reducing emissions by 50% by 2050 compared to 2008 while pursuing efforts to achieve full decarbonisation as soon as possible in this century.

The IMO strategy envisages the adoption of measures and incentives to encourage further development and use of low and zero carbon fuels in shipping, including a combination of bioenergy and renewable fuels, hydrogen and its derivatives. Research and development of these alternative fuels will require international collaboration requiring significant investments over the coming decades and Ireland will actively contribute to this agenda, including through a supportive research infrastructure where relevant. The initial IMO strategy envisaged that a revised strategy would be adopted in 2023.

In summary, the Long-term Strategy on Greenhouse Gas Emissions Reductions has established that the strategy for shipping emissions is to implement and comply with EU regulations and the IMO strategy on the reduction of greenhouse gas emissions. There are no national or port specific policies that must be adopted for the proposed development outside the EU and IMO requirements.

2.2.3.3 The National Adaptation Framework (2024)

Ireland's first statutory National Adaptation Framework[12] (NAF) was published in 2018. The NAF sets out the national strategy to reduce the vulnerability of the country to the negative effects of climate change and was developed under the Climate and Low Carbon Development Act 2015. The NAF provides a framework to ensure local authorities, regions and key sectors can assess the key risks and vulnerabilities of climate change, implement action so build resilience to climate change and ensure climate adaptation considerations are mainstreamed into all local, regional, and national policy.

The NAF also aims to improve the enabling environment for adaptation through ongoing engagement with civil society, the private sector and the research community. The key actions of relevance to the project 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 Act requires that the NAF be reviewed at least every five years. Ireland's second statutory NAF was published in June 2024 and replaces the first iteration of the framework published in 2018, which was reviewed in 2022 in line with the five year requirement of the 2015 Climate Act.

The 2024 NAF commits to the development of revised sectoral adaptation plans which are fully aligned with the NAF to strengthen the sectoral adaptation approach and align with up-to-date climate and adaptation science, policy and practice.

In terms of the transport sector, the 2024 NAF highlights the following potential adaptation impacts to the sector:

- Projected extreme precipitation may increase pluvial and fluvial flooding, impacting the transport sector with service disruptions, hazardous driving conditions, and bridge scour;
- Intensified windstorms may disrupt transport hubs, causing delays and cancellations, and affecting transport networks with fallen trees and debris;
- Sea level rise and intensified storms may significantly impact transport infrastructure in low-lying coastal areas, eroding coastlines, and estuaries; and

[12] National Adaptation Framework gov.ie - National Adaptation Framework (NAF) (www.gov.ie) [Accessed 07/02/2023]

- Heatwaves and drought may degrade transport infrastructure, affecting road surfaces and rails, and require temperature control measures in hubs.

Each of the above have been considered in the assessment presented in this report.

2.2.3.4 Sectoral Adaptation Plans

In 2019, the Climate Change Adaptation Plan for Transport was published by the Department of Transport, Tourism and Sport (as per Action 2 of the 2018 NAF). 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 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 development 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.*

As noted, the 2024 NAF requires the review of all sectoral adaption plans including the Climate Change Adaptation Plan for Transport.

2.2.3.5 National Climate Objective

Ireland's National Climate Objective, established in law by the 2021 Act, is to achieve a climate neutral economy by no later than the end of the year 2050. The 2021 Act also provides for an interim 51% reduction in emissions, relative to 2018 levels, by 2030 - in line with the European Climate Law and with the IPCC's 1.5°C pathway. The 2030 and 2050 targets are to take account of all greenhouse gases included in the common reporting format tables submitted by the Environmental Protection Agency (EPA) under the United Nations reporting guidelines.

2.2.4 Local Policy

2.2.4.1 Dublin City Development Plan 2022-2028

The Dublin City Development Plan 2022-2028 (CDP) sets out the policies and objectives and the overall strategy for the development of the city to 2028. The aim of the plan is to improve the quality of life for its citizens, and make sure that Dublin City is an attractive place to live, work and visit. The plan has sixteen key chapters covering the many aspects of development with a high level of integration and interdependency across themes, particularly climate action. The main strategic approach of the plan is to develop a city that is:

- Low Carbon;
- Sustainable; and
- Climate Resilient (the capability to anticipate, plan for, respond to and recover from significant hazardous events such as floods with minimum damage to social wellbeing, the economy, and the environment).

Chapter 3 (Climate Action) of the plan outlines the Council's policy response for climate action whilst also acknowledging an overall strategic approach to climate action involving all parts of the plan including ways to manage and adapt to climate change. This will make sure that Dublin becomes a low-carbon, climate-resilient city.

The following policies of relevance are extracted from Chapter 3 of the CDP, *Climate Action*:

CA1: National Climate Action Policy

It is the policy of Dublin City Council to support the implementation of national objectives on climate change including the 'Climate Action Plan 2021: Securing Our Future' (including any subsequent updates to or replacement thereof), the 'National Adaptation Framework' 2018 and the 'National Energy and Climate Plan for Ireland 2021-2030' and other relevant policy and legislation.

CA2: Mitigation and Adaptation

It is the policy of Dublin City Council to prioritise and implement measures to address climate change by way of both effective mitigation and adaptation responses in accordance with available guidance and best practice.

CA3: Climate Resilient Settlement Patterns, Urban Forms and Mobility

It is the policy of Dublin City Council to support the transition to a low carbon, climate resilient city by seeking sustainable settlement patterns, urban forms and mobility in accordance with the National Planning Framework 2018 and the Regional Spatial and Economic Strategy 2019.

CA4: Improving Mobility Links in Existing Areas

It is the policy of Dublin City Council to support retrofitting of existing built-up areas with measures which will contribute to their meeting the objective of a low-carbon city, such as reopening closed walking and cycling links or providing new links between existing areas.

CA5: Climate Mitigation and Adaptation in Strategic Growth Areas

It is the policy of Dublin City Council to ensure that all new development including in Strategic Development and Regeneration Areas integrate appropriate climate mitigation and adaptation measures. See also Section 15.4.3. Sustainability and Climate Action and Section 15.7.3 Climate Action and Energy Statement.

CA8: Climate Mitigation Actions in the Built Environment

It is the policy of Dublin City Council to require low carbon development in the city which will seek to reduce carbon dioxide emissions, and which will meet the highest feasible environmental standards during construction and occupation. New development should generally demonstrate/ provide for:

a. building layout and design which maximises daylight, natural ventilation, active transport, and public transport use.

b. sustainable building/services/site design to maximise energy efficiency.

c. sensitive energy efficiency improvements to existing buildings.

d. energy efficiency, energy conservation, and the increased use of renewable energy in existing and new developments.

e. on-site renewable energy infrastructure and renewable energy.

f. minimising the generation of site and construction waste and maximising reuse or recycling.

g. the use of construction materials that have low to zero embodied energy and CO_2 emissions.

h. connection to (existing and planned) decentralised energy networks including the Dublin District Heating System where feasible.

CA9: Climate Adaptation Actions in the Built Environment

It is the policy of Dublin City Council that Development proposals must demonstrate sustainable, climate adaptation, circular design principles for new buildings / services / site. The council will promote and support development which is resilient to climate change. This would include:

a. measures such as green roofs and green walls to reduce internal overheating and the urban heat island effect.

b. ensuring the efficient use of natural resources (including water) and making the most of natural systems both within and around buildings.

c. minimising pollution by reducing surface water runoff through increasing permeable surfaces and use of Sustainable Drainage Systems (SuDS).

d. reducing flood risk, damage to property from extreme events– residential, public and commercial.

e. reducing risks from temperature extremes and extreme weather events to critical infrastructure such as roads, communication networks, the water/drainage network, and energy supply.

f. promoting, developing and protecting biodiversity, novel urban ecosystems and green infrastructure.

CA19: Decarbonising Zones

It is the policy of Dublin City Council to support, encourage and facilitate the specific polices and projects identified in the Decarbonisation Zone of ***Ringsend/Irishtown*** *in order to address local low carbon energy, greenhouse gas emissions and climate needs and commit to establishing Decarbonising Zones in each LEA (Local Electoral Area) within the lifetime of this plan, with a view to designating all of Dublin City as a decarbonised zone by the end of this Development Plan.*

CA26: Flood and Water Resource Resilience

It is the policy of Dublin City Council to support, encourage and facilitate the delivery of soft, green and grey adaptation measures to enhance flood and water resource resilience in the city and support the delivery of grey adaptation measures to enhance flood and water resource resilience where necessary.

CA27: Flood Risk Assessment and Adaptation

It is the policy of Dublin City Council to address flood risk at strategic level through the process of Strategic Flood Risk Assessment, and through improvements to the city's flood defences.

CA28: Natural Flood Risk Mitigation

It is the policy of Dublin City Council to encourage the use natural flood risk mitigation or nature-based solutions including integrated wetlands, green infrastructure, and Sustainable Drainage Systems (SuDS) as part of wider adaptation and mitigation responses to achieve flood resilience.

CA29: Climate Action and Green Infrastructure

It is the policy of Dublin City Council to protect, connect and expand the city's Green Infrastructure while optimising the climate change adaptation and mitigation services it provides.

CA30: Coastal Zone Management

It is the policy of Dublin City Council to support, encourage and facilitate coastal zone management measures for adapting to climate change which include restoration of degraded ecosystems, increased flood resilience, water quality improvement, habitat conservation and provision of amenities for the residents and visitors of Dublin City.

Chapter 9, *Sustainable Environmental Infrastructure and Flood Risk*, outlines how the integration of land-use planning with infrastructure delivery is essential to achieving sustainable development. The policies and objectives in Chapter 9 are intended to address a broad range of supporting infrastructure and services, providing for improvements in water quality and water services, sustainable waste management, greater energy security and efficiency, enhanced digital connectivity, and a more holistic and nature-based approach to flood risk and surface water management, all while safeguarding environmental quality and providing for climatic resilience.

Policies relating to Flood Management in Chapter Nine Sustainable Environmental Infrastructure (SI) include:

> ***SI13: Minimising Flood Risk***
>
> *It is the Policy of Dublin City Council to minimise the flood risk in Dublin City from (all other) sources of flooding as far as is practicable, including fluvial, coastal, reservoirs and dams, the piped water system, and potential climate change impacts.*
>
> ***SI14: Strategic Flood Risk Assessment***
>
> *To implement and comply fully with the recommendations of the Strategic Flood Risk Assessment prepared as part of the Dublin City Development Plan 2022-2028, including all measures to mitigate identified climate change and flood risks, including those recommended under Part 3 (Specific Flood Risk Assessment) of the Justification Tests, and to have regard to the Flood Risk Management Guidelines (2009), as revised by Circular PL 2/2014, when assessing planning applications and in the preparation of statutory and non-statutory plans.*
>
> ***SI15: Site-Specific Flood Risk Assessment***
>
> *All development proposals shall carry out, to an appropriate level of detail, a Site-Specific Flood Risk Assessment (SSFRA).*

2.2.4.2 Climate Neutral Dublin 2030

In March 2024, Dublin City Council (DCC) adopted a local authority climate action plan 'Climate Neutral Dublin 2030', as required pursuant to Section 16 of the Climate Action and Low Carbon Development (Amendment) Act 2021. The plan sets out the actions that DCC is taking to prepare the city and its people for the known impacts of climate change – flooding, sea level rise, extreme weather events and drought. The plan details the manner in which DCC will mitigate greenhouse gas emissions and contribute the global effort to limit warming to below 1.5°C. The plan has three targets that are interdependent:

- *A 51% reduction in greenhouse gas emissions in line with our National Climate Objective by 2030, while striving for neutrality before 2050 as per Dublin City's participation in the EU Mission for 100 Climate Neutral and Smart Cities (Net Zero Cities);*
- *A Climate Resilient City prepared for the known and unknown impacts of climate change; and*
- *A Just Transition meaning that the actions we take do not cause harm.*

Under Action C.4 of this plan, a designated decarbonisation zone is established at Ringsend and Poolbeg and the boundaries of this zone include the southern port lands of Dublin Port. The key action to mandate the development of a decarbonisation plan for this area is listed as follows:

> *C4 Decarbonisation Zones: We will build on this knowledge and experience gained from our smart districts, and develop our two decarbonisation zones in Ringsend and Poolbeg, and Ballymun. The development of the decarbonisation plans for Ringsend and Poolbeg, and Ballymun, will be a collaborative effort to ensure that the unique strengths of each zone come to the fore and permits ownership of the challenges and solutions. Having due regard to environmental sensitivities such as local human receptors, European sites and biodiversity, and the need to appropriately protect and conserve protected structures.*

The key objectives in the Ringsend and Poolbeg decarbonisation zone are as follows:

- *Project will include nature based solutions; support the deployment of district heating reducing demand on electricity grid for heating;*
- *Projects will be focused on re-use, and use of available resources; and*

- *Builds on Sustainable energy communities, and active travel projects (Ringsend to College Green Active Travel Project, Dodder River Greenway).*

There are no specific actions or policies listed within the plan or in relation to the decarbonisation zone in relation to port activities, shipping or freight transport.

In more general terms the following action is of relevance to the proposed development through the city wide policy on active travel:

> *S1.1 A Connected Active Travel Network: Moving people through the city to meet friends and family, to go to work or school, or to simply explore must be easy and safe. We will bring together 95% of the population of the City within 400 metres of the active travel network; making it easier for people to walk, cycle, wheel or scoot to their destination or for leisure, day or night. Community Participation Events to celebrate new active travel routes as they open and encourage use in a responsible manner to avoid/minimise impacts to biodiversity and the environment. Ecological connectivity will be considered with regard to hedgerow development and maintenance as well as the avoidance of barrier effects such as inappropriate lighting. All active travel projects will have due regard to environmental sensitivities such as Archaeology, European sites, biodiversity and amenity value etc.*

This assessment will have due regard to the requirements of the Climate Neutral Dublin 2030 policies.

2.2.4.3 Dublin Port Masterplan

The Dublin Port Masterplan 2040 was first published in 2012 and most recently reviewed in 2018. It was developed to ensure that no capacity constraints emerge in Dublin Port between before 2040.

The 2018 revision notes Dublin Port needs to be developed on the basis of an average annual volume growth of 3.3% over the 30 years from 2010 to 2040 rather than the 2.5% originally assumed in 2012.

Mitigation measures to guide development at the port have been included in the Masterplan and those relevant to this project are listed as follows:

> ***Impact 20 - Medium and long term sustainability impacts.***
>
> *Potential to reduce GHG emissions with greater rail transport to and from Dublin Port, increase car sharing, initiate shore-side electricity at new berths to reduce diesel emissions, provide pedestrian and cycle links within Dublin Port, improve public transport connections to the Port estate etc. Continued monitoring by DPC of total CO_2 emissions and energy performance at Dublin Port.*
>
> *DPC to commit to contributing to the relevant goals, targets, and indicators of The Sustainable Development Goals National Implementation Plan 2018 – 2020, in particular - Goal 14 - Conserve and sustainably use the oceans, seas and marine resources for sustainable development. (e.g., 14.1, 14.2 and 14.a)*
>
> ***Impact 21 - Adaptation to potential climatic change.***
>
> *Individual developments to be subject to detailed Flood Risk Assessment at the planning application stage. Future port development will be designed for climate change, reducing risk to assets at the Port. DPC to develop a Climate Change Adaptation Plan.*

2.2.5 International Shipping Policy

In March 2023, the European Council and the European Parliament reached another provisional agreement on the FuelEU Maritime initiative, which imposes constraints on the average annual GHG intensity (on a well-to-wake basis) of onboard energy used by ships. These limits become stricter over time, starting at a 2% reduction in 2025, rising to 6% in 2030 and up to 80% in 2050, relative to the 2020 GHG intensity.

In January 2024, the EU Emissions Trading System (EU ETS) was extended to cover CO_2 emissions from all large ships (of 5,000 gross tonnage and above) entering EU ports, regardless of the flag they fly. The system covers:

- 50% of emissions from voyages starting or ending outside of the EU (allowing the third country to decide on appropriate action for the remaining share of emissions); and
- 100% of emissions that occur between two EU ports and when ships are within EU ports.

The ETS covers CO_2 (carbon dioxide), CH_4 (methane) and N_2O (nitrous oxide) emissions, but the two latter only as from 2026.

Each company with ships trading in the European Economic Area (EEA) is required to surrender emission allowances corresponding to a certain amount of its GHG emissions over a calendar year, starting with 40% of emissions in 2024, 70% in 2025 and 100% in 2026. The emissions are reported and verified through the existing EU Monitoring, Reporting and Verification (MRV) system, which will be revised and extended to cover necessary GHG emissions, ship types and sizes.

In July 2023, the International Maritime Organization (IMO) adopted a revised version of its GHG emissions strategy, which targets emissions from international shipping to reach net-zero by or around 2050 (compared to the 2018 strategy target of a 50% reduction in emissions with respect to 2008 levels). Member States agreed to 'indicative checkpoints' that call for reducing total GHG emissions by 20% and striving for 30% by 2030 and 70% and striving for 80% by 2040, both relative to 2008. Emissions will now be considered on a life-cycle (or well-to-wake) basis. The next steps will be to agree on mid-term measures to meet the revised objectives, such as GHG intensity standards or a fuel levy/reward.

3 BASELINE CLIMATE

3.1 Macroclimate

The EPA Research Report No. 386 'The Status of Ireland's Climate, 2020' (Walther C.A. Cámaro García and Ned Dwyer) and Met Éireann are used as a reference for the baseline climate and this report notes the following:

Atmosphere

- Global background measurements of the main greenhouse gases – carbon dioxide, methane and nitrous oxide are measured at Mace Head, Co. Galway and 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 (**Figure 3-1**).

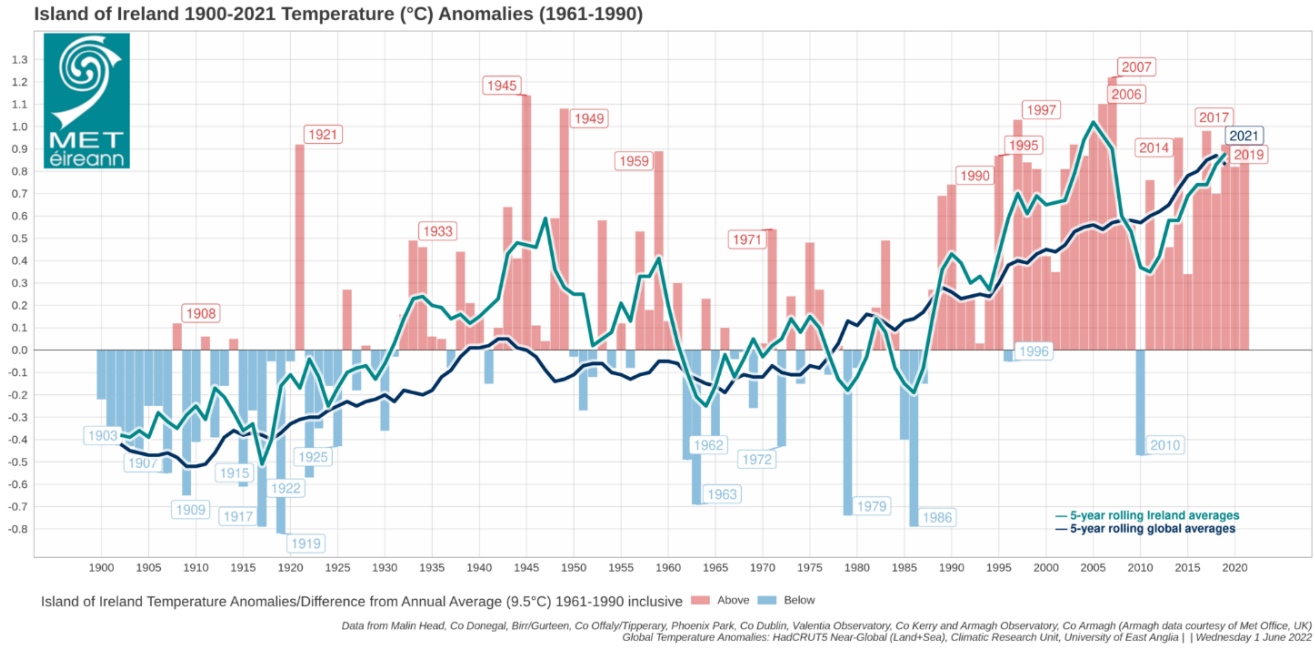

Figure 3-1: Island of Ireland 1900-2022 Temperature (°C) Anomalies (difference from 1961-1990) (Source: Met Éireann)

- 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. Sixteen of the top twenty warmest years on record nationally have occurred since 1990, with 2022 being the warmest year on record.
- 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

- Global sea level increased by approximately 0.20 m between 1901 and 2018 and the rate of sea level rise is accelerating.
- Satellite observations indicate that the sea level around Ireland has risen by approximately 2–3 mm per year since the early 1990s. Recent studies have highlighted higher rates of sea level rise over recent decades in Cork and Dublin than the global average (**Figure 3-2**). They estimate a rate of sea level rise for Dublin Bay of 1.1 mm yr^{-1} during 1953–2016, and a rate of 7 mm yr^{-1} during 1997–2016.

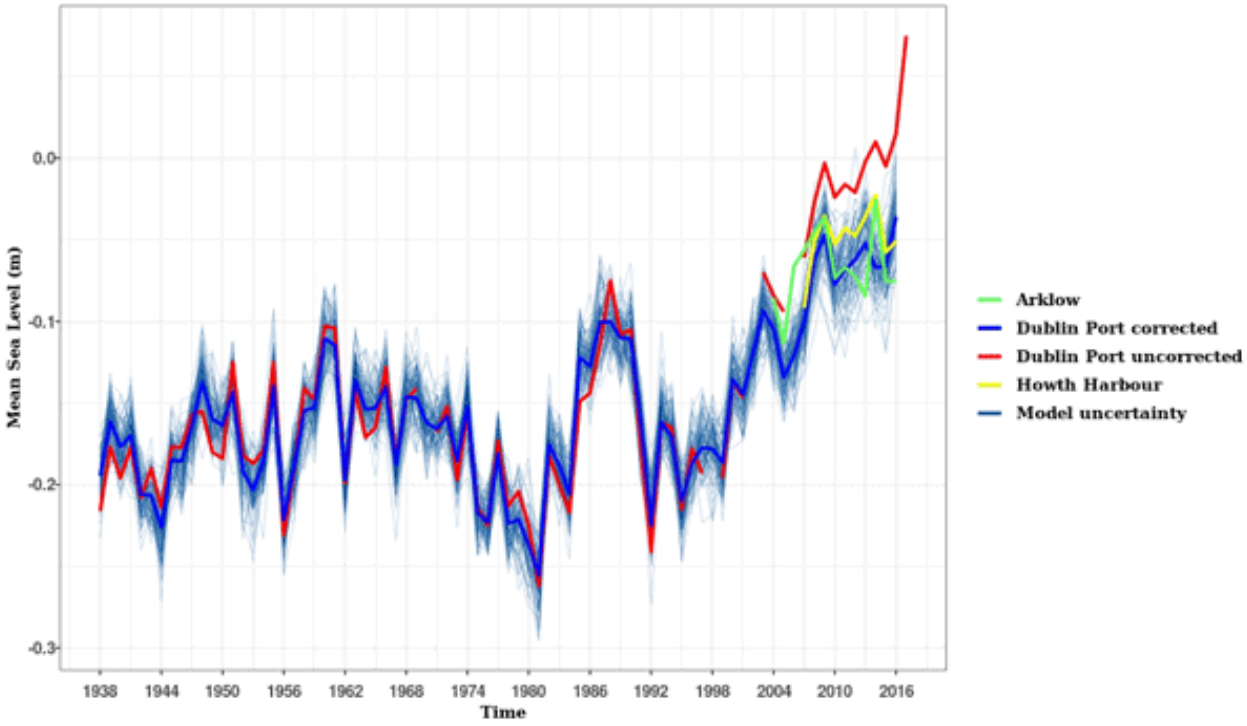

Figure 3-2: Sea Level timeseries for Dublin Port following the reconstruction by Shoari Nejad *et al*. (2022)

- **Figure 3-2** shows the necessity to adjust the recent record to account for apparent inhomogeneities that lead to an overestimate of the long-term trend.
- 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.

With every increment of global warming, changes in mean climate and extremes become more widespread and pronounced. **Figure 3-3** demonstrates what this means for Ireland relative to 1976 - 2005 baseline.

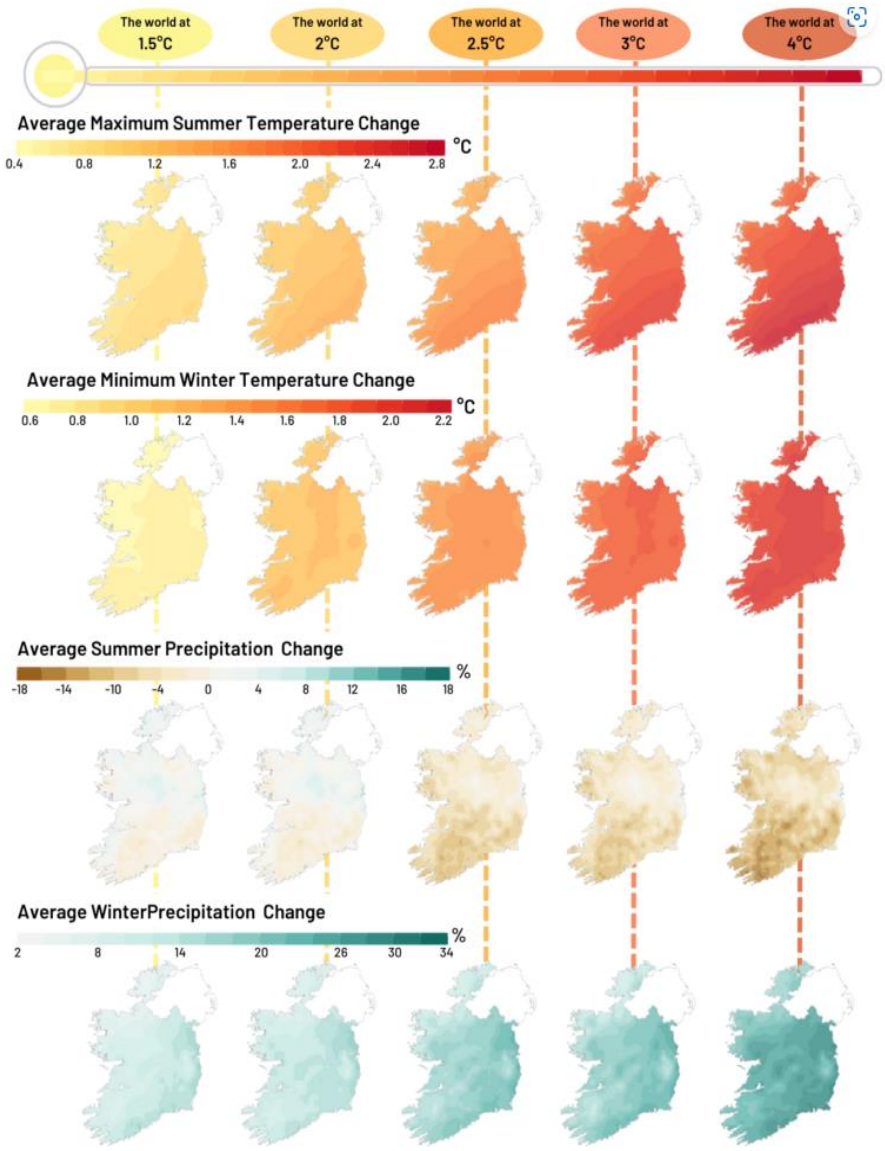

Figure 3-3: Temperature Change for Ireland under various climate scenarios relative to 1976 - 2005 baseline

As the world warms it is clear that Ireland's temperature and rainfall undergo more and more significant changes, for example on average summer temperature could increase by more than 2°C, Summer rainfall could decrease by 9% while Winter rainfall could increase by 24% (**Figure 3-4**). The design of the project has accounted for these predicted changes in flooding, extreme weather etc. to ensure that the project remains resilient to these changes.

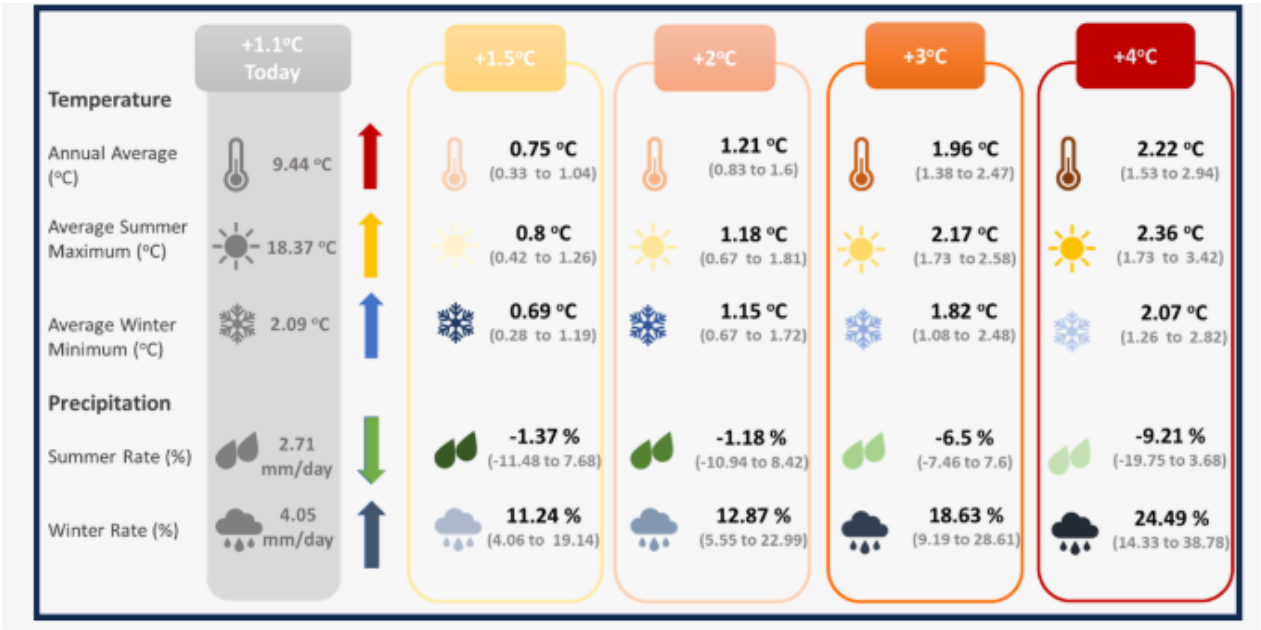

Figure 3-4: Change of Climate Variables for Ireland for different Global Warming Thresholds

3.2 Microclimate

The World Meteorological Organisation 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 around Dublin Port is estimated using the 30-year (1981-2010) average meteorological data from Met Éireann.

The nearest Met Éireann meteorological station to the project in terms of 30-year averages for climate and weather data which would be representative of climate in the vicinity of the project is the station situated at Dublin Airport, which lies approximately 10 km north of the port.

The 30-year average meteorological data[13] from the station at Dublin Airport is presented in **Table 3-1** 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 3-1: 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

[13] 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

Note that the data presented in 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 3-2** 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[14] is 29.4.

Table 3-2: 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*

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 3-5**. North and north-easterly winds tend to be very infrequent (less than 5%), with easterly and south-easterly winds more frequent (5-9%).

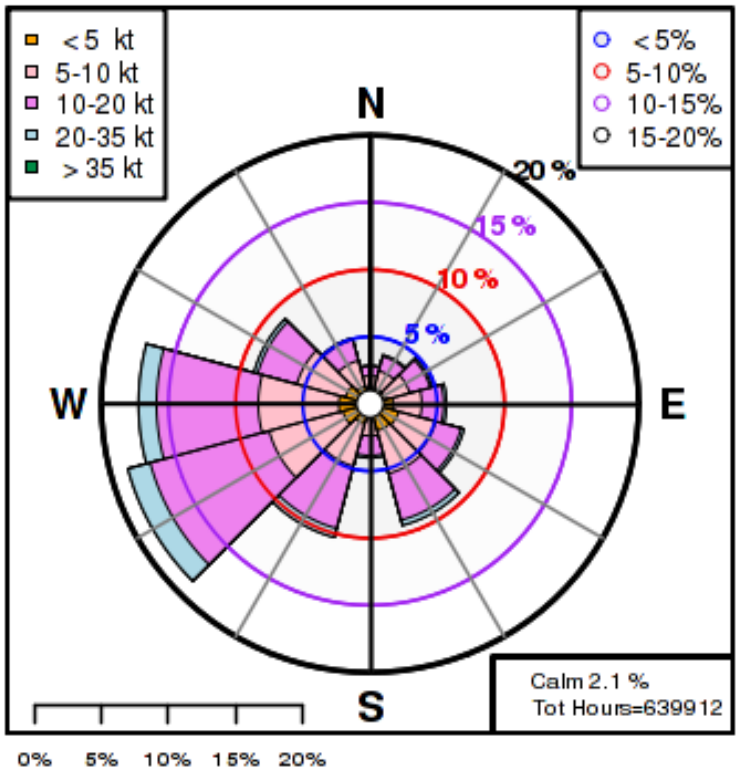

Figure 3-5: Wind-rose for the Dublin Airport Meteorological Station (1942-2014, source: Met Eireann)

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 3-3**.

[14] 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

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 3-3: 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*

The 30-year average rainfall for Dublin Airport is 758.0 mm. This is further broken down into monthly averages in **Table 3-4**, 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 3-4: 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*

This analysis must consider weather events relating to extreme temperatures, wind, rain, and events (storms, snow etc.) that may disrupt operations. **Table 3-5** 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 3-5: 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*

3.3 Projected Changes in Ireland's Climate

The climate projections for Ireland for the next century indicate that observed climate trends will continue and intensify over the coming decades with impacts ranging from extreme flooding events (both coastal and fluvial) to periods of extended droughts and increased winter precipitation[15].

Surface Air Temperature

Mean air temperatures are expected to increase everywhere and for all seasons relative to the present.

The projected temperature increase for Ireland for the years 2041 to 2060 relative to the 1981-2000 period is between 0.9 - 1.9°C depending on the time of year and the emissions scenario (low/high).

With increasing air temperatures, an increase in the intensity and duration of heat waves is expected, with a coincident decrease in the occurrence of frost days likely.

Precipitation

Projections indicate that precipitation in Ireland is expected to become more variable, with substantial projected increases in the occurrence of both dry periods and heavy precipitation events.

Projected increase in the frequency of very wet days (>30mm of precipitation) of between 21% and 31%. The largest increases are noted for Autumn and Winter.

Projected changes in the frequency of dry periods for the period 2041-2060 are expected to increase by up 26% on an annual basis and by 47% for summer when compared with period 1981-2000.

Precipitation in summer is projected to decrease by between -2% and -17% depending on a low or high emissions scenario.

Sea Level Rise

For the year 2100 and with respect to the period 1986-2005, projections suggest an increase in global sea levels between 0.43m for the low emissions scenario and 0.84m for the high emissions scenario. However due to a yet limited understanding of some of the important effects that contribute to rates of increase, a best estimate for sea level rise cannot be provided with confidence and estimates of up to 4-6 m have been projected by some models.

In addition, to establish the future levels of impacts, available projections were employed based on the information from the Climate Data Tool from Climate Ireland. This tool provides a detailed dataset of projected climate data at national and county level for the period 2041 to 2060. Projections (change relative to 1981-2000) are presented for a most likely scenario which is employed in this analysis for the Dublin Port area in **Table 3-6**.

[15] Projected Climate Changes for Ireland https://www.climateireland.ie/ - !/tools/climateInformation/essentialClimateInformation and Climate Change - Met Éireann - The Irish Meteorological Service

Table 3-6: Predicted Climate Data for the Dublin Port area (source: Climate Ireland)

Climate Variable	Predicted Climate in Dublin Port 2041 to 2060			
	Winter	Spring	Summer	Autumn
Annual Average Temperature (^{0}C)	1	1	1.3	1.5
Heatwave (No. of events)	3			
Frost Days (%)	-48.7%			
Ice Days (%)	-72.5%			
Precipitation (%)	-1.9%	0.5%	-4.6%	-4.9%
Wet Days (>20mm) (%)	4.8%			
Very Wet Days (>30mm) (%)	17.4%			
Snowfall (%)	-62%			
Dry Periods (%)	17.5%			
Wind Speed (%)	-2%	-0.5%	-0.5%	-3.3%
Wind Energy (%)	-5.2%	-2.8%	-3.7%	-7.3%

3.4 Baseline 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 development are from existing road traffic, rail, shipping, energy, residential space heating, commercial and industrial activity and waste facilities.

At a national level, according to Ireland's Final Greenhouse Gas Emissions 1990-2022 report (EPA, 2024), Ireland's GHG emissions are estimated to be 60.60 million tonnes carbon dioxide equivalent (Mt CO_{2e}), which is 1.9% lower (or 1.15 Mt CO_{2e}) than emissions in 2021 (61.75 Mt CO_{2e}) and follows a 5.1% increase in emissions reported for 2021. Emissions are 0.4% below pre COVID, 2019 figures.

The GHG inventory for 2022 is the second 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 greenhouse gas emissions by at least 42% by 2030 compared with 2005 levels.

Ireland's ESR emissions annual limit for 2022 is 42.36 Mt CO_{2e}. Ireland's final 2022 greenhouse gas ESR emissions are 45.90 Mt CO_{2e}, this is 3.54 Mt CO_{2e} more than the annual limit for 2022.

Transport accounts for 19.4% of national emissions in 2022 and road transport accounts for 94.8% of all transport emissions in 2022. Between 1990 and 2022, Transport shows the greatest overall increase of GHG emissions at 128.5%, from 5,143.3 kt CO_{2e} in 1990 to 11,751.3 kt CO_{2e} in 2022, with road transport increasing by 132.6%. The trend in transport emissions from 1990 to 2022 are shown in **Figure 3-6**.

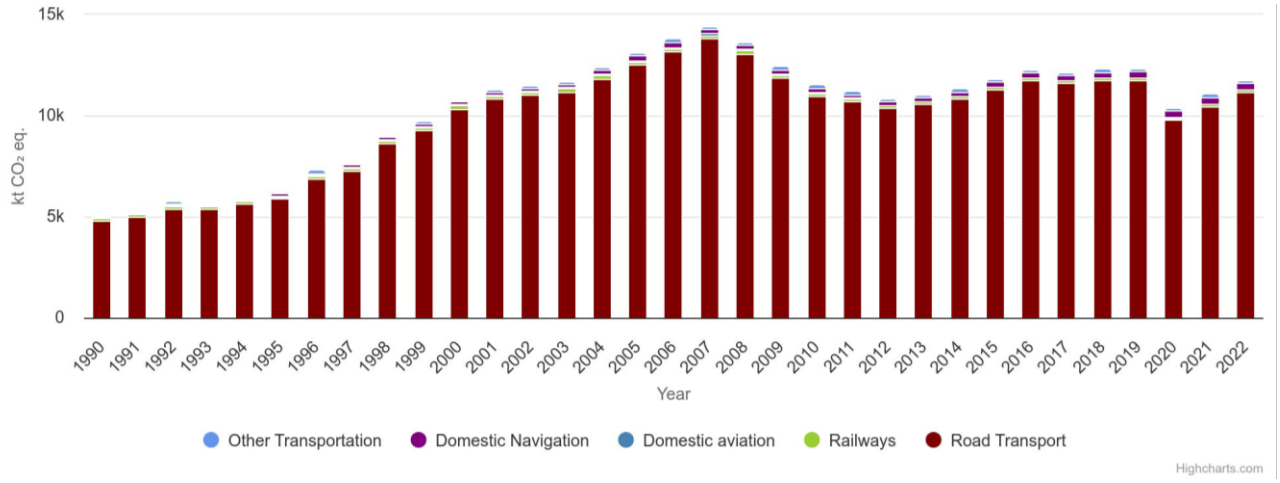

Figure 3-6: Transport Emissions 1990-2022 (Source: EPA)

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.

Under CAP24, 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. Some of the main metrics to deliver emission abatement in transport are listed as follows:

- Increase in Sustainable Transport Trips:
  - Additional 125,000 sustainable Journeys;
  - Roll-out of sustainable demand management measures informed by National Demand Strategy;
  - Delivery of Pathfinder Programmes;
  - 20% reduction in total vehicle kms relative to 2030 BAU scenario;
  - 50% reduction in fuel usage;

  - 50% increase in daily active travel Journeys;
  - 130% increase in daily public transport journeys; and
  - 25% reduction in daily car journeys.
- Fleet Electrification:
  - 175,000 passenger EVs;
  - 20,000 commercial vans;
  - 700 low-emission HGV;
  - 300 EV buses in PSO bus fleet; and
  - Expansion of electrified rail services.

With the successful implementation of these metrics and associated targets, the baseline emissions levels for transport will decrease in future years. This will be largely due to the electrification of the national fleet and the removal of direct tailpipe emissions from road traffic. It is important to note that this scenario is predicted under CAP24 regardless of the development of the 3FM Project.

The EPA undertakes emissions projections, and the latest projections are presented in Ireland's Greenhouse Gas Emissions Projections 2023-2050 (EPA, 2024). The EPA reports 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 CAP24 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 17% and 27%.
- Sectoral emissions ceilings for 2025 and 2030 are projected to be exceeded in almost all cases, including Agriculture, Electricity, Industry, and Transport.
- Ireland will not meet its non-ETS EU targets of a 42% emissions reduction by 2030 in the Additional Measures scenario even with both the ETS and LULUCF flexibilities.
- 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, 2024).

Transport emissions are projected to decrease by between 5% and 26% over the period 2022-2030 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 5% over the period 2022-2030 from 11.8 to 11.2 Mt CO_2e;
  - A 10% blend for petrol and a 12% blend for diesel at the pumps by 2025 is assumed and blends remain at this level until 2030; and
  - For uptake of Electric Vehicles, the WEM scenario assumes approximately 693,000 electric vehicles on the road by 2030. This includes approximately 430,000 passenger battery electric vehicles and 263,000 passenger plug-in hybrid electric commercial vehicles.
- **With Additional Measures (WAM) scenario:**
  - Under the WAM scenario, transport emissions are projected to decrease by 26% over the period 2022 to 2030 from 11.8 to 8.7 Mt CO_2e;
  - It is assumed that incremental blend increases will occur reaching a 10% blend for petrol and a 20% blend for diesel at the pumps by 2030 as detailed in Climate Action Plan 2024;

- Uptake of electric vehicles up to 945,000 by 2030, as a result of the implementation of the Climate Action Plan 2024. This includes over 845,000 private electric vehicles; and
- This scenario also includes a reduction in total vehicle kilometres to be achieved by behavioural and sustainable transport measures outlined in the CAP24, such as a 50% increase in daily active travel journeys and a 130% increase in daily public transport journeys.

The latest projections indicate that the share of total road transport CO_2 emissions from Heavy Duty Vehicles (HDVs) and Light Goods Vehicles (LGVs) is projected to increase from approximately 43% in 2022 to 52% by 2030, and 87% by 2050 in the WAM. 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 total GHG emissions from transport under the WEM and WAM scenarios are presented in **Figure 3-7**.

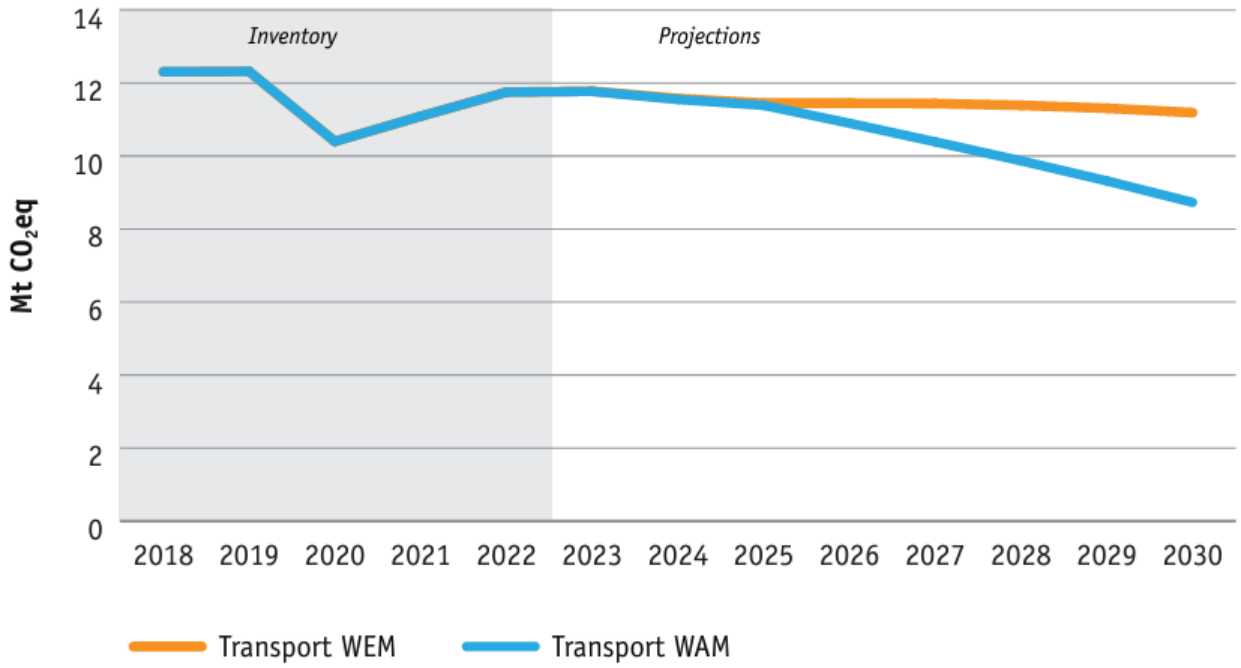

Figure 3-7: Greenhouse Gas Emissions Projections from the Transport Sector under the With Existing Measures and With Additional Measures scenarios out to 2030 (Source: EPA)

3.5 Baseline of International Shipping Emissions

While maritime transport plays an essential role in the EU economy and is one of the most energy-efficient modes of transport, it is also a growing source of greenhouse gas emissions. In 2018, global shipping emissions represented 1,076 million tonnes of CO_2 and were responsible for circa 2.9% of global emissions caused by human activities.

At an EU level, maritime transport represents 3-4% of the EU's total CO_2 emissions, or over 124 million tonnes of CO_2 in 2021. In order to significantly reduce GHG emissions from international shipping, effective global measures are desirable. In July 2023 the International Maritime Organisation (IMO) made a step on this path committing to new targets for GHG emissions reductions and to develop and adopt in 2025 a basket of measures, delivering on these reduction targets.

The International Convention for the Prevention of Pollution from Ships (MARPOL) Annex VI entered into force on 19 May 2005 and since then it has been continuously evolving in line with the commitments that Member States make within IMO to limit the harmful effects of air pollution and GHG emissions from international shipping on human health and the environment.

Member States of the IMO have adopted the 2023 IMO Strategy on Reduction of GHG Emissions from ships, with enhanced targets to tackle harmful emissions.

The revised IMO GHG Strategy includes an enhanced common ambition to reach net-zero GHG emissions from international shipping close to 2050, a commitment to ensure an uptake of alternative zero and near-zero GHG fuels by 2030, as well as indicative checkpoints for 2030 and 2040[16].

In relation to Dublin Port, the total numbers and types of vessels accessing the port are reported by the Central Statistics Office (CSO). These baseline shipping levels have been used to establish the baseline shipping emissions at the port based on the emission factors from the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and using a default origin, cruising and berthing cycle.

The results of the baseline emissions for the period 1999 to 2022 are shown in **Figure 3-8** and demonstrate a largely static or declining trend in total emissions despite the economic growth over the period. Also shown are the emissions per vessel which shows a clearly declining trend illustrating the effect of increased use of larger and more efficient vessels at the port allowing for a more efficient increase in cargo throughput at the port with no net impact on total emissions over the past twenty five years.

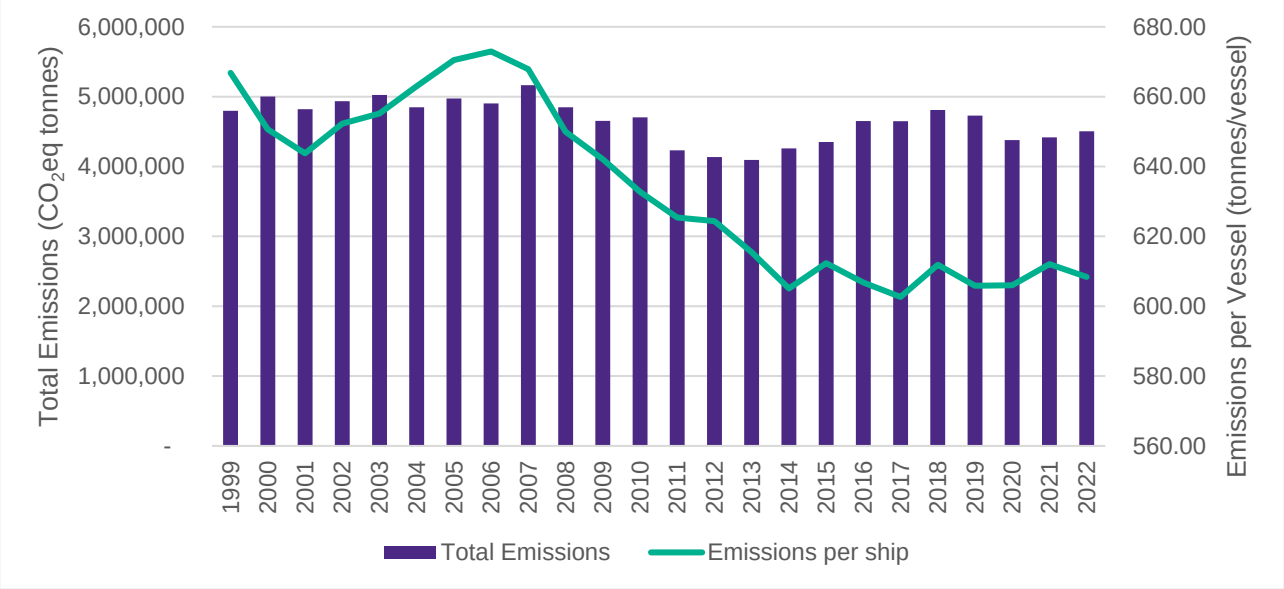

Figure 3-8: Baseline Greenhouse Gas Emissions from shipping at Dublin Port

[16] https://www.imo.org/en/MediaCentre/HotTopics/Pages/Cutting-GHG-emissions.aspx

4 CLIMATE ASSESSMENT OF ALTERNATIVES

Alternatives for Dublin Port were assessed in detail in **Chapter 2** of the EIAR. This section of the report provides supplementary details on the climate assessment of the alternatives considered within the EIAR.

4.1 Is this the right site?

Dublin Port will reach its maximum throughput capacity, achievable using its current sites (at Dublin Port and Dublin Inland Port) by 2040.

A series of origin and destination surveys of the HGVs using Dublin Port were undertaken in 2001, 2011 and 2022. These surveys have consistently confirmed the following patterns of movements to and from the Port:

- Over 20% of movements occur to or from the Inner Dublin area, < 40km radius from the port;
- Over 60% of movements occur within a 40 km radius from the port; and
- Almost 73% of movements occur within 90 km of the port.

It is immediately apparent, therefore, that in order to service the clear demand arising from the Dublin metropolitan area, suitable alternative sites would have to be located on Ireland's eastern coast. These sites would need to be located on the coastline, in proximity to sufficient water depth, in order to allow safe passage for all vessels likely to operate to and from the port.

Description of Strategic Alternative Site Scenarios

The site selection process identified that, apart from the southern port estate (Poolbeg Peninsula) where the 3FM Project is proposed, there are no other 'brownfield' (former port facilities) available to redevelop. The site selection process therefore identified 'greenfield' alternative locations at Bremore and Arklow.

The site alternatives at Bremore and Arklow were each assessed under against two long term, high level, post-2040 capacity projections, which dictate the layout (size and scale) of these facilities:

- An annual throughput of 134m tonnes at the new facility. The resulting project was referred to in the post-2040 dialogue process as 'DP2.0'; and
- An annual throughput of 58m tonnes at the new facility. The resulting project was referred to in the post-2040 dialogue process as 'DP1.5'.

The assessment of the effects on the environment for these four proposals (seen in **Figures 4-1, 4-2, 4-3** and 4-**4**) was undertaken with a focus on climate impact and in particular transport emissions.

Table 4-1 provides the emissions per tonne of material for both Dublin Port and the alternative locations considered. The emission figures for both shipping and road transport were obtained from the UK's Department for Environment Food and Rural Affairs (DEFRA) and were based off 2023 reports. UK-based emissions have been used as these are more comprehensive compared to Irish emissions reports. Rotterdam was chosen as the default shipping destination as it is the largest seaport in Europe and is a frequent route for the movement of goods to and from Ireland. The GHG emissions from an average container ship were used to calculate the emissions if a ship travelled from Rotterdam to each alternative site. The same methodology was applied to road transport whereby the Emission Factor for HGV (all rigids) was used for this calculation. The M50/N7 Interchange at the Red Cow area represents the general centre of transported goods within a 90km radius of Dublin Port.

As can be seen from **Table 4-1**, Dublin Port has the lowest GHG emissions per tonne of material transported at 39.45 tonnes relative to Bremore (49.65 tonnes) and Arklow (67.25 tonnes). Therefore, Dublin Port is considered the lowest carbon alternative of the three ports per tonne of material imported/exported and transported to the final destination in Ireland.

When extrapolated to the 778 million tonnes of materials projected in the Masterplan, the use of Dublin Port offers significantly reduced carbon options over the corresponding scenarios in Bremore or Arklow.

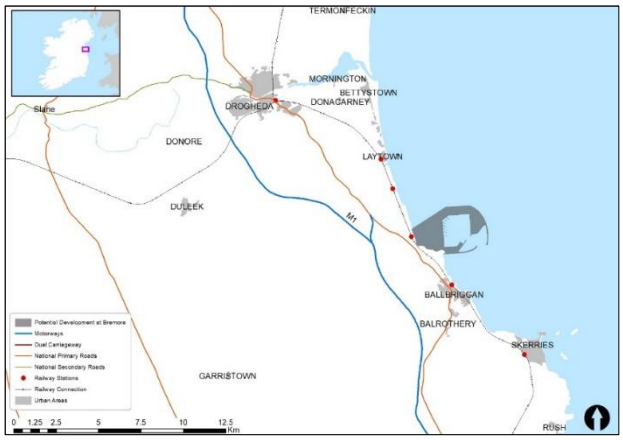

Figure 4-1: Bremore 2.0

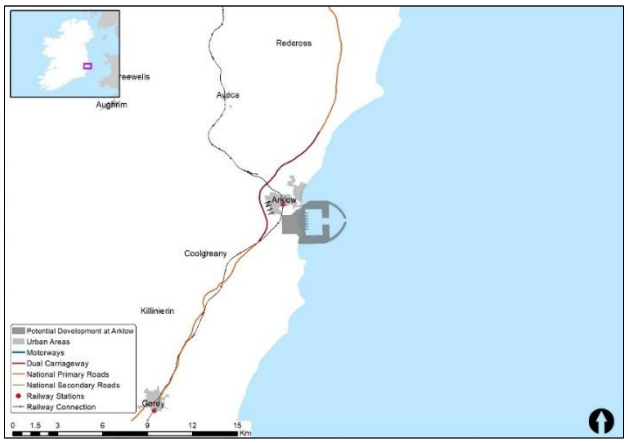

Figure 4-2: Arklow DP2.0

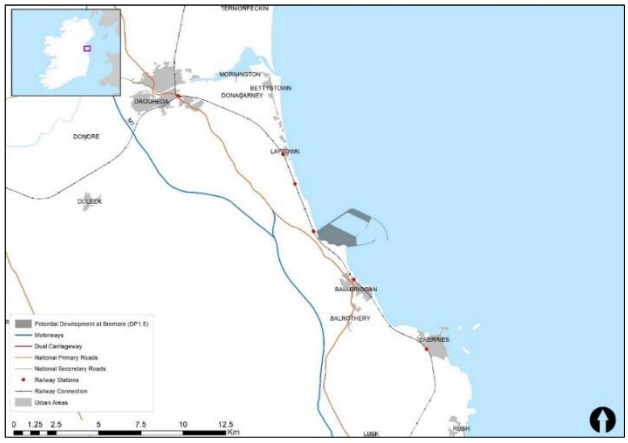

Figure 4-3: Bremore DP1.5

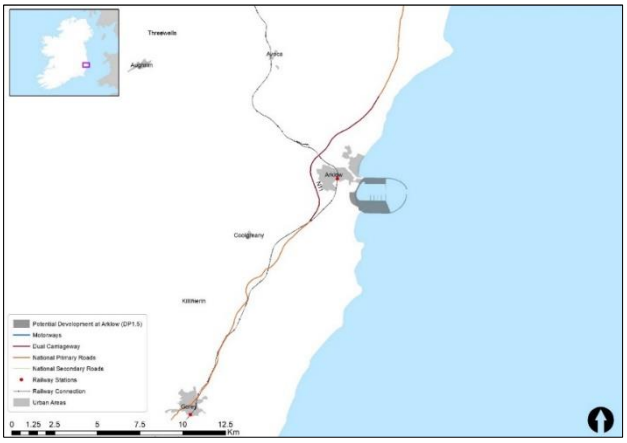

Figure 4-4: Arklow DP1.5

Table 4-1: Emissions based on Alternative Locations

Alternative	Journey	Approx. Distance (km)	Emission Factor[17] ($kgCO_2e$ per tonne.km)	Emissions ($kgCO_{2e}$) per tonne of material
Bremore	Shipping (Rotterdam to Bremore)	1263	0.016119	20.36
	Road (Bremore to Red Cow)	44.5	0.6583 (all rigids)	29.29
Total				**49.65**
Arklow	Shipping (Rotterdam to Arklow)	1150	0.016119	18.54
	Road (Arklow to Red Cow)	74	0.6583 (all rigids)	48.71
Total				**67.25**
Dublin Port	Shipping (Rotterdam to Dublin Port)	1222	0.016119	19.70
	Road (Dublin Port to Red Cow)	30	0.6583 (all rigids)	19.75
Total				**39.45**

[17] UK Greenhouse gas reporting: conversion factors 2023.

Distance: Route distance and CO_2 from Rotterdam to Arklow | Searoutes

4.2 Is this the right site layout?

During the preparation of the Dublin Port Masterplan 2040, reviewed 2018, alternative layouts to plan the port's future were considered at a strategic level. This process has informed the consideration of alternative layouts in the preparation of the 3FM Project. A number of potential scenarios were assessed yielding a full range of potential options as follows:

- No Port Expansion:
  - No port expansion. (This option represents the strategic 'do-nothing' scenario).
- Optimise Main Port Lands:
  - Optimise throughput of existing facilities;
  - Optimise throughput of existing facilities and increase berthage in North Port lands; and
  - Optimise throughput of existing facilities and increase berthage in North Port and South Port lands.
- Optimise Main Port Lands and Increase Port Lands:
  - Rationalise existing facilities, increase berthage in the North Port and South Port lands, improve road infrastructure and infill adjacent to Port (part of Tolka Estuary). This particular option represents the implementation of the Masterplan 2012 which addresses the scenario of 'The Evolution of the Environment in the Absence of the Masterplan 2040'];
  - Rationalise facilities, increase berthage in North Port and South Port lands, improve road infrastructure and develop Inland Port; and
  - Rationalise facilities, increase berthage in North Port and South Port lands, improve road infrastructure and develop additional Coastal Port Facility external to Dublin Port.

In relation to climate emissions the following consideration are presented:

The **No Port Expansion** alternative would be positive in terms of mitigating the potential for construction phase emissions (embodied carbon, material transport, plant emissions, etc.) at Dublin Port. The absence of development would negate the generation of the emissions presented in **Section 6** of this report. However, to meet the national demand for increased throughput to the State, some level of development would be required at alternative ports and/or new port development within the State. As such, the construction phase impacts mitigated at Dublin Port would, by economic necessity, have to be generated elsewhere with no significant net difference with the other alternatives considered. Without further national port expansion somewhere in the State, the import and export capacity of the national economy would be hindered, impacting national economic growth to a critical degree in the medium term, as outlined in the Dublin Port Masterplan 2040.

It is acknowledged that circular policy across the EU is seeking to develop more circular models with a greater emphasis on recycling/reuse/repair of materials. If successfully implemented this may help to reduce the consumption demand (Domestic Material Consumption) for some materials and may impact on the demand for shipping volumes. However, the main focus of current circular economy policy lies in the area of reuse and recycling of building materials, much of which are sourced and used internally with limited impacts on import/export volumes in the short to medium term.

Each of the alternatives considered will result in an increase in inbound/outbound freight transport and the CSO report that goods forwarded from Irish ports amounted to 15.2 million tonnes in 2023, while a total of 31.2 million tonnes of goods were received. Typically, this freight transport is by road (circa 1% rail) and generates a level of emissions dependent on the fuel employed (biofuel blends which are standard) and the distances travelled.

As noted, the origin destination studies show that 73% of port volume at Dublin Port emanates from within 90km of Dublin Port. As such, the volumes travelled from Dublin Port to these destinations is moderate given the relatively short distance for the bulk of traffic. If material was transport longer distances the emissions would increase.

As noted in **Section 4.1**, retaining Dublin Port in its current form and facilitating the development of other port capacity outside the Greater Dublin Area to meet the throughput demand, will result in increased emissions to transport the material to the wider Dublin area.

In short, this alternative offers no significant climate benefits during construction and presents a potential negative climate impact for transport emissions during operation.

The Optimise Main Port Lands and the Optimise Main Port Lands and Increase Port Lands alternatives will have a similar climate impact. Both scenarios will require a significant level of construction at the port as outlined in **Chapter 5**. The actual impact will vary depending on the intensity of the works undertaken, however, it is considered that this impact will be equivalent to the construction impact at alternative locations identified for the No Port Expansion alternative. In short, all three options would require a level of construction impact to develop port facilities to meet the throughput demand.

Again, as noted in **Section 4.1**, the Optimise Main Port Lands and the Optimise Main Port Lands alternatives would maintain Dublin Port as the focus point for the transport for shipping cargoes to the Greater Dublin Area and beyond. Such an approach will lead to reduced transport emissions relative to the use of other ports along the east coast or at other ports around the country and offers a net benefit for climate over the No Port Expansion alternative where cargoes would be transported over longer distances.

Initial analysis in the origin destination studies suggests that only a small portion of current port volumes could be suitable for rail freight, so this mode has been excluded as a short term reasonable alternative albeit with a very positive climate impact. The All-Island Strategic Rail Review notes that Dublin Port will play a key role in helping grow rail freight in Ireland if the recommendations of this report are implemented then a rail freight option at Dublin Port would be a preferred climate alternative.

5 CONSTRUCTION PHASE EMISSIONS

5.1 Overview

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.

The TII Climate Guidance for National Roads, Light Rail, and Rural Cycleways (Offline and Greenways) (December 2022) provides a set of assessment criteria that are employed in this analysis to determine the level of impact from construction phase GHG generation. The TII guidance states 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 TII guidance states that 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 5-1**. It is noted that the TII guidance does not differentiate between the assessment criteria presented for the construction phase (materials and plant use) and operation phase (traffic related). However, the context for impact varies between both phases as while the operational road transport impacts may be directly assessed against the State's transport emission ceilings, these ceilings do not relate to construction activities.

A CAP24 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 which will be employed for determining the significance of impact for this phase of the project.

Table 5-1: 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.

5.2 Methodology

Potential direct and indirect greenhouse gas (GHG) emissions associated with the construction and maintenance of the proposed development includes site clearance, embodied carbon, material transport, construction activities and waste management. This has been quantified using a life cycle assessment (LCA) which is the analysis of environmental impacts associated with the project life cycle from the material extraction to the production, use and its end of life.

The LCA model follows the international standards ISO14040 and ISO14044 and is aligned with guidance set out in PAS 2080 (Green Construction Board Publicly Available Specification (PAS) 2080: Carbon Management in Infrastructure) which suggests a modular structure for capturing and reporting carbon emissions according to lifecycle phase. A full suite of all materials, transport distances and operations during construction, operation and decommissioning have been compiled from the design teams and used to inform this assessment.

Consideration is given in this section to the construction of the proposed development and the GHG emissions that may arise during the construction phase from the following sources:

- Embodied emissions in the imported materials required for this area 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 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).

The following assumptions were made in the assessment 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 development;
- Earthworks volumes are based on information from the 3FM Project design team. 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, 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 provided by the design team and the primary waste stream (soil, stone, aggregate) will be transported to a suitably licensed waste facility circa 50 km from the proposed development; and
- The proposed development will not be decommissioned – estimate for decommissioning of the asset not applicable.

Each of the main infrastructural aspects of the proposed development is described in the following sections outlining a description of the main elements of construction and the associated carbon impact.

5.3 South Port Access Road (SPAR)

The South Port Access Road (SPAR) consists of three sections.

- A network of terrestrial roads, cycleways and footpaths on the lands within the south port;
- A viaduct section that runs over the River Liffey parallel to the R131 road; and
- A new bridge over the River Liffey to the east of the existing Tom Clark Bridge.

The terrestrial roadways differ in the depth of base course and width of carriageway. This is due to the requirements for vehicle types present and the existing ground in which these roadways will be constructed. In areas in which there is high HGV traffic flow, roads are wider and have a thicker a subbase to withstand the higher strains. All details of this road construction have been provided and is used to inform the embodied

carbon analysis presented in **Table 5-2**. This also includes for the cycleways and footpaths included within the terrestrial road network.

Table 5-2: Estimated Carbon associated with the Construction of Terrestrial Roads

Source		Total GHG (tonnes CO_2e)
Embodied Carbon (including transport of materials)	Road Pavements (Unbound)	**1,003**
	Road Pavements (Surface)	**588**
	Kerbing	**173**
	Road Markings	**6**
	Steel	**221**
	Total Embodied	**1,991**
Construction Activities (site clearance, demolotion, momobile plant, fixed plant, etc.)		**50**
Total		**2,041**

The main component of the terrestrial roads is the unbound subbase followed by the Hot Rolled Asphalt (HRA) surface layer of the road pavement which constitute 80% of the embodied emissions.

The viaduct is located to the north of the 3FM Project area and connects the area to the new bridge. The structure is 557.5m in length with a cross section of 17.54m. This surface of the structure consists of the cantilevered steel walkway, cycle lanes and a road carriageway supported by a concrete deck over piled foundations. **Table 5-3** outlines the estimated carbon impact of the construction of the viaduct.

Table 5-3: Estimated Carbon associated with the Construction of the Viaduct

Source		Total GHG (tonnes CO_2e)
Embodied Carbon (including transport of materials)	Structural Concrete	**2,287**
	In-Situ Concrete	**4,879**
	PreCast Concrete	**62**
	Reinforcement Steel	**450**
	Asphalt	**245**
	Other	**108**
	Total Embodied	**8,031**
Construction Activities (site clearance, demolotion, mobile plant, fixed plant, etc.)		**212**
Total		**8,243**

Concrete has the largest impact on the embodied carbon results from the viaduct construction. *In-situ* concrete accounts for 61% of the embodied carbon. This *in-situ* concrete is present within the piling, diaphragm and along the deck of the viaduct. While the structural concrete present in the Y4 beams and 30m piling accounts for 28% of overall embodied carbon emissions.

The proposed bridge from the viaduct to cross the Liffey River will be located immediately east of Tom Clarke Bridge and will comprise a number of separate structures including a main lifting span over the navigation channel, approach viaducts to the north and south and a single transition span between the south approach and the SPAR Viaduct.

The SPAR bridge has been designed so that it can be modified in the future to facilitate the potential extension of the LUAS from The Point to Poolbeg, should the NTA choose such a future routing for a LUAS extension. In addition, electric or other low carbon shunting vehicles will be used to interconnect between freight terminals in the southern Port Estate and the potential rail freight hub which may be developed by Iarnród Éireann in the vicinity of the North Port estate. Thus, the SPAR Bridge has been designed as a multi-modal transport bridge, rather than a conventional road bridge and will obviate the necessity to construct other footbridges/cycleways, a possible future LUAS bridge, and a rail interconnection bridge.

The mechanism of the lifting span is aided by a counterweight which pivots separately to the deck.

The proposed bridge comprises of the following multimodal transport lanes:

- A traffic-carrying central deck with varying width from 10.8m to 11.8m, including a two-lane carriageway with total width varying from 7m to 8m (i.e. 3.5m to 4m per lane);
- A primary Active Travel path, including a two-way cycleway with a minimum clear width of 3m and a footway adjacent to the cycleway with a clear width of 2m; and
- An additional path with clear width 3.3m, initially considered as a shared footway and cycle path but with provision to be converted to accommodate the Luas.

Table 5-4 outlines the estimated carbon impact of the construction of the bridge.

Table 5-4: Estimated Carbon associated with the Construction of the Liffey Bridge

Source		Total GHG (tonnes CO_2e)
Embodied Carbon (including transport of materials)	Concrete (pre-cast and *in-situ*)	**1,917**
	Structural Steel	**2,919**
	Reinforcement Steel	**512**
	Asphalt	**19**
	Other (resins)	**51**
	Total Embodied	**5,418**
Construction Activities (mobile plant, fixed plant, etc.)		**154**
Total		**5,572**

The results indicate that the significant quantities of steel required for this structure make up circa 54% of the embodied emissions. This steel is required for both structural beams and deck plates on the bridge structure as well as steel wires and plates for the counterweight structure. Concrete is the second largest component at 35% including both pre-cast and *in-situ* concretes for the deck slabs, piers and piles.

5.4 Area K

Area K is situated in the centre of the south port estate along the Liffey's edge. The proposed redevelopment involves the conversion of the existing Lo-Lo facility to a Ro-Ro facility. The redeveloped area will include trailer and container storage, roads, buildings, and other structures required for the safe and effective operation of the facility. The proposed new infrastructure at this area consists of the following:

- Re-fronting of Berth 45 and 'cranked' section of Berth 44 to tie in with existing sheet pile re-fronting on Berth 44;
- Installation of scour mattresses at eastern end of Berth 45 along existing caisson face at location of ESB cables and ESB intakes;
- Provision and installation of quay furniture (fenders, bollards, ladders, grab chains etc);
- Resurfacing of the existing footprint of Area K to accommodate trailer parking, general circulation and container stacking in dedicated areas;
- A dedicated surface water drainage system;
- Potable and non-potable water system;
- Maintenance and Office building;
- Entrance Works with required barriers;
- White lining for trailer parking and staff car parking; and
- Boundary Fencing including ISPS, and vehicle restraint systems, etc.

The proposed works at Area K will include the following activity which will result in direct and indirect GHG emissions including:

- Site enabling works and utility diversions;

- Site clearance and earthwork movements;
- Demolitions and breaking out of hard materials including pavement;
- Road and pavement construction including drainage;
- Construction of buildings;
- 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;
- Dredging (calculated separately); and
- Infilling.

A summary of the results from the carbon calculation exercise are detailed in **Table 5-5**.

Table 5-5: Estimated Carbon associated with the Construction Phase of Area K

Source		Total GHG (tonnes CO_2e)
Embodied Carbon (including transport of materials)	Aggregates	**341**
	Cement/Concrete	**15,922**
	Steel	**23,598**
	Asphalt	**502**
	Other	**4,036**
	Total Embodied	**44,399**
Construction Activities (site clearance, demolotion, mobile plant, fixed plant, etc.)		**1,822**
Total		**46,221**

Overall, the results indicate that the primary source of GHG emissions from the construction phase of Area K is from emissions associated with the embodied carbon from the materials used in the construction of infrastructure. The total estimated carbon generated during the construction phase is 46,221 tonnes CO_2e.

Embodied carbon in the materials required for construction is the largest component of emissions at circa 96% of the total. Of the materials used, cement/concrete (36%) and steel (53%) make up a combined 88% of all embodied emissions.

5.5 Area L

The proposed development of Area L includes for construction of a container transit storage yard to be operated in conjunction with Area N. This waterside site will be operated using six RTG cranes, across TEU ground slot, with six high container stacking. The proposed development involves;

- Site clearance will include demolition of a number of existing structures serving the current sites;
- Construction of a new reinforced concrete yard slab to provide for container handling and storage;
- Site access route and circulation lanes;
- New vertical piled crane rail beams to support electric RTGs;
- Refrigerated container gantries will be provided within the electric RTG container stacks;
- A two-storey administration building and two-storey maintenance building will be constructed; and
- High Mast Lights (HML) on reinforced piled foundations.

The proposed works at Area L will include the following activity which will result in direct and indirect GHG emissions including:

- Site enabling works and utility diversions;

- Site clearance and earthwork movements;
- Demolitions and breaking out of hard materials including pavement;
- Road and pavement construction including drainage;
- Construction of buildings;
- Haulage, traffic movements, traffic management, movement of site staff;
- Movement and use of plant and machinery; and
- Removal of materials off-site and the importation of materials to site.

A summary of the results from the carbon calculation exercise are detailed in Table 5-6.

Table 5-6: Estimated Carbon associated with the Construction Phase of Area L

Source		Total GHG (tonnes CO_2e)
Embodied Carbon (including transport of materials)	Aggregates	8
	Cement/Concrete	8,625
	Steel	16,761
	Asphalt	87
	Other	2,901
	Total Embodied	28,382
Construction Activities (site clearance, demolotion, mobile plant, fixed plant, etc.)		**770**
Total		**29,152**

Overall, the results indicate that the primary source of GHG emissions from the construction phase of Area L is from emissions associated with the embodied carbon from the materials used in the construction of infrastructure. The total estimated carbon generated during the construction phase is 28,382 tonnes CO_2e.

Embodied carbon in the materials required for construction is the largest contributor of emissions (98%). Of the materials used, Steel (59%) and Cement/Concrete (30%) make up a combined 89% of all embodied emissions.

5.6 Area N

The proposed development of Area N is an 8.7ha plot, it is situated at the mouth of the main navigation channel between Dublin Port and the Irish Sea. Areas L, N and O will be operated together as a single terminal. The proposed development involves;

- A working area reclaimed/infilled area incorporated within the quay structure;
- ESB Jetty & dolphin structures;
- Three access structures;
- Dredging;
- A surface water drainage system;
- Potable and non-potable water system;
- Surfacing Design;
- Maintenance and Office buildings;
- Entrance Works including automated entrance barriers; and
- Boundary Fencing including ISPS, Visual Barrier and vehicle restraint systems, etc.

The proposed works at Area N will include the following activity which will result in direct and indirect GHG emissions including:

- Site enabling works and utility diversions;
- Site clearance and earthwork movements;
- Demolitions and breaking out of hard materials including pavement;
- Road and pavement construction including drainage;
- Construction of buildings;
- 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;
- Dredging; and
- Infilling.

A summary of the results from the carbon calculation exercise are detailed in **Table 5-7**.

Table 5-7: Estimated Carbon associated with the Construction Phase of Area N

Source		Total GHG (tonnes CO_2e)
Embodied Carbon (including transport of materials)	Aggregates	**6,769**
	Cement/Concrete	**24,410**
	Steel	**51,556**
	Asphalt	**0**
	Other	**8,310**
	Total Embodied	**91,045**
Construction Activities (site clearance, demolotion, mobile plant, fixed plant, etc.)		**1,266**
Total		**92,311**

Overall, the results indicate that the primary source of GHG emissions from the construction phase of Area N is from emissions associated with the embodied carbon from the materials used in the construction of infrastructure. The total estimated carbon generated during the construction phase is 92,311 tonnes CO_2e.

Embodied carbon in the materials required for construction is the largest contributor of emissions (98%). Of the materials used, Steel (57%) and Cement/Concrete (27%) make up a combined 83% of all embodied emissions.

5.7 Area O

The proposed development in Area O is a transit Ro-Ro trailer yard to be operated in conjunction with Area K. This site will be operated across 352 trailer ground slots, with single height containers or trailers only. The proposed new infrastructure at this area consists of the following:

- A series of trailer ground slots;
- Internal roads and walkways;
- A kiosk; and
- An amenity building.

The proposed works at Area O will include typical construction activity similar to other areas which will result in direct and indirect GHG emissions A summary of the results from the carbon calculation exercise are detailed in **Table 5-8**.

Overall, the results indicate that the primary source of GHG emissions from the construction phase of Area O is from emissions associated with the embodied carbon from the materials used in the construction of infrastructure. The total estimated carbon generated during the construction phase is 8,915 tonnes CO_2e.

Embodied carbon in the materials required for construction is the largest component of emissions at circa 91% of the total. Of the materials used, cement/concrete is the largest fraction (78%).

Table 5-8: Estimated Carbon associated with the Construction Phase of Area O

Source		Total GHG (tonnes CO_2e)
Embodied Carbon (including transport of materials)	Aggregates	262
	Cement/Concrete	6,333
	Steel	120
	Asphalt	0
	Other	1,450
	Total Embodied	8,165
Construction Activities (site clearance, demolotion, mobile plant, fixed plant, etc.)		**750**
Total		**8,915**

5.8 Turning Circle

The 3FM Project requires the creation of a 325-metre diameter ship turning circle at a depth of -10.0 metres to provide a safe area for ships to turn. The equipment used is assumed to be a Trailer Suction Hopper Dredger. As a reference the Costa la Luz from the Van Ord fleet was used to estimate fuel usage for the work undertaken. This is the vessel used in previous dredging operations for the Dublin Port MP2 project.

A model was developed to calculate the carbon emissions form the construction phase of this dredging project. The inputs required were:

- Engine power in kilowatts;
- The total hours a vessel will be in use during the project;
- Specific Fuel Consumption per hour; and
- The most recent emission factor available applied to the proposed fuel type.

The results are presented in **Table 5-9** and illustrate that this dredging operation will generate 4,586 tonnes of GHG to support the proposed development.

Table 5-9: Dredging Model Inputs

Parameter	Unit	Value
Type of Equipment	Trailer Suction Hopper Dredger	-
Material to be dredged (clay, silt, sand, gravel, and cobbles)	m^3	4,100m^3 (per trip) 3,848,451m^3 (Total)
Fuel Type	Heavy Fuel Oil	-
Total Installed Power	kW	5,504
SFC (Specific Fuel Consumption)	Litres per Hour	443
Total Hours	Hours	3,286.5
Emission Factor	$kgCO_2e/l$	3.15
Total GHG Emissions from Dredging	**tCO_2e**	**4,586**

5.9 Community Gain – Maritime Village & Port Park

The Maritime Village is located west of Area K and is proposed total of 1.8 Ha to comprise of a sailing, rowing and maritime campus adjacent to the existing Poolbeg Yacht Club. The proposed new infrastructure at this area consists new facilities for local sailing, boat and rowing clubs including:

- Stella Maris Club;
- Yacht Club;
- Maritime Training;
- Boat Maintenance;
- Harbour operations; and
- Public Slipway.

In addition to the Maritime Village, the Port Park will be developed as part of the community gain aspect of the project, this comprises of a 2.7ha landscaped area on the south side of the park. The proposed works at the both the Maritime and Port Park will result in direct and indirect GHG emissions. A summary of the results from the carbon calculation exercise are detailed in **Table 5-10**.

Overall, the results indicate that the primary source of GHG emissions from the construction phase of both the Maritime Village and Port Park are the emissions associated with the embodied carbon from the materials used in the construction of infrastructure. The total estimated carbon generated during the construction phase is 4,270 tonnes CO_2e.

Embodied carbon in the materials required for construction is the largest component of emissions at circa 87% of the total. Of the materials used, Cement/Concrete makes up 43% of all embodied emissions. It is important to note that the building material was not assessed separately, and an emissions factor based on the green business council was applied to the building as a whole[18], the proposed buildings make up 66% of the maritime village emissions.

Table 5-10: Estimated Carbon associated with the Construction Phase of the Maritime Village and Port Park

Source		Total GHG (tonnes CO_2e)
Embodied Carbon (including transport of materials)	Aggregates	**168**
	Cement/Concrete	**2,126**
	Steel	**0**
	Asphalt	**0**
	Other (including Maritime Village buildings)	**1976**
	Total Embodied	**4,270**
Construction Activities (site clearance, demolotion, momobile plant, fixed plant, etc.)		**626**
Total		**4,896**

5.10 Summary

The total carbon emissions emitted from the development of the 3FM Project as a result of material use, construction activities and transport to site was calculated to be 201,937 tCO_2e, the results are presented in **Table 5-11**.

Embodied carbon in construction material was found to be the largest contributor to the overall construction phase emissions (95%). Within construction material embodied carbon associated with steel (48%) and cement/concrete (33%) had the highest overall emissions share (81%).

Figure 5-1 graphically represents the emissions associated with the construction phase of the 3FM Project and illustrates the dominance of the above materials.

[18] https://www.igbc.ie/wp-content/uploads/2022/02/22-Whole-Life-Carbon-Built-Environment-Report.pdf

Table 5-11: Estimated Carbon associated with the Construction Phase

Source of Emissions	tCO_2e	Percentage of Total Emissions
Aggregates	9,139	5%
Cement/Concrete	66,734	33%
Steel	96,137	48%
Asphalt	853	<1%
Other (Including Maritime Village Building)	18,838	9%
Total Embodied Carbon from Construction Material	191,701	**95%**
Construction	5,650	3%
Dredging	4,586	2%
Total Carbon from Construction Activities	10,236	**5%**
Total Embodied Carbon	201,937	**100%**

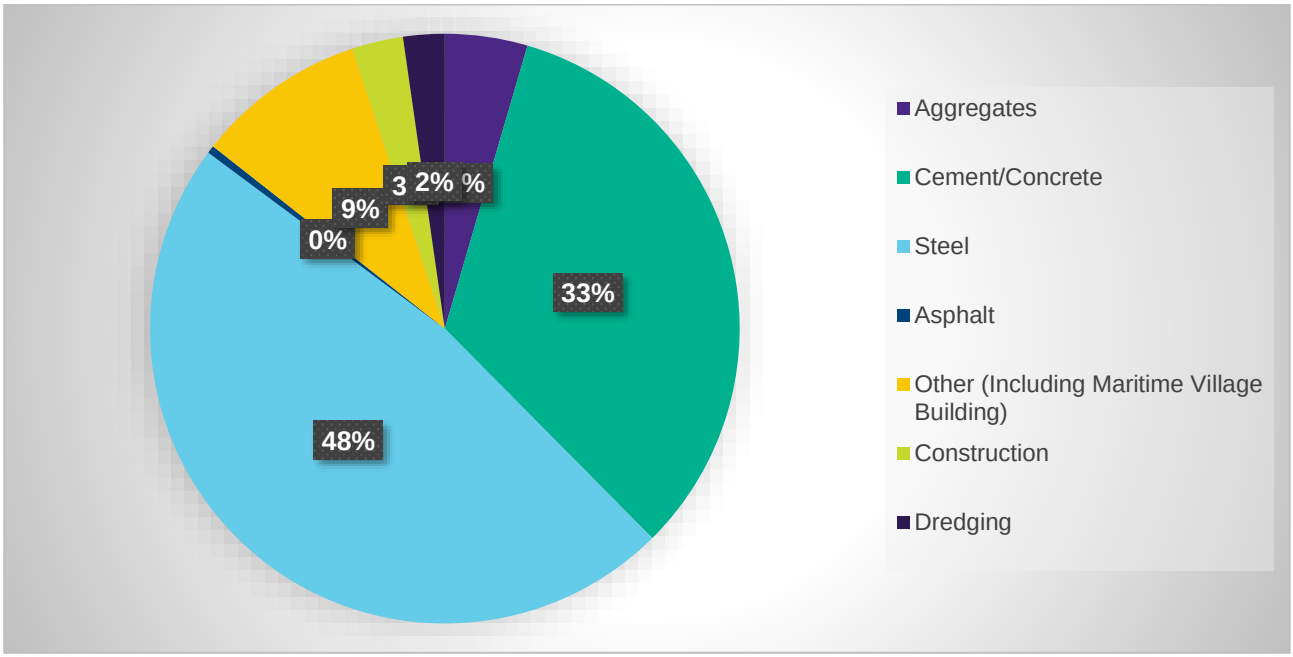

Figure 5-1: Share of GHG Emissions during the Construction Phase of 3FM

5.11 Design Mitigation

The projected emissions from the construction phase are presented using traditional methods and materials and are predicted to result in a moderate adverse impact for climate given the scale of the works being undertaken coupled with the absence of any policy mandated mitigation.

The need to mitigate these impacts is clearly signalled in national policy such as CAP24 (*3.5.1 Specify low carbon construction methods and low carbon cement material as far as practicable for directly procured or supported construction projects from 2023*). There has been ongoing interaction between the climate team and the design team to assess the potential pathways for mitigation during construction of the proposed development.

The SPAR bridge has been designed so that it can be modified in the future to facilitate the potential extension of the LUAS from The Point to Poolbeg, should the NTA choose such a future routing for a LUAS extension. In addition, electric or other low carbon shunting vehicles will be used to interconnect between freight terminals in the southern Port Estate and the potential rail freight hub which may be developed by Iarnród Éireann in the

vicinity of the North Port estate. Thus, the SPAR Bridge has been designed as a multi-modal transport bridge, rather than a conventional road bridge and will obviate the necessity to construct other footbridges/cycleways, a possible future LUAS bridge, and a rail interconnection bridge. Embodied carbon in the materials employed in the construction phase dominate the impact, in particular those relating to cement/concrete and steel. As such, to mitigate these impacts mandatory use of the following materials will be required by any contractor as a contractual obligation:

- As a replacement for traditional precast concrete materials made with Portland cement mixes, the proposed development will use 50% ground granulated blast-furnace slag (GGBS) cement for all structural and non-structural precast structures, kerbs, drains, etc. The exception to this commitment are the concretes required for the SPAR bridge which cannot meet this commitment at present;
- Similarly, all concrete poured *in-situ* for the proposed development will consist of 50% GGBS cement blend as a minimum; and
- Reinforcing steel or other steel employed on site will be 85% (as a minimum) recycled steel but this excludes any structural steel associated with the SPAR bridge, sheet piles and the tubular steel piles in the marine areas.

DPC will revisit this mix during detailed design to seek to achieve greater embodied reductions where possible based on industry practices, availability of material at the time of construction and the availability of novel low carbon substitutes.

The impacts of the use of these low carbon materials are presented in **Table 5-12** which shows the baseline levels of embodied carbon in these materials relative to the mitigated levels of embodied carbon. The total embodied carbon saved by these measures is 57,533 tCO_2e which is equivalent to **30%** of the total embodied carbon estimated for the proposed development (191,701 tonnes). During the design stage it is essential the use of low carbon material is assessed on a site-by-site basis as such material may not be suitable for use in some circumstances.

Table 5-12: Mitigation of Embodied GHG in Construction Materials

Material	Total Baseline GHG (tonnes CO_2e)	Low Carbon Material	Reduction as a Result of GHG Mitigation (tCO_2e)
Cement/Concrete	66,734	50% GGBS Blend	27,068
Steel	96,137	85% Recycled Steel	30,465
Total Reduction		57,533	
Reduction in Embodied Emissions		**30%**	

It is important to note that during the detailed design and construction phases there will be ongoing value engineering to optimise material volumes, material choices and construction methods. This value engineering may alter the mix of materials and carbon footprint presented in this assessment but the commitment to achieving a 30% reduction on the of the total embodied carbon will not change. DPC commits to achieving or exceeding this target in line with the requirements of CAP24 regardless of the volumes and mix of materials.

This commitment will be tracked through a Project Carbon Management Plan (PCMP) (refer to the CEMP (under separate cover)) which will be developed in accordance with PAS 2080 (Carbon Management in Infrastructure). The PCMP is used to monitor and report on the above committed carbon management measures and all other measures adopted during the design, procurement and construction phases.

5.12 Other Mitigation

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.

5.13 Residual Impact

The residual impact from the construction stage is assessed against the criteria in **Table 5-1**.

- It is considered that the project's GHG impacts are mitigated through effective 'good practice' measures, such as through sustainable material choices to reduce embodied carbon from the construction of the proposed development by 30%, which is a significant carbon saving; and
- The construction stage of the project will comply with existing policy requirements and in particular the target in Chapter 13 of CAP24 which sets a target to decrease embodied carbon in construction materials produced and used in Ireland by 2030. The mitigation in the proposed development complies with this target.

For both of the above criteria, the residual impact on climate of the construction phase emissions, with the committed mitigation in place, would be a **minor adverse climate impact** over the short term construction phase.

For impacts under the direct control of DPC, such as the construction works, the onsite energy use or the climate resilience, the impacts have been suitably mitigated and designed in line with national policy. The carrying out of the construction phase of the proposed development will be fully aligned with the requirements of policies relating to the climate impact of these activities, while the energy efficiency measures, active travel, modal shift and electric or other low carbon vehicle enhancements in the operational phase will all contribute to the national targets and measures for these elements of national and international policy.

DPC have devised the proposed development to be consistent, in so far as practicable, with the relevant climate policy base and, in assessing the proposed development and deciding to grant permission for the 3FM Project, the Board would comply with the requirements of section 15 of the Climate Action and Low Carbon Development Act 2015, as amended.

6 OPERATION PHASE EMISSIONS

6.1 Overview

Once constructed the operations at the port will continue to give rise to GHG emissions and these sources may be largely attributed to the following operations:

- **Port Activity** including use of cranes and other mobile plant, shore to ship power and general lighting and heating;
- **Road Transport** which relates to the changes in road traffic patterns on the road network and the difference between the Do-Minimum and Do-Something scenarios; and
- **Marine Transport** which relates to the changes in shipping numbers and types using the port and the difference between the Do-Minimum and Do-Something scenarios.

Each of these sources is addressed and characterised in the sections within this chapter of the report.

As with the GHG assessment, the TII assessment criteria are employed as the guide to assess the potential for significant impact as listed in **Table 5-1**.

However, to determine significance of each of the sources, the assessment criteria are informed by the following CAP24 or other targets:

- **Port Activity** will be assessed relative to the CAP24 industry targets to achieve a 75% share in carbon neutral heating and 10% reduction in fossil fuel demand by 2030;
- **Road Transport** will be assessed relative to the CAP24 target to achieve a 50% reduction in emissions by 2030 relative to 2018 in addition to wider measures, including the delivery of active travel and modal shift infrastructure; and
- **Marine Transport** will be assessed relative to the CAP24 requirement to promote renewable and advanced fuel use in maritime transport.

6.2 Port Activity

DPC and the Sustainable Energy Authority of Ireland (SEAI) signed a joint energy efficiency agreement in 2014. As a member of the Public Sector Energy Partnership Programme, Dublin Port Company and SEAI work in partnership to achieve targets of energy efficiency savings and improvements by 2030.

Dublin Port subsequently partnered with the SEAI to achieve ISO 50001, the international standard for Energy Management, in December 2016. From this a number of efficiency projects were established with some of biggest projects including:

- Changing all of the high mast lighting (HML's) within the Dublin Port estate to highly efficient LED;
- Renewable energy generation projects using solar PV and wind energy; and
- Optimisation of operational assets.

DPC again obtained certification for ISO 50001 the international Energy Management Standard in July 2020.

DPC's expected electrical power consumption was calculated based on the estimated demand during the operation phase (including shore to ship power demand). **Table 7-1** presents the estimated energy demand which is estimated to be 31,923,302 kWhr per annum at full capacity.

Using the EPA 2022 emissions intensity of power generation (332g CO_2/kWh)[19] the total tonnes of CO_2e (tCO_2e) that will be emitted during the operation phase is estimated to be 10,599 tCO_2e per annum.

[19] https://www.epa.ie/our-services/monitoring--assessment/climate-change/ghg/energy-/#:~:text=In%202022%2C%20electricity%20generated%20from,the%20period%201990%20to%202022.

Table 6-1: Dublin Port's Estimated Annual Power Consumption

Area	Connected Load (kVA)	Estimated Max Demand (kVA)	Annual Power Consumption (kWhr)
Plot K	7,068	3,171	9,091,369
Plot N/L	19,793	6,598	17,157,730
Plot O	300	1,970	5,564,702
Road Lighting	25	25	109,500
Results	**27,186**	**11,763**	**31,923,302**

The share of renewable electricity in 2022 was 38.6% while CAP24 includes a target to increase the share of electricity generated from renewable sources to 80% by 2030. In future years, the carbon intensity of the electricity generating sector will continue to reduce with the increasing share of renewable generation.

In March 2020 the EU Technical Expert Group on Sustainable Finance published its recommendations for an EU Taxonomy for Sustainable Activities[20]. A key feature of the recommendations around electricity generation was a target emissions threshold of 100g CO_2e/kWh by 2050. As the fraction of renewable energy increases within the grid, the emissions intensity of electricity will reduce to reach this target in 2050.

Figure 6-1 graphically represents the predicted drop in electricity emissions and **Table 6-2** shows the projected reduction in Dublin Ports electricity emissions from 2023 to 2050.

CAP24 includes a target to increase the share of electricity generated from renewable sources to 80% by 2030 Once the State complies with these Climate targets, the annual operational emissions will drop from 10,599 tCO_2e (using the 2022 carbon intensity) to 3,193 tCO_2e in 2050 assuming the EU target is achieved (refer **Table 6-2**).

Table 6-2: Dublin Port' Estimated Electricity Emissions

Year	kWh	Emissions Factor	Total tCO_2e
2023	31,923,302	0.000313	10,599
2050	31,923,302	0.000100	3,192

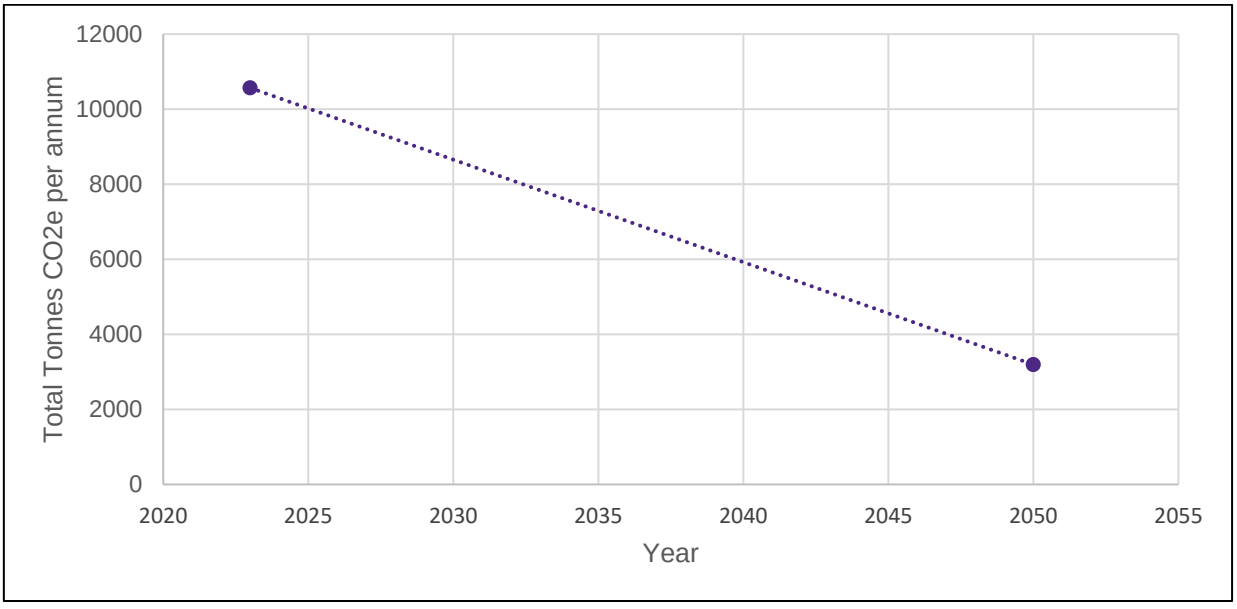

Figure 6-1: Dublin Port Estimated Electricity Emissions

[20] Link: https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities_en

6.3 Road Transport

Emissions from road transport when the project 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 project with Irish fleet composition information.

Traffic information for both the northern port land and the southern port lands and the surrounding public roads have been incorporated into the model to simulate the impacts of the planned increases in throughput associated with the proposed development and the impacts of the South Port Access Road.

The traffic model for the project predicts future traffic levels across the wider road network in the area around the port both in the absence (i.e. the Do-Minimum scenario) and presence of the 3FM Project (i.e. the Do-Something scenario). The predicted emissions for operational traffic under both scenarios are presented in **Table 6-3**.

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 as per the TII guidelines.

Note that the Climate Action Plan scenario assumes full delivery of the targets for fleet electrification on the public road network as follows:

- 175,000 passenger EVs;
- 20,000 commercial vans;
- 700 low-emission HGV; and
- 300 EV buses in PSO bus fleet.

The results for the Do-Minimum 2040 scenario indicate that road traffic emissions will generate 29,202 tonnes per annum of GHG under the business as usual scenario whereby no climate mitigation policies for transport are adopted. This would reduce to 25,172 tonnes per annum if the full CAP24 measures were adopted by the State.

With the proposed development in operation with an increased port throughput and the South Port Access Road in operation, the total GHG emissions are predicted to increase by circa 14-16% per annum regardless of the implementation of the CAP24 policies.

Table 6-3: Predicted Annual GHG Emissions from Road Transport from the Project

Scenario	BaU Scenario (tonnes CO_2e)	Intermediate Scenario (tonnes CO_2e)	CAP Scenario (tonnes CO_2e)
Do-Minimum 2040	29,202	26,537	25,172
Do-Something 2040	33,403	30,703	29,319
Change (%)	**+14%**	**+16%**	**+16%**

In terms of mitigation of these road transport impacts, this is typically at national policy level and the following mitigation is committed to in CAP24 specifically in relation to road traffic emissions from freight:

- Ireland's Road Haulage Strategy (published December 2022) provides a roadmap as to how the Irish Government will support the Road Freight sector to decarbonise and meet the targets set out in CAP.
- CAP23 included a new target for the sector following Ireland becoming a signatory in November 2022 to the Global MOU on Zero Emission Medium- and Heavy-Duty vehicles. This non-binding agreement targets 30% of sales of new Medium- and Heavy-duty vehicles (trucks and buses) to be zero emission by 2030, increasing to 100% of new sales in 2040.
- In 2022, 7% of the diesel fuel supplied was from renewable sources and the State's intention is to increase the level of renewable fuel usage in transport to achieve an equivalent 20% biodiesel blend by 2030, a move which will help to significantly reduce emissions from the Road Freight sector.
- Eco-Driver training, which trains drivers to operate vehicles in a safer and more eco-friendly manner, will be important in promoting decarbonisation in the road freight sector.

- The All-Island Strategic Rail Review has been published for public consultation and sets out further recommendations to increase the level of ambition for rail freight on the island, thereby contributing to the decarbonisation of the sector. These include recommendations to develop sustainable solutions for first/last mile rail freight access for Dublin Port, reduce Track Access Charges for freight services; strengthen rail connectivity to the island's busiest ports; and to develop a network of inland terminals close to major cities on the rail network.

With the proposed development in operation with an increased port throughput and the Southern Port Access Route (SPAR) in operation, the total GHG emissions are predicted to increase by circa 14-16% per annum regardless of the implementation of the CAP24 policies. While there are significant indirect impacts to climate identified as a result of road transport, the planned legislative mitigation measures at international, EU and national levels will reduce these impacts.

In conclusion, DPC have devised the proposed development to be consistent, in so far as practicable, with the relevant climate policy base and, in assessing the proposed development and deciding to grant permission for the 3FM Project, the Board would comply with the requirements of section 15 of the Climate Action and Low Carbon Development Act 2015, as amended.

6.4 Marine Transport

In addition to road transport, marine transport is also a potential source of GHG from the proposed development. It is acknowledged that as an island nation, the Irish economy is reliant on the movement of goods to Great Britain, mainland Europe or other jurisdictions through air or marine transport.

While shipping is the low-carbon option relative to aviation, it remains a source of GHG emissions (refer **Section 3.5**). The total shipping volumes at the port from 2016 to 2022 have been derived from both the CSO[21] and DPC[22] databases and these are presented in **Table 6-4**.

Also included in the table is the total throughput for each year and the calculated average throughput per cargo vessel. This indicator shows a continued increase reflecting the move towards larger vessels meaning greater throughputs may be accommodated within the same numbers of albeit larger vessels. This is reflected in the largely static emissions profile for the port (refer **Figure 3-8**) despite the increasing throughput.

Table 6-4 also shows a metric of the average number of sailings per week over the seven year period with the average ranging from 139 per week (during Covid) up to 151 before Covid in 2018.

Table 6-4: Total Shipping and Cargo Volumes 2016 to 2022

Vessel Type	2016	2017	2018	2019	2020	2021	2022
Roll On/Roll Off	6,120	6,238	6,157	6,178	5,867	5,826	5,959
Load On/Load Off	882	834	966	870	814	899	855
Bulk Solid	80	44	60	61	69	40	35
Bulk Liquid	474	470	527	540	473	454	530
Passenger	109	127	150	157	1	0	23
Total Throughput ('000 Gross Tonnes)	**34,931**	**36,428**	**38,001**	**38,145**	**36,859**	**34,929**	**35,631**
Total Sailings	**7,665**	**7,713**	**7,860**	**7,806**	**7,224**	**7,219**	**7,402**
Average Sailings per Week	**147**	**148**	**151**	**150**	**139**	**139**	**142**
Average '000 Gross Tonnes per Cargo Vessel	**4.56**	**4.72**	**4.83**	**4.89**	**5.10**	**4.84**	**4.81**

[21] Link: https://www.cso.ie/en/statistics/transport/statisticsofporttraffic/

[22] Link: https://www.dublinport.ie/trade-statistics/

The 3FM Project will facilitate an increase in both Roll On/Roll Off (Ro-Ro) and Lift On/Lift Off (Lo-Lo) freight at Dublin Port. As per the projection rationale presented in Chapter 2 of the EIAR, the net change in vessel numbers will result in circa ten additional sailings per week utilising the berths at the South Port (Areas K, L and N). This net increase in sailings per week equates to a 7% increase on the baseline levels of sailings shown in **Table 6-4** with additional Ro-Ro and Lo-Lo services and a reduction in cargo services. Shipping emissions associated with the current and proposed development have been quantified using the emission factors presented in the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories based on a default voyage. **Table 6-5** provides the 2022 GHG emissions generated from shipping at the port as well as the emissions associated with the proposed development.

Table 6-5: Shipping Emissions for the Baseline (2022) and Do-Something Scenarios

Scenario	Total Emissions (kilotonnes CO_2e)
Baseline (2022)	4,503
Do-Something	4,880

Table 6-5 shows that the total GHG emissions from the proposed development will increase by 8% per annum with the additional ten sailing per week.

It is important to note that these calculations are highly conservative and do not include any reduced emissions associated with engine and fuel type as mandated through policy such as the International Maritime Organisation ambition to reach net zero emissions from international shipping for 2050[23]. In addition, CAP24 requires the promotion of Renewable Fuel Use in Maritime Transport.

Given the existing legal requirements around fuel and emissions for shipping, the extent of emissions per vessel are gradually reducing and will continue to reduce in future years. As such, the analysis presented in **Table 6-5** should be considered a conservative worst-case estimate.

Total GHG emissions from the proposed development will increase by 8% per annum with the additional ten sailings per week. While there are significant indirect impacts to climate identified as a result of Marine transport, the planned legislative mitigation measures at international, EU and national levels will reduce these impacts.

In conclusion, DPC have devised the proposed development to be consistent, in so far as practicable, with the relevant climate policy base and, in assessing the proposed development and deciding to grant permission for the 3FM Project, the Board would comply with the requirements of section 15 of the Climate Action and Low Carbon Development Act 2015, as amended.

6.5 Residual Impact

Port activity emissions are predicted at circa 10,599 tonnes CO_2e per annum based on the 2022 energy mix but these emissions are predicted to decrease in future years with the decarbonisation of the electricity grid. It is considered that this operational emissions meet the following criteria:

- The project's GHG impacts are mitigated through 'good practice' measures such as through the electrification of works thereby allowing for natural mitigation through the grid;
- The project has complied with existing and emerging policy requirements such as the shore to ship power and the use of low carbon electricity; and
- The operations are fully in line to achieve Ireland's trajectory towards net zero as shown in **Figure 6-1**.

In short, port activity emissions are considered to pose **a minor adverse climate impact** over the long term of the port Masterplan.

Employing the significance criteria in **Table 5-1**, the following considerations apply to the operational road traffic emissions for the Do Something scenario relative to the Do-Minimum Scenario:

- The project's GHG impacts will be somewhat mitigated through legislative measures – in the case of the modelled emissions under the CAP scenario, this includes national measures such as the electrification

[23] https://ec.europa.eu/commission/presscorner/detail/en/ip_23_3745

of the fleet and the biofuels blend as per CAP24. 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
- The predictions suggest that the Do-Something scenario will increase and therefore is not fully in line to achieve Ireland's trajectory towards net zero.

With these factors considered, the net impact on climate of the operational phase road traffic emissions is classed as **moderate adverse in the long term**.

Total shipping emissions are projected to increase by 8% relative to baseline. This increase does not include or any of the projected fuel and engine improvements anticipated under international maritime policy and the EU regulations. The residual impact from shipping is considered under the following criteria:

- The project's GHG impacts will be somewhat mitigated through EU and international legislative measures on fuel and engine technology and the inclusion of shipping in the ETS and this mitigation has not been factored into the analysis presented;
- The project complies with existing and emerging policy requirements such as the inclusion of shipping in the EU ETS and the policy move towards more sustainable fuels; and
- The predictions suggest that the Do-Something scenario will increase and therefore is not fully in line to achieve Ireland's trajectory towards net zero.

DPC have devised the proposed development to be consistent, in so far as practicable, with the relevant climate policy base and, in assessing the proposed development and deciding to grant permission for the 3FM Project, the Board would comply with the requirements of section 15 of the Climate Action and Low Carbon Development Act 2015, as amended.

With these factors considered, the net impact on climate of the operational phase shipping emissions is classed as **moderate adverse in the long term**.

7 CLIMATE ADAPTATION/CLIMATE CHANGE RISK

7.1 Sensitivity Analysis

The Climate Act 2015 provides a legal definition for adaptation as adjustment to any system designed or operated by humans, including an economic, agricultural, or technological system, or any naturally occurring system, including an ecosystem, that is intended to counteract the effects of climate change, prevent or moderate environmental damage resulting from climate change, or confer environmental benefits.

In the context of climate change, risks emerge from the interactions between climate change and related hazards (heatwaves, floods, droughts etc.), exposure and vulnerability. Risk is in constant evolution as the frequency and intensity of weather extremes increase and as exposure and vulnerability change. Therefore, adaptation should be seen as iterative risk management process (IPCC, AR6, WGII, 2022), that responds to the dynamics and evolution of risk, where emphasis is placed on ongoing processes of assessment, action, monitoring, evaluation, learning and improvement.

Widespread, pervasive impacts to ecosystems, people, settlements, and infrastructure have resulted from observed increases in the frequency and intensity of climate and weather extremes, including hot extremes on land and in the ocean, heavy precipitation events, drought, and fire weather. These extremes are occurring simultaneously, causing cascading impacts that are increasingly difficult to manage, (IPCC, AR6, WGII, 2022).

There is increased evidence of maladaptation across many sectors and regions since the AR5. Maladaptive responses to climate change can create lock-ins of vulnerability, exposure and risks that are difficult and expensive to change and exacerbate existing inequalities. Maladaptation can be avoided by flexible, multi-sectoral, inclusive and long-term planning and implementation of adaptation actions with benefits to many sectors and systems. (IPCC, AR6, WGII, 2022).

A sensitivity analysis was carried out on both the construction and operation phase of the project. A sensitivity analysis is used to identify which climate hazards are relevant to the specific type of project irrespective of its location. **Table 7-1** presents the reasons behind the sensitivity score for the construction of the project and **Table 7-2** presents the reason behind the sensitivity score for the use phase of the project. **Table 7-3** presents the sensitivity analysis grid.

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.

The aim of the sensitivity analysis is to identify which climate hazards are relevant to the specific type of project, irrespective of its location (European Commission, 2021).

The climate change risk register shows that with the detailed controls in place, the risk of adverse climate impact on the proposed development has been suitably mitigated to reduce the likelihood of such an event having a significant adverse impact. In short, the vulnerability of the works and operations to climate change has been suitably mitigated and the potential impact is considered to be **minor adverse** for the short-term construction phase and for the longer term operation phase.

Table 7-1: Sensitivity Analysis of Climate Hazards to the Construction of the Project Irrespective of Location.

Climate event	Detail
Flooding (Coastal)	High sensitivity to coastal flooding. Damage caused by flooding tends to last longer than any other weather-related hazard. It can damage buildings by waterlogging which can cause rotting. Flooding can impact roads and can cause damage to the integrity of the road and port; it can lead to road closures or port restrictions slowing down the construction.
Flooding (Pluvial)	High sensitivity to pluvial flooding – as above.
Flooding (Fluvial)	High sensitivity to fluvial flooding – as above

Extreme heat	Medium sensitivity to extreme heat. Any concrete may be sensitive to extreme heat which can cause concrete to crack or other construction constraints. Extreme heat can cause tar on roads to melt. Working in extreme heat can cause dehydration and heatstroke.
Extreme cold	High sensitivity to extreme cold weather, cold weather can cause pipes to burst and can impact the integrity of drainage or by causing concrete to crack.
Wildfire	High sensitivity to wildfires as wildfires can cause severe damage to structures or plant.
Drought	Low sensitivity to drought. Drought will have little to no impact on the port.
Extreme wind	Medium sensitivity to the extreme wind. Extreme wind can cause material to disperse and high-rise cranes or other elevated works may be restricted
Lightning and hail	Medium sensitivity to lightning and hail as it may halt the construction if severe.
Fog	Low sensitivity to fog, fog will have no impact on the construction.

Table 7-2: Sensitivity Analysis of Climate Hazards to the Use of the Project Irrespective of Location.

Climate event	Detail
Flooding (Coastal)	High sensitivity to coastal flooding. Flooding can impact the running of a port. It can flood buildings impacting staffing and running of the port. It can cause road closures impacting the transporting of goods from the port. Flooding will cause an increase in sea level impacting a ships' ability to load on load off and roll on roll off. Flooding can cause machinery and technology to break down. Flooding could cause environmentally hazardous material to pollute the surrounding water.
Flooding (Pluvial)	High sensitivity to pluvial flooding – as above
Flooding (Fluvial)	High sensitivity to fluvial flooding – as above
Extreme heat	Medium sensitivity to extreme heat. Extreme heat can cause buildings to overheat, hindering staff' ability to work in the facility. Port staff working outside may be victim to heatstroke or dehydration.
Extreme cold	High sensitivity to extreme cold weather, cold weather can cause pipes to burst. It can cause roads to become icy or closed due to snow.
Wildfire	High sensitivity to wildfires, wildfires can cause severe damage to a port.
Drought	Low sensitivity to drought.
Extreme wind	High sensitivity to the extreme wind, wind can cause structures to blow down and/or objects to crash into the structures. Wind forces have the most significant impact on the safe operation of port and marine terminal equipment. Large cargo handling equipment could become unstable, dropping the cargo. Objects blown down could cut electricity. These scenarios can cause the port to shut down or work at reduced capacity.
Lightning and hail	Medium sensitivity to lightning and hail, lighting and hail can impact the use of large machinery at the port.
Fog	Low sensitivity to fog, extreme fog could prevent boats docking and can prevent heavy cargo machinery to be used safely however it will not have major impacts.

Table 7-3: Sensitivity Analysis Grid

Aspect	Flooding (Coastal)	Flooding (pluvial)	Flooding (Fluvial)	Extreme heat	Extreme cold	Wildfire	Drought	Extreme Wind	Lightning & Hail	Fog
Construction	3	3	3	2	3	3	1	2	2	1
Use	3	3	3	2	3	3	1	3	2	1

7.2 Exposure Analysis

An exposure analysis was carried out on the port and **Table 7-4** presents the reasons for the exposure scoring based on past climates[25]. **Table 7-5** presents the reason for the exposure scoring based on future projections. The exposure analysis results are presented in **Table 7-6.** The screening is broken down into three steps:

- a sensitivity analysis;
- an exposure analysis; and
- when combined make up the vulnerability assessment, which is discussed in **Section 7.3**.

Table 7-4: Exposure Analysis of the Location Based on Past Climate Events

Climate Event	Detail
Flooding (Coastal)	Coastal flooding is rated as medium exposure. A small portion of the flooding boundary is located on the new SPAR bridge and along the edge of the port [24].
Flooding (Pluvial)	Pluvial flooding is rated as low exposure. No flooding events have occurred in the area [24].
Flooding (Fluvial)	Fluvial flooding is rated as low exposure. No flooding events have occurred in the area [24].
Extreme heat	Extreme heat is rated medium exposure, extreme heat has occurred in this area in the past. In 2022 temperatures reached 33.0°C. In 2018 there was high temperatures causing heatwaves and drought. 2006 was warmest summer ever recorded since 1995**.** The maximum temperature recorded 1979 – 2010 was 28.7 °C.
Extreme cold	Extreme cold is rated medium exposure. Extreme cold spells do occur in the area, in 2018 there was heavy snowfall and in 2010 there was snow and a severe cold spell. There was a yearly average of 16.6 days with sleet or snow between 1979 – 2010 but only a yearly average of 3.4 days with snow lying at 0900 UTC.
Wildfire	Wildfire is ranked as low exposure. No wildfires have been recorded in the area.
Drought	Drought is rated as medium exposure; it does occur in the area but not regularly.
Extreme wind	Extreme wind is ranked as high exposure, extreme winds, and storms occur yearly [25].
Lightning and hail	Lightning and hail are ranked as medium exposure, these conditions occur regularly in Ireland. The mean number of yearly hail days between 1979-2010 was 9.7 days. The mean number of yearly thunder days between 1979-2010 was 5.5 days.
Fog	Fog is ranked as high exposure. Fog occurs regularly in Ireland, the mean number of yearly fog days between 1979-2010 in the area was 41.5 days.

Table 7-5: Exposure Analysis of the Location Based on Projected Climate Events

Climate Event	Detail
Flooding (Coastal)	Coastal flooding is rated as medium exposure. The site is at risk of flooding.
Flooding (Pluvial)	Pluvial flooding is rated as low exposure. The Strategic Flood Risk Assessment concluded this location is not at risk of pluvial flooding.
Flooding (Fluvial)	Fluvial flooding is rated as medium exposure. Fluvial flooding may occur around the exterior of the port.
Extreme heat	Extreme heat is ranked as high exposure, climate change is set to increase in intensity and duration of heatwaves.
Extreme cold	Extreme cold is ranked as medium exposure, climate change is predicted to increase the extremes and there is a history of extreme cold spell, however a decrease in frost days is predicted.
Wildfire	Low exposure, there are trees/hedgerows along the perimeter of the site and a park is set to be developed. Wildfires can be a result of periods of dry weather or can be accidently started. Setting fire

[24] Floodinfo.ie https://www.floodinfo.ie/map/floodmaps/?X=7047243.634011469&Y=-695106.5153536589&Z=14

[25] https://www.met.ie/climate/major-weather-events

	to vegetation is prohibited between March 1st and August 31st hence wildfires are not predicted to increase[26].
Drought	Drought is ranked as medium exposure. Drought is predicted to increase, an increase in extreme heat will result in an increase in drought.
Extreme wind	Extreme winds are ranked as high exposure, storms regularly occur, and the frequency of these storms is set to continue to increase.
Lightning and hail	Lighting and hail are ranked as medium exposure, storms are predicted to increase and hail, and lightning occur regularly.
Fog	Fog is ranked as high exposure. Fog occurs regularly in the area and is predicted to continue occurring.

Table 7-6: Exposure Analysis Results

Aspect	Flooding (Coastal)	Flooding (Pluvial)	Flooding (Fluvial)	Extreme heat	Extreme cold	Wildfire	Drought	Extreme Wind	Lightning and hail	Fog
Current	2	1	1	2	2	1	2	3	2	3
Future	2	1	2	3	2	1	2	3	2	3
Highest Score Current and future	2	1	2	3	3	1	2	3	3	3

[26] https://www.ucc.ie/en/flares/thescienceofwildfires/

7.3 Vulnerability Analysis

Using the sensitivity analysis and exposure analysis a vulnerability assessment was carried out. The results are presented in **Table 7-7.**

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: (this being the 3rd step)

- a sensitivity analysis;
- an exposure analysis; and
- when combined make up the vulnerability assessment.

The aim of the sensitivity analysis is to identify which climate hazards are relevant to the specific type of project, irrespective of its location (European Commission, 2021).

The climate change risk register shows that with the detailed controls in place, the risk of adverse climate impact on the proposed development has been suitably mitigated to reduce the likelihood of such an event having a significant adverse impact. In short, the vulnerability of the works and operations to climate change has been suitably mitigated and the potential impact is considered to be **minor adverse** for the short-term construction phase and for the longer term operation phase.

Table 7-7: Vulnerability Analysis Results

Aspect	Flooding (Coastal)		Flooding (pluvial)		Flooding (Fluvial)		Extreme Heat		Extreme Cold		Wildfire		Drought		Extreme Wind		Lightning and Hail		Fog	
	Sensitivity	Exposure	Sensitivity	Exposure	Sensitivity	Exposure	Sensitivity	Exposure	Sensitivity	Exposure	Sensitivity	Exposure	Sensitivity	Exposure	Sensitivity	Exposure	Sensitivity	Exposure	Sensitivity	Exposure
Construction	3	2	3	1	3	2	2	3	3	3	3	1	1	2	2	3	2	2	1	3
Vulnerability	6		3		6		6		9		3		2		6		4		3	
Use	3	2	3	1	3	2	2	3	3	3	3	1	1	2	3	3	2	2	1	3
Vulnerability	6		3		6		6		9		3		2		9		4		3	

7.4 Climate Risk Assessment

Coastal Flooding, Fluvial Flooding, Extreme heat, extreme cold, and extreme wind were assessed in the climate risk assessment as they were ranked >5 in the climate vulnerability assessment.

7.4.1 Likelihood Analysis

A likelihood analysis was carried out on the port and scoring was quantified using information on future projections based on the latest available data from the IPCC and the EPA. The extremes considered include temperature extremes, heavy precipitation and pluvial floods, river floods, droughts, storms (including tropical cyclones), as well as compound events (multivariate and concurrent extremes). Where a compound event is described as: (i) two or more extreme events occurring simultaneously or successively, (ii) combinations of extreme events with underlying conditions that amplify the impact of the events, or (iii) combinations of events that are not themselves extremes but lead to an extreme event or impact when combined.

With every fraction of additional global warming, heat extremes & heavy precipitation events become both more frequent & more intense on average over land regions as shown in **Figure 7-1**. **Table 7-8** presents the reason for scoring and **Table 8-9** presents the qualitative analysis.

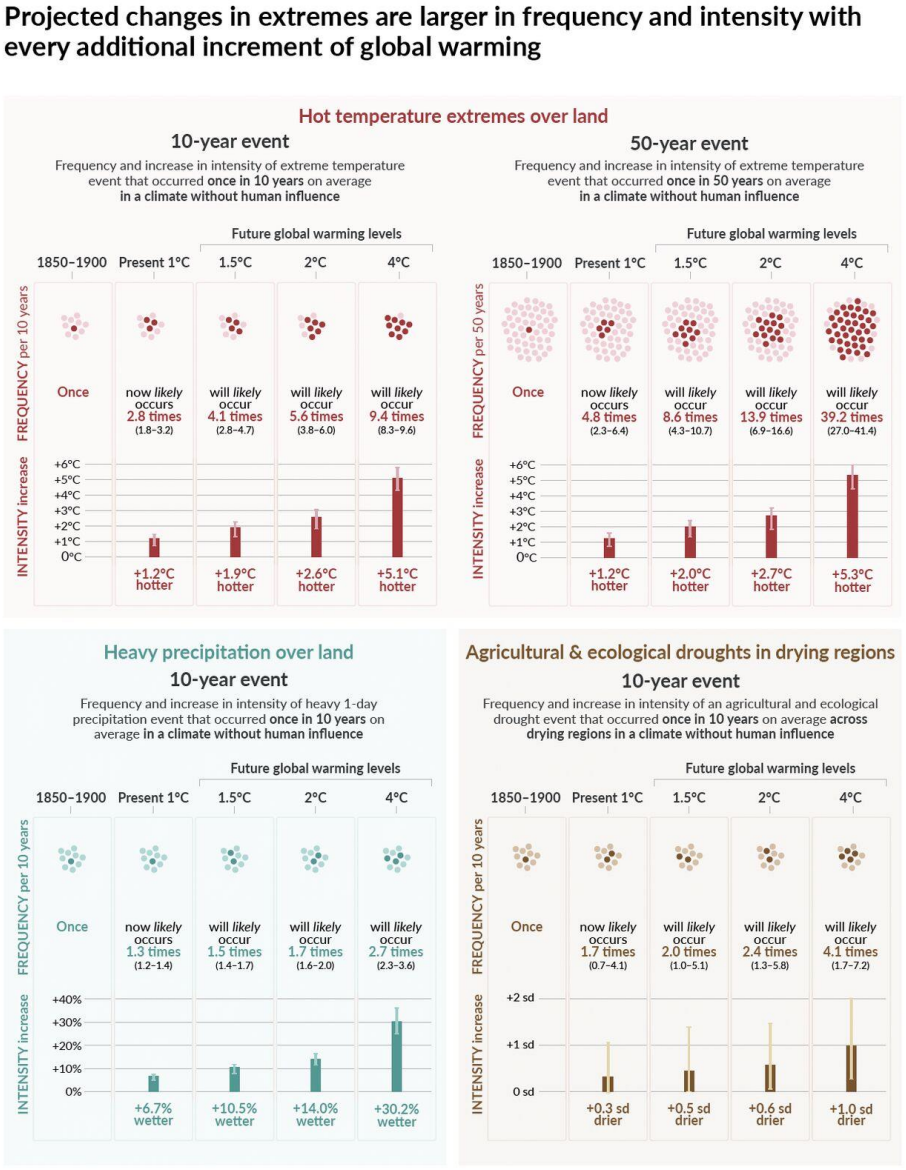

Figure 7-1: Projected Changes in Extreme Weather

Table 7-8: Scoring Rationale

Climate Event	Detail
Flooding Coastal	Future predictions from the IPCC[27] indicate a likely global increase in sea level rise of between 0.43m and 0.84m by 2100. The OPW has used the evidence from the IPCC and other authoritative sources to model coastal flooding in Ireland for two emission scenarios that result in an increase in rainfall and a) a sea level rise of 500mm and b) a sea level rise of 1000mm. Both scenarios indicate that coastal flooding is evident in the project location. Therefore, the likelihood of coastal flooding in the project location is assessed as likely to occur.
Flooding Fluvial	The EPA report [28] shows that there is an observed increase in river flows across most of the country. Projected changes in temperature and precipitation will affect hydrological response. A 20% increase in the amount of water flowing through rivers are expected for the majority of catchment by mid-late century while for summer decreases of over 40% (those with little groundwater storage in particular) have been simulated for the end of the century. Projected increases in winter flows coupled with likely increases in extreme precipitation events are likely to lead to an increased flood risk. However, catchment response time will be critical in determining the changing nature of extremes and those catchment with fast response times are likely to be most at risk. The OPW has modelled River Flood Extents for Mid-Range Future Scenarios and High-End Future Scenarios as above and indicate that there is evidence of fluvial flooding along sections of the project site. Therefore, the likelihood of fluvial flooding in the project location is assessed as likely to occur.
Extreme Heat	Ireland has observed climate changes in line with global trends. The EPA project a temperature increase for Ireland the years 2041 to 2060 relative to the 1981-2000 period between 0.9 - 1.9°C depending on the time of year and the emissions scenario (low/high). With increasing air temperatures, an increase in the intensity and duration of heat waves is expected [29] . Therefore, the likelihood of extreme heat is assessed as almost certain.
Extreme Cold	The number of frost and ice days is projected to decrease by the middle of the century[29]. The number of frost days is projected to decrease by between 45% and 58% and the number of ice days is projected to decrease by 68% and 78% for the different emissions scenarios. While there is a decrease indicated, extreme cold events still may occur in the lifetime of the project has it has in recent years therefore extreme cold is classified as likely to occur.
Extreme Wind	Projections indicate a decrease in the numbers of less intense storms for Ireland with an increase in more intense storms which are rare events [30]. Irelands climate projections 2041 – 2060 predict wind speed projections speed to decrease for 2041-2060 (change relative to 1981-2000). Although there is a predicted decrease of wind speed, extreme winds have occurred in the past and are likely to occur in the project's lifetime.

Table 7-9: Qualitative Results of Likelihood Analysis.

Climate hazard	Qualitative Analysis
Flooding Coastal	Likely to occur
Flooding Fluvial	Likely to occur
Extreme Heat	Almost Certain
Extreme Cold	Likely to occur
Extreme Wind	Likely to occur.

[27] IPCC Special Report on Ocean and Cryosphere in a changing climate. Summary for Policy Makers Section B.3. https://www.ipcc.ch/srocc/chapter/summary-for-policymakers/ [accessed 04/04/2023]

[28] EPA Climate Observations and Projections: https://www.climateireland.ie/ - !/tools/climateInformation/essentialClimateInformation [accessed 04/04/2023].

[29] EPA research report 339. Section 3.4 Frost and Ice Days: https://www.epa.ie/publications/research/climate-change/Research_Report_339_Part2.pdf [accessed 04/04/2023]

[30] EPA Climate Ireland Website: https://www.climateireland.ie/ - !/tools/climateInformation/essentialClimateInformation [accessed 04/04/2023]

7.4.2 Impact Analysis

An impact analysis was carried out on the construction phase of the project. **Table 7-10** presents the reasoning behind the scoring of the coastal flooding impact analysis. **Table 7-11** presents the impact analysis results for coastal flooding. **Table 7-12** presents the reasoning behind the scoring of the fluvial flooding impact analysis. **Table 7-13** presents the impact analysis results for fluvial flooding impact analysis. **Table 7-14** presents the reasoning behind the scoring of the extreme heat impact analysis. **Table 7-15** presents the impact analysis results for extreme heat impact analysis. **Table 7-16** presents the reasoning behind the scoring of the extreme wind impact analysis. **Table 7-17** presents the impact analysis results for extreme wind impact analysis. **Table 7-18** presents the reasoning behind the scoring of the extreme cold impact analysis. **Table 7-19** presents the impact analysis results for extreme cold impact analysis.

Table 7-10: Coastal Flooding Impact Analysis on the Project

Coastal Flooding	Detail
Asset Damage	Asset damage impacts are rated as major. Flooding can cause buildings to become waterlogged and over time can weaken them causing them to collapse. It can close road and impact the integrity of roads. Water can also damage electronics and large waves can cause destruction to the port.
Safety and Health	Safety and health impacts are rated as major. Flooding can create dangerous working conditions, it can increase the chances of someone slipping, it can also increase the chance of drowning. Collapsed building can also cause serious injuries. Coastal flooding is often caused by large waves these can be very dangerous to people on the port.
Environmental	Environmental impacts are rated as moderate for coastal flooding. Any runoff or oil spilled will enter the sea and other water ways through flooding. If there is any hazardous material it could enter the waterways. Big waves may also cause destruction causing oil leaks.
Social	Social impacts are rated minor, it may cause people to be out of work.
Financial	Financial impacts are rated minor, coastal flooding could cause the port to close or work at a reduced capacity based on the Port' 2022 turnover if the port loses a day of work, it is at a loss of €278,000.[31]
Reputational	Reputational impacts are rated minor, if flooding occurs the public might see it as a failure to plan.
Cultural Heritage and Cultural premises	Cultural impacts are rated minor. Dublin port is considered and area of nature, heritage and conservation. Extreme weather events like flooding may negatively impact the site. The development of the maritime village will add to the cultural aspects of the port. This area could be impacted during extreme weather [32].

[31] Dublin Port Company Report and Financial Statements For the Year Ended 31 December 2022 https://opac.oireachtas.ie/Data/Library3/Documents%20Laid/2023/pdf/DPCOdoclaid280623_182720.pdf

[32]Dublin Port: https://www.dublinport.ie/safetyenvironment/environment-wildlife/#:~:text=Dublin%20Port%20Company%20Awarded%20Ecoports%20Certification&text=Dublin%20Port%20remains%20a%20centre,Irish%20sense%20but%20across%20Europe [Accessed 04/03/2023]

Table 7-11: Coastal Flooding Impact Analysis Results.

	Insignificant	Minor	Moderate	Major	Catastrophic
Asset Damage				X	
Safety and health				X	
Environmental			X		
Social		X			
Financial		X			
Reputational		X			
Cultural		X			

Table 7-12: Fluvial Flooding Impact Analysis on the Project

Fluvial Flooding	Detail
Asset Damage	Asset damage is rated as major. As described in coastal flooding impacts flooding can cause buildings to become waterlogged and over time can weaken them causing them to collapse. It can cause road and/or port closure and impact the integrity of the quays, road, etc.
Safety and Health	Safety and health impacts are rated as major. Flooding can create dangerous working conditions. Flooding can increase the chances of someone slipping, it can also increase the chance of drowning. Collapsed building can also cause serious injuries
Environmental	Environmental impacts are rated as moderate. Any runoff or oil spilled will enter the sea and other water ways through flooding.
Social	Social impacts are rated minor, it may cause people to be out of work.
Financial	Financial impacts are rated minor, as stated in coastal flooding, if fluvial flooding causes the port to close or work at reduced capacity, one day of lost work results in a loss of €278,000 for the port.[31]
Reputational	Reputational impacts are rated minor, if flooding occurs the public might see it as a failure to plan.
Cultural Heritage and cultural premises	Cultural impacts are rated minor. Dublin port is considered and area of nature, heritage and conservation. Extreme weather events like flooding may negatively impact the site. The development of the maritime village will add to the cultural aspects of the port. This area could be impacted during extreme weather [33].

[33]Dublin Port: https://www.dublinport.ie/safetyenvironment/environment-wildlife/#:~:text=Dublin%20Port%20Company%20Awarded%20Ecoports%20Certification&text=Dublin%20Port%20remains%20a%20centre,Irish%20sense%20but%20across%20Europe [Accessed 04/03/2023]

Table 7-13: Fluvial Flooding Impact Analysis Results.

	Insignificant	Minor	Moderate	Major	Catastrophic
Asset Damage				X	
Safety and health				X	
Environmental			X		
Social		X			
Financial					
Reputational	X				
Cultural		X			

Table 7-14: Extreme Heat Impact Analysis on the Project

Extreme heat	Detail
Asset Damage	Asset damage is rated as minor. Extreme heat can cause the concrete in buildings to crack and port concrete structures to crack. It can cause the tar on roads to melt.
Safety and Health	Safety and health impacts are rated as minor. Extreme heat can cause dehydration and heat stroke. Extreme heat can cause exacerbate the level of dust.
Environmental	Environmental impacts are rated minor, extreme heat can cause exacerbate the level of dust.
Social	Social impacts are rated insignificant, no social issues will be caused by extreme heat.
Financial	Financial impacts are rated insignificant, no financial issues will be caused by extreme heat.
Reputational	Reputational impacts are rated insignificant, no reputational issues will be caused by extreme heat
Cultural	Cultural impacts are rated insignificant, no cultural issues will be caused by extreme heat.

Table 7-15: Extreme Heat Impact Analysis Results.

	Insignificant	Minor	Moderate	Major	Catastrophic
Asset Damage		X			
Safety and health		X			
Environmental		X			
Social	X				
Financial	X				
Reputational	X				
Cultural	X				

Table 7-16: Extreme Wind Impact Analysis on the Project

Extreme Wind	Detail
Asset Damage	Asset damage impact is rated as major. Extreme wind can cause cranes to become unstable potentially dropping cargo and construction material. Large cargo operational machines also have the potential of becoming unstable causing destruction.
Safety and Health	Extreme wind impact is rated as moderate. Wind can cause structures to blow down and loose objects to disperse causing injury/damage.
Environmental	Environmental impacts are rated as minor, extreme wind could cause objects to enter the sea.
Social	Social impacts are rated insignificant, no social issues can be caused by extreme wind.
Financial	Extreme wind may have a financial impact, as stated previously one day of lost work results in a loss of €278,000 for the port. [31]
Reputational	Reputational impacts are rated not significant, no reputational issues will be caused by extreme wind.
Cultural	Cultural impacts are rated insignificant, no cultural issues will be caused by extreme wind.

Table 7-17: Extreme Wind Impact Analysis Results.

	Insignificant	Minor	Moderate	Major	Catastrophic
Asset Damage				X	
Safety and health			X		
Environmental		X			
Social	X				
Financial		X			
Reputational	X				
Cultural		X			

Table 7-18: Extreme Cold Impact Analysis on the Project

Extreme Cold	Detail
Asset Damage	Asset damage impact is rated as minor. Extreme cold can cause pipes to burst and can potentially cause concrete to crack.
Safety and Health	Safety and health impacts are rated as moderate. Extreme cold can create icy conditions on roads and paths making it unsafe to drive and increasing the risk of slipping. Extreme cold can also cause snow which can make working conditions dangerous. Using heavy machinery in icy weather can be dangerous and increase the risk of accident.
Environmental	Environmental impacts are rated as minor. The contents of the burst pipes such as sewage could enter the sea.
Social	Social impacts are rated insignificant, no social issues can be caused by extreme cold.
Financial	Extreme wind may have a financial impact, as stated previously one day of lost work results in a loss of €278,000 for the port. [31]
Reputational	Reputational impacts are rated insignificant, no reputational issues will be caused by extreme cold.
Cultural	Cultural impacts are rated insignificant, no cultural issues will be caused by extreme cold.

Table 7-19: Extreme Cold Impact Analysis Results.

	Insignificant	Minor	Moderate	Major	Catastrophic
Asset Damage		X			
Safety and health			X		
Environmental		X			
Social	X				
Financial		X			
Reputational	X				
Cultural	X				

7.4.3 Climate Risk Analysis

Using the likelihood analysis and impact analysis a climate risk assessment was carried out. The results are presented in **Table 7-20.**

7.5 Residual Impact

The climate change risk register shows that with the detailed controls in place, the risk of adverse climate impact on the proposed development has been suitably mitigated to reduce the likelihood of such an event having a significant adverse impact. In short, the vulnerability of the works and operations to climate change has been suitably mitigated and the potential impact is considered to be **minor adverse** for the short-term construction phase and for the longer term operation phase.

Table 7-20: Climate Risk Assessment Results

Risk ID	Climate variable	Stage of project	Risk statement	Project receptors	Impact type	Planned controls	Initial risk rating		
1	Coastal Flooding	Construction/ Use	Coastal flooding has the potential to cause: • Waterlogging of buildings • Large wave destruction • Machinery and other electronics breaking from water damage. • Unsafe working conditions for staff and construction workers. • Oil or environmentally hazardous material running off into the surrounding sea	Structures Machinery Environment Employees	Asset damage Health and safety Environmental	• No construction will be carried out during flooding. • Machinery will not be used. • All hazardous material will be stored correctly. • Strong border preventing wave damage. • Buildings and structures will be weather resistant by coating, sealants, waterproofs. • Building will be constructed above proposed flood level, e.g. the new bridge has been designed to be outside of the predicted flood event	Likely to occur	Major	Does not apply
2	Fluvial Flooding	Construction/ Use	Fluvial flooding has the potential to cause: • Waterlogging of buildings • Machinery and other electronics breaking from water damage. • Unsafe working conditions for staff and construction workers. • Oil or environmentally hazardous material running off into the surrounding sea	Structures Machinery Environment Employees	Asset damage Health and safety Environmental	• No construction will be carried out during flooding. • Machinery will not be used. • All hazardous material will be stored correctly. • Strong broader preventing wave damage. • Buildings and structures will be weather resistant by coating, sealants, waterproofs. • Building will be constructed above proposed flood level,	Likely to occur	Major	Does not apply

3	Extreme Heat	Construction/ Use	Extreme heat has the potential to cause: • Concrete cracking • Tar melting on the roads. • Uncomfortable Working Conditions for staff • exacerbate the amount of dust generated	Structures Machinery Environment Employees	Asset damage Health and safety Environmental	The concrete will be developed to withstand high heats. No construction will be carried out during extreme heat. Dust suppression, health and safety plan.	Almost Certain	Minor	Does not apply
4	Extreme Wind	Construction/ Use	Extreme wind has the potential to cause: • Large cargo operational machinery and cranes becoming unstable during extreme wind. • Objects blowing into the sea.	Structures Machinery Environment Employees	Asset damage Health and safety Environmental	No construction will be carried out during extreme wind. Building and structure is built to withstand strong winds.	Likely to occur	Major	Does not apply
5	Extreme Cold	Construction/ Use	Extreme cold has the potential to cause: • Pipes bursting entering water. • Concrete cracking • Unsafe working conditions for staff and construction workers during icy conditions.	Structures Machinery Environment Employees	Asset damage Health and safety Environmental	The pipes will follow Uisce Éireann guidelines and will be deep enough not to be impacted. No construction will be carried out during extreme cold spells	Likely to occur	Moderate	Does not apply

8 INTERACTIONS AND CUMULATIVE IMPACT

8.1 Cumulative Impact

A cumulative impact assessment has been undertaken to consider potential for cumulative impact of the 3FM Project with other approved development. The assessment has considered cumulative sources and impact pathways which could impact on climate.

Projects have been screened-in to the analysis where there is potential for significant climate impacts (positive or negative) and these are listed in **Table 8-1**. 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 list.

Table 8-1: Projects Screened-in for Potential Cumulative Effects on Climate

Project Descrioption
In-Port Projects
Alexandra Basin Redevelopment (ABR) – ABP Reg. Ref. PL29N.PA0034
MP2 Reg. Ref. ABP-304888-19
1.4km pedestrian walkway and a 2-way cycle lane – Reg. Ref. 3220/21
T10 Link Road – Reg. Ref. 4894/22
Dublin Harbour Capital Dredging Project – Reg. Ref. Foreshore Application FS007164/DAS Application S0033-01
Dublin Port Maintenance Dredging Programme 2022–2029 – Reg. Ref. FS007132 / DAS Permit S0004-03
Open Cycle Gas Turbine (OCGT) and a generating plant. – Reg. Ref. PWSDZ3074/23 – done Q26
Underground Cable Programme is set to replace and upgrade five 220kV circuits – Reg. Ref.
Construction of a new 220kV gas insulated switchgear (GIS) Switchboard building – Reg. Ref. 4057/23.
Planning permission for the continuation of use of an existing concrete batching plant and associated facilities. Reg. Ref. PWSDZ3469/22
Development at the Ringsend Wastewater Treatment Plant. Reg. Ref. 5319/22
Upgrade of the Ringsend Wastewater Treatment Plant (WwTP). Reg. Ref. PL29S.301798
Projects in the area Surrounding Dublin Port
North Lotts & Grand Canal Dock Planning Scheme 2014- BP Ref. PL29N.ZD2011
Point Bridge and Dodder Bridge
The Howth Yacht Club Marina Extension – Reg. Ref. DAS Permit Reg. No. S0010-01
Poolbeg West SDZ. BP Ref. PL29N.ZD2013
Development that will be for mixed usage – Reg.Ref. PWSDZ3270/19
Development that will be for mixed usage – Reg.Ref. PWSDZ3207/21
Development that will be for mixed usage – Reg.Ref. PWSDZ4121/21
Development that will be for mixed usage – Reg.Ref. PWSDZ3406/22
Development that will be for mixed usage – PWSDZ3062/24
Offshore Wind Energy Projects
Dublin Array Wind Farm – Reg. Ref. FS007188
Codling Wind Park – Reg. Ref. FS007045
North Irish Sea Array – Reg. Ref. FS007031
Seastacks Wind Farm - Reg. Ref. FS007134

There are potential cumulative construction phase impacts for each of the in-port projects listed through the need for significant material inputs depending on the scale of the projects listed as well as material transport. It is noted that both the larger projects, the ABR and MP2 projects (which include other listed projects such as the roads within the port and the capital/maintenance dredging, etc.), were subject to EIA processes. The climate impact assessments for these projects included construction phase mitigation to support the use of

low carbon materials for these projects. Therefore, while there is potential for cumulative construction phase impact to climate from embodied carbon in materials and construction methods from these Dublin Port projects, the cumulative impacts are considered minor adverse given the level of mitigation applied.

In terms of the operation phase of the in-port projects, the ABR and MP2 projects (including the associated road/walkway development) are key features of the DPC Masterplan and both projects, in combination with the 3FM Project, will facilitate greater shipping and road traffic movements at the port. However, it is noted that these cumulative shipping and traffic volumes have been accounted for in the traffic and shipping numbers in the 3FM Project assessment presented in **Section 6** of this report. As such, there is potential for indirect cumulative adverse climate impacts from the transport elements associated with these projects. Mitigation of both road and marine transport emissions is mandated at EU and national level through climate policy and the residual cumulative climate impact from shipping and road traffic from these projects is considerate moderate adverse.

There will also be direct GHG combustion emissions from the OCGT (periodically) and the concrete batching plant and to a lesser degree the upgrade of the treatment plant and the GIS switchboard. These will be in addition to the direct operational emissions at the port energy use but the cumulative impacts during the combined operations are classed as a minor adverse climate impact.

For the projects in the area surrounding Dublin Port and Poolbeg West SDZ, there are potential construction phase impacts associated with the significant material inputs required and therefore potential for cumulative adverse impact from embodied carbon in materials and construction methods. The cumulative impacts are considered minor adverse given the level of mitigation applied as mandated by the Climate Action Plan policies on embodied carbon.

During operations, each of these developments will generate (such as the North Lotts/Grand Canal scheme, Poolbeg West SDZ and Howth Yacht Club Marina Extension) or carry (the Point Bridge and Dodder Bridge) additional road traffic volumes on the local road network. It is noted that these additional traffic volumes have been accounted for in the traffic analysis presented in this report for the 3FM Project. Traffic and transport emissions from these developments may be somewhat mitigated through the active travel proposals included in the 3FM Project which are beneficial relative to the baseline infrastructure. As noted, mitigation of road transport emissions is mandated at national level through the CAP and the residual cumulative climate impact from road traffic from these projects is considerate moderate adverse.

Space heating at these residential/leisure developments may also generate direct greenhouse gas emissions and electricity use during operations will have an indirect climate impact. The scale of this impact will depend on the carbon intensity of the power generation sector and the energy demand of the development.

8.2 Interactions

Article 3(1) of the Environmental Impact Assessment (EIA) Directive requires that the interaction between the factors (population and human health, biodiversity, land, soil, water, air and climate, material assets, cultural heritage and the landscape) is identified, described and assessed in the EIAR. The EPA Guidelines (2022) states that:

> *'The interactions between effects on different environmental factors should be addressed as relevant throughout the EIAR. For example, where it is established in the Hydrology section that there will be an increase in suspended solids in discharged surface waters during construction, then the Biodiversity section should assess the effect of that on sensitive aquatic receptors.'*

The climate interactions assessment has been carried out with regard to the following guidelines:

- EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (EPA, 2022); and
- The Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions (European Commission (EC), 1999).

The assessment of interactive effects has considered likely significant effects that may arise during construction, operational and maintenance, and decommissioning phases of the 3FM Project. The assessment of interaction of effects has been undertaken on a qualitative basis based on best scientific knowledge.

Climate change will result in modified climate conditions and an increase in extreme weather events and the adaption of the 3FM Project to these impacts has been considered into the design of the project (see Project

Description chapter of the EIAR). This adaption is also addressed within the EIAR section relating to Risks of Major Accidents and Natural Disasters.

The Project Rationale and Project Description chapters of the EIAR have provided information on construction works, port activities and shipping numbers that have been used to inform the analysis in this report.

The effects on climate also have the potential to have secondary interactive effects on the following receptors:

- Traffic and transport – the road traffic information provided in this chapter has been utilised to quantify the potential greenhouse gas emissions associated with road traffic generation on the immediate road network as a result of the operation of the 3FM Project;
- Air quality – the key sources for the generation of greenhouse gases during the operation phase include shipping, road traffic and port operations and these combustion sources are also relevant for the air quality assessment and both assessments have interacted to align the input data and assumptions employed;
- Population and Human Health – the effects of the project on climate and the resulting indirect effects on population and human health have been included such as the public health effects from climate change and adaptation and the public health effects from wider societal infrastructure and resources; and
- Biodiversity – a specific assessment of the benefits on ecological receptors is not provided in biodiversity chapter, however, it is widely recognised that climate change affects ecosystems on land and in water in many ways. The Intergovernmental Panel on Climate Change (IPCC) Synthesis Report of the IPCC Sixth Assessment Report (Ar6) (IPCC, 2023) summarises the state of knowledge of climate change, its widespread impacts and risks, and climate change mitigation and adaptation. It also recognises the interdependence of climate, ecosystems and biodiversity, and human societies.

9 CONCLUSION

9.1 Residual Impacts

9.1.1 Construction Phase

The residual impact from the construction stage is assessed against the criteria in **Table 5-1**.

- It is considered that the project's GHG construction impacts are mitigated through 'good practice' measures such as through sustainable material choices to reduce embodied carbon from the construction of the proposed development by 30%; and
- The construction stage of the project will comply with existing policy requirements and in particular the target in Chapter 13 of CAP24 which sets a target to decrease embodied carbon in construction materials produced and used in Ireland by 2030. The mitigation in the proposed development complies with this target.

For both of the above criteria, the residual impact on climate of the construction phase emissions, with the committed mitigation in place, would be a **minor adverse climate impact** over the short term construction phase.

For impacts under the direct control of DPC, such as the construction works, the onsite energy use or the climate resilience, the impacts have been suitably mitigated and designed in line with national policy. The carrying out of the construction phase of the proposed development will be fully aligned with the requirements of policies relating to the climate impact of these activities, while the energy efficiency measures, active travel, modal shift and electric or other low carbon vehicle enhancements in the operation phase will all contribute to the national targets and measures for these elements of national and international policy.

In conclusion, DPC have devised the proposed development to be consistent, in so far as practicable, with the relevant climate policy base and, in assessing the proposed development and deciding to grant permission for the 3FM Project, the Board would comply with the requirements of section 15 of the Climate Action and Low Carbon Development Act 2015, as amended.

The climate change risk register for the construction phase shows that with the detailed construction controls in place, the risk of adverse climate impact on the proposed development 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 construction phase.

9.1.2 Operational Phase

Port activity emissions equate to circa 10,566 tonnes CO_2e per annum based on the 2022 energy mix but these emissions are predicted to decrease in future years with the decarbonisation of the electricity grid. It is considered that this operational emissions meet the following criteria:

- The project's GHG impacts are mitigated through 'good practice' measures such as through the electrification of works thereby allowing for natural mitigation through the grid;
- The project has complied with existing and emerging policy requirements such as the shore to ship power and the use of low carbon electricity; and
- The operations are fully in line to achieve Ireland's trajectory towards net zero as shown in **Figure 6-1**.

In short, operational emissions are considered to pose **a minor adverse** climate impact over the long term of the port Masterplan.

While there are significant indirect impacts to climate identified as a result of road traffic and shipping, the planned legislative mitigation measures at international, EU and national levels will reduce these impacts. DPC will continue to perform its functions, in so far as practicable, in a manner consistent with any current or future climate policy on road traffic and shipping to aid in the reduction of these indirect sources.

In conclusion, DPC have devised the proposed development to be consistent, in so far as practicable, with the relevant climate policy base and, in assessing the proposed development and deciding to grant permission for

the 3FM Project, the Board would comply with the requirements of section 15 of the Climate Action and Low Carbon Development Act 2015, as amended.

Total road transport emissions associated with the operation of the proposed development are estimated to have a 14-16% net increase over the Do-Minimum scenario. Employing the significance criteria in **Table 5-1**, the following considerations apply to the operational road traffic emissions for the Do Something scenario relative to the Do-Minimum Scenario:

- The project's GHG impacts will be somewhat mitigated through legislative 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 CAP24. 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
- The predictions suggest that the Do-Something scenario will increase and therefore is not fully in line to achieve Ireland's trajectory towards net zero.

With these factors considered, the net impact on climate of the operational phase road traffic emissions is classed as **moderate adverse in the long term**.

Total shipping emissions are projected to increase by 8% relative to baseline. This increase does not include or any of the projected fuel and engine improvements anticipated under international maritime policy and the EU regulations. The residual impact from shipping is considered under the following criteria:

- The project's GHG impacts will be somewhat mitigated through EU and international legislative measures on fuel and engine technology and the inclusion of shipping in the ETS and this mitigation has not been factored into the analysis presented;
- The project complies with existing and emerging policy requirements such as the inclusion of shipping in the EU ETS and the policy move towards more sustainable fuels; and
- The predictions suggest that the Do-Something scenario will increase and therefore is not fully in line to achieve Ireland's trajectory towards net zero.

With these factors considered, the net impact on climate of the operational phase shipping emissions is classed as **moderate adverse in the long term**.

The climate change risk register shows that with the detailed controls in place, the risk of adverse climate impact on the proposed development has been suitably mitigated to reduce the likelihood of such an event having a significant adverse impact. In short, the vulnerability of the port operations to climate change has been suitably mitigated and the potential impact is considered to be **minor adverse for the long term**.

9.2 Consistency with Climate Policy

As noted in **Section 2.1.3**, in deciding whether to grant development consent, An Bord Pleanála is required under Section 15 of the Climate Action and Low Carbon Development Act 2015, as amended, to perform its functions, in so far as practicable, in a manner consistent with the following:

- The most recently approved Climate Action Plan;
- The most recently approved national long term climate action strategy;
- The most recently approved national adaptation framework and approved sectoral adaptation plans;
- The furtherance of the National Climate Objective; and
- The objective of mitigating GHGs and adapting to the effects of climate change in the State.

This climate policy framework is summarised in **Section 2.2** of this report. **Table 9-1** presents a summary of the relevant policy objectives and actions and provides an overview of the consistency of the proposed development to these policies.

In short, the analysis shows that in the event that ABP decides to grant permission for the 3FM Project, it would be performing its assessment and consenting function, in so far as practicable, in a manner consistent with the following:

- The most recently approved Climate Action Plan;

- The most recently approved national long term climate action strategy;
- The most recently approved national adaptation framework and approved sectoral adaptation plans;
- The furtherance of the National Climate Objective; and
- The objective of mitigating GHGs and adapting to the effects of climate change in the State.

For impacts under the direct control of DPC, such as the construction works, the onsite energy use or the climate resilience, the impacts have been suitably mitigated and designed in line with national policy.

The carrying out of the construction phase of the proposed development will be fully aligned with the requirements of policies relating to the climate impact of these activities, while the energy efficiency measures, active travel, modal shift and electric or other low carbon vehicle enhancements in the operation phase will all contribute to the national targets and measures for these elements of national and international policy.

While there are significant indirect impacts to climate identified as a result of road traffic and shipping, the planned legislative mitigation measures at international, EU and national levels will reduce these impacts. DPC will continue to perform its functions, in so far as practicable, in a manner consistent with any current or future climate policy on road traffic and shipping to aid in the reduction of these indirect sources.

In conclusion, DPC have devised the proposed development to be consistent, in so far as practicable, with the relevant climate policy base and, in assessing the proposed development and deciding to grant permission for the 3FM Project, the Board would comply with the requirements of section 15 of the Climate Action and Low Carbon Development Act 2015, as amended.

Table 9-1: Consistency with Climate Policy

Section 15(1) Criteria	Policy	Policy Requirement	Consistency of the Proposed Development
The most recent approved climate action plan	CAP24 Chapter 10 (KPI)	3.5.1 Specify low carbon construction methods and low carbon cement material as far as practicable for directly procured or supported construction projects from 2023.	Dublin Port Company commits to the use of low carbon cements, concrete products, steel and asphalt with a carbon reduction of 30% over baseline. Fully consistent with section 15 of the Act.
	CAP24 Chapter 13 (Action)	2030 KPI: Decrease embodied carbon in construction materials produced and used in Ireland by at least 30% through product substitution for construction materials and reduction of clinker content in cement.	As above, fully consistent with section 15 of the Act.
	CAP24 Chapter 15 (Action)	TR/24/25 Re-evaluation of the policy framework for the decarbonisation of ports as part of the overall review of National Ports Policy.	Dublin Port Company is a key contributor to the review of National Ports Policy and has included a range of in port decarbonisation measures such as shore to ship power to enable demand management for on-site energy use. Dublin Port Company will comply with all decarbonisation policies presented within the reviewed National Ports Policy. Fully consistent with section 15 of the Act.
		PW/24/2 Establish structure(s) for evaluating further Modal Shift (Freight) and Sustainable Biofuels in Transport, for the purpose of addressing the currently unallocated emission savings.	While an action for national government, Dublin Port supports any policy that enables modal shift of fright traffic and/or the increased use of sustainable biofuels for transport. Fully consistent with section 15 of the Act.
		TR/24/14 (TF) Continue investment in passenger and freight rail, informed by outcomes of All Island Strategic Rail Review.	Dublin Port is identified as a key response to rail freight in the All Island Strategic Rail Review and while the proposed development does not include for any supporting rail infrastructure, the development does not preclude future rail transport at the port as may be mandated under the All Island Strategic Rail Review. Fully consistent with section 15 of the Act.
		JM/24/6 Support regeneration, repurposing and sustainable development of walking and cycling tracks and trails, and waterways.	Safe and segregated cycle paths and pedestrian routes are proposed throughout the Poolbeg Peninsula as part of the proposed development to enable residents, workers and commuters in the Ringsend and wider area to shift to active travel transport. Fully consistent with section 15 of the Act.
		TR/24/11 (TF) Advance roll-out of walking/cycling infrastructure in line with National Cycle Network and CycleConnects plans.	As above, safe cycle paths and pedestrian routes are proposed throughout the Poolbeg Peninsula as part of the proposed development. Fully consistent with section 15 of the Act.

The most recent approved national long term climate action strategy	Emission Reduction Measures and Milestones to 2050 for shipping	The 2018 International Maritime Organisation (IMO) strategy on the reduction of greenhouse gas emissions from ships has the objective of reducing emissions by 50% by 2050 compared to 2008 while pursuing efforts to achieve full decarbonisation as soon as possible in this century.	Ships using the proposed infrastructure at Dublin Port will be required to comply with the IMO strategy actions to reduce shipping emissions by 50% by 2050. Fully consistent with section 15 of the Act.
		The IMO strategy envisages the adoption of measures and incentives to encourage further development and use of low and zero carbon fuels in shipping, including a combination of bioenergy and renewable fuels, hydrogen and its derivatives.	Ships using the proposed infrastructure at Dublin Port will be required to adopt IMO measures on low and zero carbon fuels with a view to reducing emissions from shipping activity. Fully consistent with section 15 of the Act.
The most recent approved national adaptation framework and approved sectoral adaptation plans	National Adaptation Framework 2018 and 2024	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.	A Climate Change Risk assessment is undertaken at planning stage to identify the vulnerability of this development to climate change and to consider adaptation measures to increase the resilience of the project. This has been fully documented within this report to ensure a climate resilient project is developed. 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.