

19 Climate

19.1 Introduction

This chapter assesses the likely significant effects of the proposed development on climate, including a quantitative carbon impact assessment. The impact of climate change on the proposed development in terms of the adaptability of the scheme to address an increase in flood events is considered in Chapter 4 *Description of the Proposed Scheme* and in Chapter 14, *Water*.

Chapter 4, *Description of the Proposed Scheme* provides a description of the proposed development and Chapter 5, *Construction Strategy* describes the construction strategy for the proposed development. The following aspects are particularly relevant to the climate assessment:

- The climate impact associated with the use of raw materials for construction, operation and maintenance of the proposed development.

19.2 Assessment Methodology

19.2.1 General

The climate assessment for the proposed development in this chapter estimates the potential for greenhouse gas (GHG) emissions, i.e. carbon.

EU greenhouse gas emission reduction targets and reduction obligations for Ireland are split into two broad categories. The first category covers the large energy and power (i.e. energy intensive) industry which have their emissions controlled under the EU Emissions Trading Scheme (ETS). The second category deals with the non-Emissions Trading Scheme (non-ETS) sectors such as agriculture, transport, residential, commercial, waste and non-energy intensive industry. The operational phase of the proposed development will involve emergency water pumps and associated emergency generator. The maintenance phase of the proposed development will involve bridge pier, debris and silt trap, flood wall maintenance and channel dredging (approximately every 10 years). The effect of the maintenance and operational phases is predicted to be not significant. As such, its impact on climate is not considered significant. As construction materials (primarily concrete and steel) are manufactured using energy intensive practices, the carbon impact is assessed against the ETS category.

The results of this assessment have been compared against the EPA's projected GHG emissions for both the Emission Trading Scheme (ETS) sector and total emissions for 2020¹.

¹ EPA, 2020. *Ireland's Greenhouse Gas Emissions Projections 2019 - 2040*. Available at https://www.epa.ie/pubs/reports/air/airemissions/ghgprojections2019-2040/2020-EPA-Greenhouse-Gas-Emissions-Projections_final.pdf

19.2.2 Guidance and Legislation

19.2.2.1 National

The Government of Ireland's *Climate Action Plan*² was published in 2019. It commits to achieving a net zero carbon energy systems objective for Ireland. The plan sets out a detailed sectoral roadmap to deliver a cumulative reduction in emissions.

The *Climate Action and Low Carbon Development Bill 2020*³ was published by government in October 2020 and updated in March 2021. The Bill sets out the national objective of transitioning to a low carbon, climate resilient and environmentally sustainable economy in the period up to 2050. The Bill provides for the preparation of Sectoral Plans which will specify policies to reduce greenhouse gas emissions for each sector.

In October 2014, the European Council reached political agreement on headline greenhouse gas emissions reduction targets in the context of the *2030 Climate and Energy Framework*⁴. An overall EU reduction of at least 40% in greenhouse gas emissions by 2030 compared to 1990 levels is to be delivered collectively by the EU.

Ireland's 2030 target is to achieve a 30% reduction of non-Emissions Trading Scheme sector emissions on 2005 levels with annual binding limits set for each year over the period 2021-2030.

The EU ETS is implemented in Ireland under *S.I. 490 of 2012*⁵ and amendments and *S.I. No. 261 of 2010* and amendments. The legislative framework of the EU ETS was revised in 2018 to enable it to achieve the EU's 2030 emission reduction targets in line with the *2030 Climate and Energy Policy Framework*⁴ and as part of the EU's contribution to the *2015 Paris Agreement*⁶.

19.2.2.2 Regional

*Wicklow County Council Change Adaptation Strategy*⁷ was adopted in September 2019. The aim of this first strategy is to identify the risks, challenges and opportunities that need to be considered and to take coherent coordinated action. The Adaptation Strategy is based around six thematic areas that are developed further as High Levels Goals. These goals identify the desired outcomes anticipated through the effective implementation of the Adaptation Strategy. These goals are supported by specific objectives and adaptation actions to achieve their desired outcomes:

² Climate Action Plan, Government of Ireland 2019

³ Climate Action and Low Carbon Development Bill 2020.

⁴ European Commission, 2013. 2030 Climate & Energy Framework

⁵ Irish Statute Book. 2012. EC Greenhouse Gas Emissions Trading Regulations

⁶ Paris Agreement, 2015. https://ec.europa.eu/clima/policies/international/negotiations/paris_en

⁷ Wicklow County Council Change Adaptation Strategy, 2019

<https://www.wicklow.ie/Portals/0/Documents/Climate%20Action/Adaptation%20Strategy/Climate%20Adaptation%20Strategy.pdf>

1. Local Adaptation Governance and Business Operations
2. Infrastructure and Built Environment
3. Land use and development
4. Drainage and Flood Management
5. Natural Resources and Cultural Infrastructure
6. Community Health and Wellbeing

The proposed scheme is considered to be compliant with the following objectives and actions outlined in the Adaptation Strategy:

(Theme 2) Objective: *“To ensure and increase the resilience of infrastructural assets and inform investment decisions”*

Action 2.4: *“Integrate climate considerations into the design, planning and construction of multilevel developments to take account of predicted flood events.”*

19.2.3 Study Area

The proposed development is located in Arklow, Co. Wicklow. The proposed development is contained within the planning boundary as shown in the site location and site layout maps; refer to **Figure 1.1** and **Figure 1.2** in **Chapter 1, Introduction**.

The potential effects of emissions of carbon due to the proposed development are considered in the context of Ireland’s national climate change obligations.

19.2.4 Site Visits

No site visits were considered necessary in the preparation of this chapter.

19.2.5 Categorisation of the Baseline Environment

A desk-based study of the baseline environment of the proposed development area was undertaken in order to inform this assessment. The EPA’s *Ireland’s Greenhouse Gas Emissions Projections 2019-2040*¹⁰ was referred to.

19.2.6 Impact Assessment Methodology

An assessment of carbon emissions was carried out in order to determine the likely increases in greenhouse gas emissions (Mt CO₂ equivalent) due to the construction of the proposed development, relative to Ireland’s projected baseline for 2025 (Q4 2022 to 2025 is the planned construction duration), as reported by the EPA. This assessment focuses on the embodied carbon of the material used during the construction phase.

The University of Bath's (via Circular Ecology) carbon calculator (Version 1.1 November 2019)⁸ has been used to calculate the embodied carbon of cement and concrete mixtures in terms of carbon dioxide equivalency (CO₂e). The calculator uses data from the *Inventory of Carbon and Energy (ICE) Database - Embodied Carbon Model of Cement, Mortar and Concrete*.

For elements that are not covered by the Circular Ecology carbon calculator, namely, ceramics, hardcore and wastes, the Environment Agency's Carbon Calculator⁹ has been used to estimate carbon emissions due to construction activities in terms of carbon dioxide equivalency (CO₂e).

Both the Circular Ecology and the Environment Agency's Carbon Calculator considered the transport of material to the site, depending on the material under consideration. A transport distance of 20km has been included in both calculators for the transportation materials such as concrete/boulders/soil to site. A transport distance of 50km is applied to steel materials.

Individual values for the embodied carbon contribution of each element, quantities of material, assumptions and total tonnes of CO₂e are provided in **Table 19.1**.

19.3 Baseline Conditions

19.3.1 Flooding

As outlined in **Chapter 2, Background and Need for the Scheme**, Arklow has experienced recurring flooding events in the past, some of which have resulted in damage to property. The largest flood event recorded in the study area was in August 1986 resulting from extreme meteorological conditions commonly referred to as 'Hurricane Charley'.

19.3.2 Carbon Emissions

In July 2020, the EPA released the report *Ireland's Greenhouse Gas Emissions Projections 2019-2040*¹⁰. This report stated that total national greenhouse gas emissions in 2018 were estimated to be 60.9 million tonnes carbon dioxide equivalent (Mt CO₂eq). This is 1.1% lower than emissions in 2017. Ireland's greenhouse gas emissions for the energy intensive industries (known as the ETS sectors) were recorded to be 15.5 Mt CO₂ eq. in 2018.

⁸ <http://www.circularecology.com/embodied-energy-and-carbon-footprint-database.html>

⁹ Environment Agency Carbon Calculator, 2007.

¹⁰ EPA, 2020. Ireland's Provisional Greenhouse Gas Emissions 2019 – 2040.

Table 19.1: Projected Emissions for the ETS Sector and Total Emissions (EPA, 2020)¹⁰

Projections	Year	ETS Sector Only (Mt CO ₂ eq.)	Total (Mt CO ₂ eq)
Projections (with existing measures) ¹¹	2020	17.01	63.15
	2025	16.27	62.25
Projections (with additional measures) ¹²	2020	17.23	62.64
	2025	13.78	54.54

Ireland is projected to meet non-ETS EU targets over the period 2021 to 2030. This assumes full implementation of the 2019 Climate Action Plan and the use of flexibilities in relation to land use, land use change and forestry. However, Ireland's non-ETS emissions are projected to be only 2-4% below 2005 levels in 2020, compared to the EU target of 20%¹.

19.4 Likely Significant Effects

19.4.1 'Do-Nothing' Scenario

In the scenario where the proposed development did not proceed as planned, none of the construction or operational effects as set out in this chapter would occur.

As outlined in **Chapter 1, Introduction** and **Chapter 2, Background and Need for the Scheme**, the need for flood risk management measures in Arklow town has been well documented in national, regional and local policy as well as legal cases. Without intervention, Arklow faces the continued onset of a range of issues associated with flooding including; tangible and intangible flood damages, financial loss, extensive community disruption, health and safety issues and development restrictions.

For these reasons, the 'do-nothing' scenario is considered to have a significant negative effect with regards to flooding.

¹¹ The *With Existing Measures* scenario assumes that no additional policies and measures, beyond those already in place by the end of 2018 (latest national greenhouse gas emission inventory), are implemented. (EPA, 2020)

¹² The *With Additional Measures* scenario assumes implementation of the *With Existing Measures* scenario in addition to, based on current progress, further implementation of Government renewable and energy efficiency policies and measures including those set out in the National Renewable Energy Action Plan (NREAP) and the National Energy Efficiency Action Plan (NEEAP) and more recently Ireland's National Development Plan 2018 - 2027 (EPA, 2020).

19.4.2 Construction

19.4.2.1 Direct Effects

The estimated carbon footprint of the proposed development during the construction phase is predicted to be 8,404 tonnes of CO₂eq, as outlined in **Table 19.2**.

The following miscellaneous items are not included in the carbon calculations as no quantities have been assigned; electrical control kiosks/panels and steel covers, signage, flood barriers, public lighting, non-return valves and hand railings. For materials that have a significant transport element associated with them a distance of 20km has been assigned. Steel piles have been assigned a transport distance of 50km.

Table 19.2: Estimated embodied carbon of the proposed development

Element	Embodied Carbon Contribution tonnes CO ₂ e /tonnes (transport distance)	Quantity – tonnes (steel reinforcement)	Comment / Assumptions	Tonnes CO ₂ e	Sources (Circular Ecology (CE) / UKEA)
Work Package 1					
Concrete (with steel reinforcement)	0.21 (20km)	3,672 (72 tonnes of reinforcement)	15% Portland cement, 15% water 70% aggregate	786.2	CE
Circular hollow steel piles	2.73 (50km)	76	Steel piles – cold rolled	207.5	CE
Mortar	0.16	4	Assumed 1:4	0.6	CE
Grout	0.93	1,021	Cement grout	949.5	CE
Rip rap rock boulders	0.08 (20km)	2,025	General stone	162.0	UKEA
Medium size construction site, 751 kgCO ₂ e per week, 96-week duration				72.0	UKEA
Work Package 2					
Rip rap rock boulders	0.08 (20km)	2,963	General stone	237.0	UKEA
Small size construction site, 313 kgCO ₂ e per week, 36-week duration				27.0	UKEA
Work Package 3					
Concrete (with steel reinforcement)	0.245	457 (18)	15% Portland cement, 15%	116.4	CE

Element	Embodied Carbon Contribution tonnes CO ₂ e /tonnes (transport distance)	Quantity – tonnes (steel reinforcement)	Comment / Assumptions	Tonnes CO ₂ e	Sources (Circular Ecology (CE) / UKEA)
	(20km)		water 70% aggregate		
Precast concrete piles	0.249 (20km)	86	Precast concrete beams and columns with world average steel reinforcement	21.4	CE
Rip rap rock boulders	0.08 (20km)	65	General stone	5.2	UKEA
Medium size construction site, 751 kgCO ₂ e per week, 28-week duration				21	UKEA
Work Package 4					
Concrete (with steel reinforcement)	0.246 (20km)	3,410 (136)	15% Portland cement, 15% water 70% aggregate	872.3	CE
Steel sheet piles	2.73 (50km)	770	Steel piles – cold rolled	2,102	CE
Precast concrete panels	0.09 (20km)	323	High density concrete block	29.1	CE
Concrete pipework	0.146 (20km)	288	Precast concrete pipe	42.0	CE
Tarmacadam	0.05 (20km)	1,725	Asphalt, 5% binder content	86.3	CE
Rip rap rock boulders	0.081 (20km)	143	General stone	11.6	UKEA
Granular material	0.007 (20km)	2,940	Quarried aggregate	20.6	UKEA
Paving stones	0.481 (20km)	542	Clay tile	260.7	UKEA
Medium size construction site, 751 kgCO ₂ e per week, 72-week duration				54.0	UKEA
Work Package 5					
Steel sheet piles	2.73 (50km)	91	Steel piles – cold rolled	248.4	CE

Element	Embodied Carbon Contribution tonnes CO ₂ e /tonnes (transport distance)	Quantity – tonnes (steel reinforcement)	Comment / Assumptions	Tonnes CO ₂ e	Sources (Circular Ecology (CE) / UKEA)
Concrete (with steel reinforcement)	0.243 (20km)	156 (6)	15% Portland cement, 15% water 70% aggregate	39.3	CE
Concrete pipework	0.146 (20km)	37	Precast concrete pipe	5.4	CE
Plastic sheet piles	3.23 (20km)	68	PVC pipe	219.6	UKEA
Rip rap rock boulders	0.08 (20km)	30	General stone	2.4	UKEA
Granular material	0.007 (20km)	412	Quarried aggregate	2.9	UKEA
Clay	0.026 (20km)	26,487	General rammed soil	692.2	UKEA
Medium size construction site, 751 kgCO ₂ e per week, 32-week duration				24.0	UKEA
Soil balance for entire scheme					
Soil reuse	n/a	8,125	Approx. 13,000m ³ for embankment construction at bulk density of 1.6	-	UKEA
Soil landfill	0.022 (20km)	49,333	Approx. 74,000m ³ to be taken offsite at average bulk density of 1.5	1,085	UKEA
Total (Tonnes CO₂e)				8,404	

The total tonnes CO₂e has been assigned across the four years of the main construction phases of the proposed development (2023-2026), as presented in **Table 19.3**. The highest annual value (Y4) is then brought forward for assessment in **Table 19.4**.

Table 19.3: Estimated tonnes of CO₂e per construction year

Year	Total (Tonnes CO ₂ e)
2023	1,161
2024	997
2025	4,477

Year	Total (Tonnes CO ₂ e)
2026	1,769

Table 19.4: Estimated carbon emissions during the construction phase

Highest annual estimated CO ₂ eq during construction phase (Mtonnes)	Projected ETS Sector CO ₂ eq emissions in 2025 with additional measures (Mtonnes)	As a percentage of 2025 ETS Sector CO ₂ eq emissions with additional measures	Projected Total CO ₂ eq emissions in 2025 with additional measures (Mtonnes)	As a percentage of 2025 Total CO ₂ eq emissions with additional measures
0.0047	13.78	0.03%	54.54	0.009%

As a percentage of the projected 2025 ETS Sector CO₂eq emissions (with additional measures) the estimated increase due to embodied carbon from the proposed development is 0.03% of the 2025 ETS projection.

As ETS carbon allowances for energy intensive industries are regulated by the EPA under the GHG permitting regime, the CO₂ eq. calculated, and shown in **Table 8.3** is assumed to be included in ETS allowances for industry. ETS allowances are reduced annually, forcing industry to reduce emissions. On this basis and due to the relatively low embodied carbon estimated to be generated, the effects to on carbon emissions are considered slight, negative, long-term.

As improvements in sustainability and recycling measures are progressed throughout the construction industry it is expected that the embodied carbon calculated as part of this assessment can be taken as a worst case, as with time this figure will reduce.

The proposed development will also improve the following aspects; tangible and intangible flood damages, financial loss, extensive community disruption, health and safety issues and development restrictions.

19.5 Mitigation Measures and Monitoring

19.5.1 Mitigation

As no significant adverse effects are predicted to occur during the construction or operation of the proposed development, no mitigation measures are required.

19.6 Cumulative Effects

This section includes an assessment of the potential for likely significant direct and indirect cumulative effects of projects listed in **Table 20.1** in **Chapter 20** ‘*Cumulative and Interactive Effects*’ in combination with the proposed scheme and taken together in combination with the proposed scheme.

In relation to climate, the projects listed in **Table 19.1** have been assessed individually for their climate impact. Cumulatively, none of the projects have a direct or indirect impact on the proposed development.

19.6.1 Monitoring

As no significant adverse effects are predicted to occur during the construction or operation of the proposed development, no monitoring is required.

19.7 Residual Effects

In relation to climate, over the lifespan of the proposed development, no significant effects are predicted.

19.8 References

Circular Ecology, 2019. Carbon Tool. Embodied Energy and Carbon Footprint Database.

Climate Action and Low Carbon Development (Amendment) Bill 2021.

Climate Action Plan, Government of Ireland 2019

EC Directive 2013. 2030 Climate & Energy Framework

EC Directive 2012. Greenhouse Gas Emissions Trading Regulations

EC 2015. Paris Agreement.

https://ec.europa.eu/clima/policies/international/negotiations/paris_en

Environment Agency Carbon Calculator, 2007.

EPA, 2020 Ireland's Greenhouse Gas Emissions Projections 2019-2040.

Available at https://www.epa.ie/pubs/reports/air/airemissions/ghgprojections2019-2040/2020-EPA-Greenhouse-Gas-Emissions-Projections_final.pdf

National Renewable Energy Action Plan (NREAP) and the National Energy Efficiency Action Plan (NEEAP) and more recently Ireland's National Development Plan 2018-2027 (EPA, 2019).

Wicklow County Council, 2019. Change Adaptation Strategy

<https://www.wicklow.ie/Portals/0/Documents/Climate%20Action/Adaptation%20Strategy/Climate%20Adaptation%20Strategy.pdf>