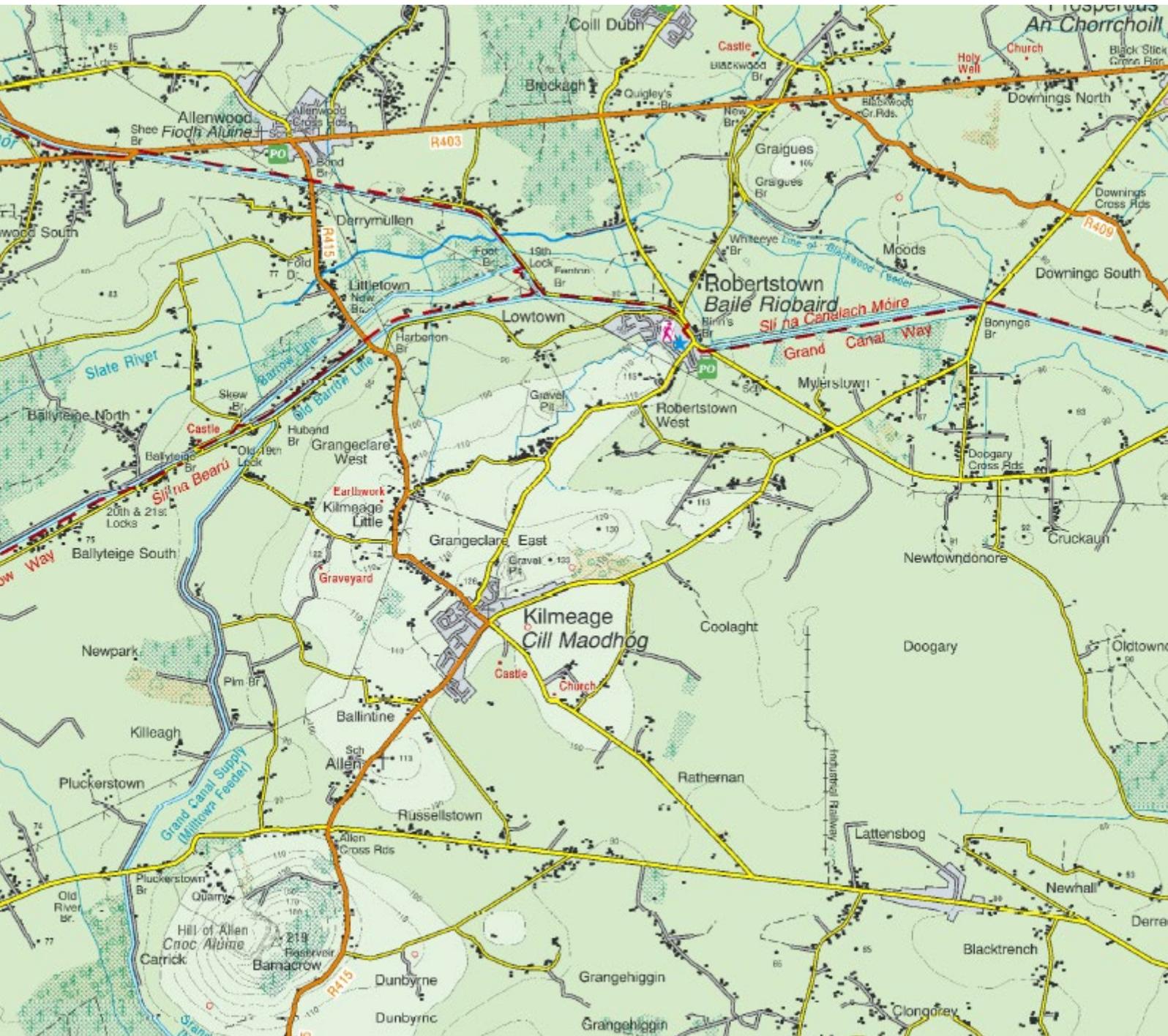


CHAPTER 9

CLIMATE

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CHAPTER 9: CLIMATE

Introduction

9.1 This chapter provides an assessment of the impacts of climate change on the proposed development and an assessment of potential changes in greenhouse gas emissions resulting from the proposed sand & gravel pit and soil recovery facility at Coolaght, Kilmeague, Co. Kildare.

Scope of Work

9.3 The following sections of this Chapter describe the potential climate change impacts associated with the proposed development. The following issues are addressed separately:

- climate change legislative framework/policy context;
- analysis of evolving environmental baseline trends;
- identifying climate change concerns in relation to proposed development;
- assessing effects (cumulative effects and uncertainty);
- identifying alternatives and mitigation measures;
- identifying monitoring and adaptive management.

Contributors

9.4 The Climate assessment presented in this Chapter was prepared by Quarry Consulting. This chapter was prepared by Rory Brickenden (B.A. Geoscience) and Peter Kinghan (B.Sc. Mineral Surveying; PG Dipl. Environmental Engineering).

Climate Change and Greenhouse Gases

9.5 Although variation in climate is thought to be a natural process, the rate at which the climate is changing has been accelerated rapidly by human activities. Climate change is one of the most challenging global issues facing us today and is primarily the result of increased levels of greenhouse gases in the atmosphere. These greenhouse gases come primarily from the combustion of fossil fuels in energy use. Changing climate patterns are thought to increase the frequency of extreme weather conditions such as storms, floods and droughts. In addition, warmer weather trends can place pressure on animals and plants that cannot adapt to a rapidly changing environment. Moving away from our reliance on coal, oil and other fossil fuel-driven power plants is essential to reduce emissions of greenhouse gases and combat climate change.

Greenhouse Gas Emission Targets

9.6 Ireland is a Party to the Kyoto Protocol, which is an international agreement that sets limitations and reduction targets for greenhouse gases for developed countries. It is a protocol to the United Nations Framework for the Convention on Climate Change. The Kyoto Protocol came into effect in 2005, as a result of which, emission reduction targets agreed by developed countries, including Ireland, are now binding.

9.7 Under the Kyoto Protocol, the EU agreed to achieve a significant reduction in total greenhouse gas emissions in the period 2008 to 2012. These EU emission targets are legally binding on Ireland. Ireland's contribution to the EU commitment for the period 2008 – 2012 was to limit its greenhouse gas emissions to no more than 13% above 1990 levels.

Doha Amendment to the Kyoto Protocol

9.8 In Doha, Qatar, on 8th December 2012, the "Doha Amendment to the Kyoto Protocol" was adopted. The amendment includes:

- New commitments for Annex I Parties to the Kyoto Protocol who agreed to take on commitments in a second commitment period from 1 January 2013 to 31 December 2020;
- A revised list of greenhouse gases (GHG) to be reported on by Parties in the second commitment period; and
- Amendments to several articles of the Kyoto Protocol which specifically referenced issues pertaining to the first commitment period and which needed to be updated for the second commitment period.

9.9 During the first commitment period, 37 industrialised countries and the European Community committed to reduce GHG emissions to an average of 5% below 1990 levels. During the second commitment period, Parties committed to reduce GHG emissions by at least 18% below 1990 levels in the eight-year period from 2013 to 2020. The composition of Parties in the second commitment period is different from the first; however, Ireland and the EU signed up to both the first and second commitment periods.

9.10 Under the protocol, countries must meet their targets primarily through national measures, although market-based mechanisms (such as international emissions trading) can also be utilised.

COP21 Paris Agreement

9.11 COP21 was the 21st session of the Conference of the Parties (COP) to the United Nations Convention. Every year since 1995, the COP has gathered the 196 Parties (195 countries and the European Union) that have ratified the Convention in a different country, to evaluate its implementation and negotiate new commitments. COP21 was organised by the United Nations in Paris and held from 30th November to 12th December 2015.

9.12 COP21 closed on 12th December 2015 with the adoption of the first international climate agreement (concluded by 195 countries and applicable to all). The twelve-page text, made up of a preamble and 29 articles, provides for a limitation of the temperature rise to below 2°C above pre-industrial levels and even to tend towards 1.5°C. It is flexible and takes into account the needs and capacities of each country. It is balanced as regards adaptation and mitigation, and durable, with a periodical ratcheting-up of ambitions.

COP25 Climate Change Conference

9.13 The 25th United Nations Climate Change conference COP25 was held in Madrid and ran from December 2nd to December 13th, 2019. While largely regarded as an unsuccessful conference, the European Union launched its most ambitious plan, 'The European Green New Deal' which aims to lower CO₂ emissions to zero by 2050. The deal includes proposals to reduce emissions from the transport, agriculture and energy sectors and will affect the technology chemicals, textiles, cement and steel industries. Measures such as fines and pay-outs by member states who rely on coal power will be in place to encourage the switch to renewable clean energies

such as wind. On the 4th of March 2020, the European Commission put forward the proposal for a European climate law. This aims to establish the framework for achieving EU climate neutrality. It aims to provide a direction by setting a pathway to climate neutrality and to this end, aims to set in legislation the EU's 2050 climate-neutrality objective.

COP26 Climate Change Conference Glasgow

9.14 COP21 COP26 took place in Glasgow, Scotland between the 31st October and 12th November 2021. The summit was centred around the fact that "climate change is the greatest risk facing us all." The UK, as hosts for the summit, have developed a ten point plan to deliver a green industrial revolution, seeking to lead the world in tackling and adapting to climate change.

9.15 The key items COP26 seeks to achieve are:

- Secure global net zero by mid-century and keep 1.5 degrees within reach
- Adapt to protect communities and natural habitats
- Mobilise finance
- Work together to deliver

9.16 All world leaders at the summit confirmed the need to urgently address the gaps in ambition and work together to achieve climate action.

9.17 The summit highlighted that the Paris Agreement is working, with leaders outlining national targets and efforts to further reduce emissions. There was a clear commitment to working together to achieve climate aims, with significant announcements including:

- "Over 40 leaders joined the Breakthrough Agenda, a 10-year plan to work together to create green jobs and growth globally, making clean technologies and solutions the most affordable, accessible and attractive option before 2030 – beginning with power, road transport, steel, hydrogen and agriculture.
- Over 120 countries covering more than 90% of the world's forests endorsed the Glasgow Leaders' Declaration on Forests & Land Use committing to work collectively to halt and reverse forest loss and land degradation by 2030, backed by the biggest ever commitment of public funds for forest conservation and a global roadmap to make 75% of forest commodity supply chains sustainable.
- A Just Energy Transition Partnership was announced to support South Africa's decarbonisation efforts; a powerful example of collaboration between an emerging economy and international partners.
- The launch of the Global Methane Pledge saw over 100 countries committing collectively to reduce global methane emissions by 30% by 2030."

European Green Deal - European Climate Law (2021)

9.18 The European Green Deal, initially introduced by the European Commission in December 2019, sets out the 'blueprint' for a transformational change of the 27-country bloc from a high- to a low-carbon economy, without reducing prosperity and while improving people's quality of life, through cleaner air and water, better health and a thriving natural world. The Green Deal is intended to work through a framework of regulation and legislation setting clear overarching targets, e.g. a bloc-wide goal of net zero carbon emissions by 2050 and a 55% cut in emissions by 2030 (compared with 1990 levels). This is a substantial increase compared to the existing target, upwards from the previous target of at least 40% (2030 Climate & Energy Framework),

and furthermore, these targets demonstrate the ambition necessary to keep the global temperature increase to well below 2°C and pursue efforts to keep it to 1.5°C as per the Paris Agreement. With regard to the energy sector, the Green Deal focuses on 3 no. key principles for the clean energy transition, which will help reduce greenhouse gas emissions and enhance the quality of life for citizens:

- Ensuring a secure and affordable EU energy supply;
- Developing a fully integrated, interconnected and digitalised EU energy market; and
- Prioritising energy efficiency, improving the energy performance of our buildings and developing a power sector based largely on renewable sources (e.g. the subject development).

9.19 The European Climate Law 2021 writes into law the objectives set out above in the European Green Deal for Europe's economy and society to become climate-neutral by 2050. Climate neutrality by 2050 means achieving net zero greenhouse gas emissions for EU countries as a whole, mainly by cutting emissions, investing in green technologies and protecting the natural environment. The Climate Law includes:

- A legal objective for the Union to reach climate neutrality by 2050;
- An ambitious 2030 climate target of at least 55% reduction of net emissions of greenhouse gases as compared to 1990, with clarity on the contribution of emission reductions and removals;
- A process for setting a 2040 climate target, taking into account an indicative greenhouse gas budget for 2030-2050 to be published by the Commission;
- A commitment to negative emissions after 2050;
- The establishment of European Scientific Advisory Board on Climate Change, that will provide independent scientific advice;
- Stronger provisions on adaptation to climate change; and
- Strong coherence across Union policies with the climate neutrality objective

9.20 The law aims to ensure that all EU policies contribute to this goal and that all sectors of the economy and society play their part. All 27 no. EU Member States have committed to turning the EU into the first climate neutral continent by 2050. One third of the 1.8 trillion-euro investments from the NextGenerationEU Recovery Plan, and the EU's seven-year budget, will finance the European Green Deal. On 14th July 2021, the European Commission adopted a set of proposals to make the EU's climate, energy, transport and taxation policies fit for reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels. Achieving these emission reductions in the next decade which is crucial to Europe becoming the world's first climate-neutral continent by 2050 would clearly be assisted by the Proposed Development.

Intergovernmental Panel on Climate Change

9.21 The Intergovernmental Panel on Climate Change released their Sixth Assessment Report Climate Change 2021: The Physical Science Basis in August 2021 which categorically states the rise in global temperatures and increase in frequency and severity of natural disasters experienced across the world is related to human activity. It indicates that climate change has and will negatively impact all aspects of human life and unless immediate action is taken. It states that the aim to curtail global temperature rise to 1.5 degrees is now not possible

however, maintaining just a 2-degree rise may be possible, only with immediate and large-scale action is taken to reduce greenhouse gas emissions. The report is hopeful that if global emissions can be cut in half by 2030 and that if net zero emissions can be achieved by 2050 the rise in temperatures can be halted and possibly reversed. This report is a stark warning that decarbonisation must be increased additional efforts made to reduce carbon emissions across all sectors.

- 9.22 Greenhouse gas (GHG) emissions resulting from the provision of energy services have contributed significantly to the historic increase in atmospheric GHG concentrations with most of the observed increase in global average temperature since the mid-20th century is very likely due to the observed increase in anthropogenic GHG emissions with the consumption of fossil fuels accounts for the majority of global anthropogenic GHG emissions. There are multiple options for lowering GHG emissions from the energy system while still satisfying the global demand for energy services. Wind energy has significant potential to reduce GHG emissions. Moreover, attempts to measure the relative impacts of various electricity supply technologies suggest that wind energy generally has a comparatively small environmental footprint.

Climate Change Performance Index

- 9.23 Established in 2005, the Climate Change Performance Index (CCPI) is an independent monitoring tool which tracks countries climate protection performance. It assesses individual countries based on: climate policies, energy usage per capita, renewable energy implementation and Greenhouse Gas Emissions (GHG) and ranks their performance in each category and overall.
- 9.24 Ireland, ranked 47th in 2022, has climbed 9 places to 37th in 2023, and remains as a “low” performer in international performance. However, it remains at “very low” at a national performance level. The CCPI report states:
- *‘Ireland is committed to reducing emissions by 51% by 2030 (compared to 2018 levels) and achieving net-zero emissions by no later than 2050. Despite these goals, Ireland’s emissions are rising and have rebounded to pre-pandemic levels.*
 - *The CCPI experts note that significant progress in climate policy in 2022, with the introduction of legally binding carbon budgets and sectoral emissions ceilings. However, government implementation remains weak with necessary actions and measures delayed or ignored in many areas.*
 - *The experts welcome the five-year carbon budgets and sectoral emissions ceilings approved in 2022. However, they stress these improvements urgently need to be translated into substantive actions across all relevant sectors to actually reduce Ireland’s emissions.’*

National Legislation and Policy

Climate Action Plan 2023

- 9.25 The Climate Action Plan (CAP 2023) was published on the 21st of December 2022 by the Department of Communications, Climate Action and Environment and featured 183 action plans which set out how Ireland would meet its EU targets to reduce its carbon emissions by 30% between 2021 and 2030 and laid the foundations for achieving net zero carbon emissions by 2050.

9.26 The plan implements the carbon budgets and sectoral emissions ceilings and sets out a roadmap for taking decisive action to halve our emissions by 2030 and reach net zero no later than 2050, as committed to in the Programme for Government. Climate Action Plan 2023 sets out how Ireland can accelerate the actions that are required to respond to the climate crisis, putting climate solutions at the centre of Ireland's social and economic development.

Climate Action and Low Carbon Development (Amendment) Act, 2021

9.27 The Climate Action and Low Carbon Development (Amendment) Act 2021, which was signed into law on the 23rd July 2021, legally binds Ireland to achieve Net-Zero emissions no later than 2050, and to a 51% reduction in emissions by 2030. The Act provides the framework for Ireland to meet its international and EU climate commitments and to become a leader in addressing climate change. As indicated by the premise of the legislation, the reduction of emissions is a key proponent of the Climate Action and Low Carbon Development (Amendment) Bill 2021 and incorporates the following key provisions:

- Embeds the process of setting binding and ambitious emissions-reductions targets in law;
- Provides for a national climate objective, which commits to pursue and achieve no later than 2050, the transition to a climate resilient, biodiversity-rich, environmentally-sustainable and climate-neutral economy;
- Provides that the first two five-year carbon budgets proposed by the Climate Change Advisory Council should equate to a total reduction of 51% over the period to 2030, relative to a baseline of 2018;
- The role of the Climate Change Advisory Council has been strengthened;
- The government must adopt carbon budgets that are consistent with the Paris agreement and other international obligations;
- Actions for each sector will be detailed in the Climate Action Plan which must be updated annually; and
- Local Authorities must prepare individual Climate Action Plans which will include both mitigation and adaptation measures and will be updated every five years.

9.28 The Proposed Development is therefore considered compliant with the relevant planning policies and objectives set out at both the European (e.g. European Green Deal) and National tiers of governance.

Ireland's Greenhouse Gas Emissions Projections 2023

9.29 The EPA published a document called Ireland Greenhouse Gas Emissions Projections in June 2023.

9.30 The EPA has produced two scenarios in preparing these greenhouse gas emissions projections: a "With Existing Measures" (WEM) scenario and a "With Additional Measures" (WAM) scenario. These scenarios forecast Ireland's greenhouse gas emissions in different ways. The WEM scenario assumes that no additional policies and measures, beyond those already in place by the end of 2021 (latest national greenhouse gas emission inventory), are implemented. The WAM scenario assumes that in addition to the existing measures, there is also full implementation of planned government policies and measures to reduce emissions such as those in the 2023 Climate Action Plan.

- 9.31 Greenhouse gas emissions projections show total emissions decreasing from the latest Inventory (2021) levels by 15% by 2030 under the With Existing Measures (WEM) scenario and by 32% under the more ambitious With Additional Measures (WAM) scenario.

United Nations Sustainable Development Summit 2019

- 9.32 Transforming our World: the 2030 Agenda for Sustainable Development which includes 17 Sustainable Development Goals (SDGs) and 169 targets was adopted by all UN Member States at a UN summit held in New York in 2015. The agenda is universally applicable with all countries having a shared responsibility to achieve the goals and targets which came into effect on January 1st, 2016. The goals and targets are to be actions over the 15-year period, are integrated and indivisible i.e., all must be implemented together by each Member State. On 24 and 25 September 2019, Heads of State and Government gathered at the United Nations Headquarters in New York to follow up and comprehensively review progress in the implementation of the 2030 Agenda for Sustainable Development and the 17 Sustainable Development Goals (SDGs). The event was the first UN summit on the SDGs since the adoption of the 2030 Agenda in September 2015.

Programme for Government: Our Shared Future

- 9.33 The Department of the Taoiseach published the Programme for Government on the 29th of October 2021. The programme states the importance addressing the changing climates:

'The next ten years are critical if we are to address the climate and biodiversity crisis which threatens our safe future on this planet.'

- 9.34 The programme states in relation to natural resources:

'We will harness the natural resources to meet our needs in this country, without compromising the ability of future generations to meet theirs.'

And

'We will work in partnership with industry, retailers, and consumers to promote a more sustainable and responsible system and culture for consumption, use and re-use of materials and end of use recycling and disposals. We will also work with the EU implementing the agreed Circular Economy approach.'

Catchment Flood Risk Assessment and Management (CFRAM) Programme

- 9.35 The current Catchment Flood Risk Assessment and Management (CFRAM) Programme (see www.cfram.ie) is the mechanism established to facilitate future adaptation to climate change. It provides for long-term flood risk management in Ireland and the embedment of flood risk assessment in the future development of capital projects. The future scenario flood maps produced under the CFRAM Programme will facilitate this approach, inform other industrial sectors, and provide a valuable resource for local adaptation planning and sustainable land use management and planning.

EIA Directive 2014/52/EU on the Assessment of the Effects of Certain Public and Private Projects on the Environment

- 9.36 Directive 2014/52/EU of the European parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment had to be transposed into national law by 16 May 2017, necessitating changes in laws, regulations, and administrative provisions across a number of legislative codes.

9.37 Key changes introduced in the 2014 Directive (in Annex IV - Information referred to in Article 5(1) - Information for the Environmental Impact Assessment Report) and the national transposing regulations (the European Union (Planning and Development)(Environmental Impact Assessment) Regulations, S.I. No. 296 of 2018) include a requirement for information on the impact of a project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change to be provided in the Environmental Impact Assessment Report.

Guidelines

Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment {EC, 2012}

9.38 EU Guidelines provide recommendations how to integrate climate change and biodiversity in Environmental Impact Assessment (EIA). The need for action on climate change and biodiversity loss is recognised across Europe and around the world. The guidelines contain explanation as to why climate change and biodiversity are so important in EIA, present the relevant EU-level policy background, provide advice on how to integrate climate change and biodiversity into selected stages of the EIA process. The annexes provide sources of further reading and links to other relevant information, data, and tools.

Assessing Greenhouse Gas Emissions and Evaluating their Significance {IEMA, 2017}

9.39 IEMA Guidance provides information to assist practitioners with addressing greenhouse gas (GHG) emissions assessment and mitigation in statutory and non-statutory Environmental Impact Assessment (EIA). It complements IEMA's earlier guide on Climate Change Resilience and Adaptation and builds on the Climate Change Mitigation and EIA overarching principles. The requirement to consider this topic has resulted from the 2014 amendment to the EIA Directive.

Local Authority Adaptation Strategy Development Guidelines

9.40 IEMA Guidance was produced to provide a consistent and coherent process for local authorities in helping them develop local adaptation strategies and contain information on the process of developing an adaptation strategy:

- provide background information on what adaptation entails and provides the rationale behind implementing a local scale adaptation strategy.
- outline the initial steps required in launching a strategy development process, describing key roles and who can fulfil them, and setting out important factors to consider in the early stages of strategy development.
- explains how to assess the role that weather extremes and periods of climate variability currently play within the local jurisdiction, and it describes why doing so is a fundamental element of working towards a more climate-resilient future.
- moves from the present to the identification of future climate risks, describing a staged risk assessment process and positioning the adaptation strategy within more detailed risk assessments undertaken during shorter term decision-making processes such as statutory plan-making.

- on the basis of the risk assessment process undertaken determination of adaptation goals and objectives and the types of adaptation actions that are available and outlines how each might be identified, assessed, prioritised and implemented is described.
- outlines the steps required to move from a phase of planning to one of implementation, and it explains the importance of monitoring and evaluation in ensuring that the strategy is achieving its anticipated adaptation objectives.

Kildare County Council Climate Adaptation Strategy

9.41 Under the National Adaption Frameworks (NAF) the Environment Directorate of Kildare County Council developed the Climate Adaptation Strategy for Kildare County

9.42 The Climate Change Adaptation Strategy takes on the role as the primary instrument at local level to:

- Ensure the proper comprehension of the key risks and vulnerabilities of climate change;
- Bring forward the implementation of climate resilient actions in a planned and proactive manner; and
- Ensure that climate adaptation considerations are mainstreamed into all plans and policies and integrated into all operations and function of Kildare County Council.

Existing Environment

Regional Context

Current Climate and Weather

9.43 Ireland has a temperate maritime climate characterized by mild temperatures, high levels of precipitation, and relatively consistent weather patterns influenced by the North Atlantic Drift, an extension of the Gulf Stream. The climate is typified by its variability, with frequent changes in weather due to the influence of various atmospheric systems and the surrounding oceanic conditions. Winters are generally mild, and summers are cool, with average temperatures ranging from around 4°C in winter to 15°C in summer.

Climate Change and Future Weather Changes

9.44 Climate change is expected to bring significant changes to Ireland's climate and weather patterns. The increase in greenhouse gas concentrations, primarily carbon dioxide (CO₂) and methane (CH₄), is contributing to global warming and altering the Earth's climate systems.

9.45 Ireland's temperate maritime climate is expected to undergo significant changes in the coming decades due to climate change and increased greenhouse gas concentrations. Rising temperatures, altered precipitation patterns, sea level rise, and increased storm intensity are some of the key challenges that Ireland will likely face. As a result, it is crucial for the country to continue its efforts to both mitigate and adapt to these changes in order to minimize the negative impacts on its environment, economy, and society.

9.46 In Table 9.1 summarises climate impact projections for Ireland, estimates of projections confidence are derived from published projection data from the National Adaptation Framework 2018.

Table 9.1: Summary of observed and projected climate changes and impacts for Ireland

Parameter	Observed	Projected	Example of Biophysical Impacts
Temperature	<p>Average temperatures have increased by 0.8°C since 1900, an average of 0.07°C per decade.</p> <p>The number of warm days (over 20°C) has increased while the number of cold days (below 0°C) has decreased.</p>	<p>Projections indicate an increase in average temperatures across all seasons (0.9-1.7°C).</p> <p>The number of warm days is expected to increase and heat waves are expected to occur more frequent.</p>	<p>Incidences of cold stress are likely to decrease while incidences of heat stress will increase.</p> <p>The duration of the growing season will increase, occurring earlier and extending farther.</p>
Precipitation	<p>Increase in average annual national rainfall of approximately 60mm or 5% in the period 1981-2010, compared to the 30-year period 1961-1990.</p> <p>The largest increases are observed over the west of the country.</p>	<p>Significant reductions are expected in average levels of annual, spring and summer rainfall.</p> <p>Projections indicate a substantial increase in the frequency of heavy precipitation events in Winter and Autumn (approx. 20%)</p>	<p>The increased occurrence of dry spells will result in increased pressure on water supply.</p> <p>An increase in the frequency of extreme precipitation events will result in increased fluvial and pluvial flood risk.</p>
Wind Speeds and Storms	<p>No long-term change in average wind speed or direction can be determined with confidence.</p> <p>The number and intensity of storms in the North Atlantic has increased by approx. three storms per decade since 1950.</p>	<p>Projections indicate an overall decrease in wind speed and an increase in extreme wind speeds, particularly during winter.</p> <p>The number of very intense storms is projected to increase over the North Atlantic region.</p> <p>Projections suggest that the winter track of these storms may extend further south and over Ireland more often.</p>	<p>Increases in extreme wind speeds may impact on wind turbines and the continuity of power supply.</p> <p>Infrastructure will be at risk due to the increased occurrence of intense storms (e.g. winter 2013/2014).</p>

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<p>Sea Level and Sea Surface Temperature</p>	<p>Historically, sea level has not been measured with the necessary accuracy to determine sea level changes around Ireland. However, measurements from Newlyn, in southwest England, show a sea level rise of 1.7cm per decade since 1916. These measurements are considered to be representative of the situation to the South of Ireland.</p> <p>Sea surface temperatures have increased by 0.85°C since 1950, with 2007 the warmest year in Irish coastal records.</p>	<p>Sea levels will continue to rise for all coastal areas, by up to 0.8 m by 2100. The south of Ireland will likely feel the impacts of these rises first.</p> <p>Sea surface temperatures are projected to continue warming for the coming decade. For the Irish Sea, projections indicate a warming of 1.9°C by the end of the</p>	<p>Significant increase in areas at risk of coastal inundation and erosion.</p> <p>Increased risk to coastal aquifers and water supply.</p> <p>Change in distribution fish species.</p> <p>Implications for fisheries and aquaculture industries.</p>
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Local Context

- 9.47 The Lullymore Nature Centre weather station is located approx. 8.42 km west of the proposed development and is considered representative of conditions experienced at the application site.
- 9.48 The moderating influence of the Atlantic Ocean is felt throughout Ireland. The annual mean temperature for different areas in Ireland varies between mountainous regions, lowlands and the coast. Mean daily maximum temperatures are typically between 13.7 to 16.01° C and mean daily minimum temperatures are typically between 5.55 to 7.58° C for the area surrounding Lullymore Nature Centre weather station, refer to table 9.2. There has been a steady increase in mean daily minimum temperature from 2012 to 2022. Trends are less apparent in the mean daily maximum temperature and mean daily rainfall.

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Table 9.2: Lullymore weather station temperature and precipitation averages from 2010 to 2022

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	
Temperature													
Mean Daily Maximum Temperature	XX	13.70	14.18	14.72	13.82	14.08	14.52	14.67	14.33	14.51	14.59	16.01	
Mean Daily Minimum Temperature	XX	6.17	5.90	6.35	5.55	5.87	6.56	6.03	6.29	6.40	6.40	7.58	
Rainfall													
Mean Daily Rainfall (mm)	2.30	2.67	2.24	2.53	2.81	2.37	2.40	2.05	2.70	2.75	2.31	2.50	

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9.49 During the period 2011-2022, the mean daily rainfall was between 2.05mm and 2.7mm at the Lullymore Nature Centre weather station (refer to table 9.2)

Impact Assessment Methodology

9.50 There are no specific tools developed for assessing climate change for the extraction industry.

9.51 The Institute of Environmental Management and Assessment (IEMA) published a document in 2020 called Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation. The climate change risk assessment outlined by IEMA in Appendix 1 of their report will be used to assess the how the proposed development vulnerabilities to climate change.

9.52 A detailed methodology of the climate change risk assessment is provided in Appendix A of this report.

9.53 Transport Infrastructure Ireland designed a carbon assessment tool in December 2022 that has been used to calculate the carbon emissions from the proposed development.

Assessment

Climate Change Risk Assessment

9.54 The aim of the climate change risk assessment is to determine the relevant weather events that have the potential to impact the proposed development. The results of the climate change risk assessment will be used to implement measures to improve the resilience of the proposed development to climate change. If necessary, climate change will be integrated into the design process of the project.

9.55 Table 9.3 show the results of the climate change risk assessment.

Table 9.3: Climate change risk assessment summary

Weather Event	Risk Category
Temperature Extremes	Low risk
Flooding	Low risk
High Wind Speeds	Low risk
Fire	Low risk
Landslide	Low risk
Lightning	Low risk

9.56 Table 9.3 shows that each of the weather events have a low risk of impacting the proposed development.

Carbon Footprint Assessment

9.57 The proposed development presents varied carbon emission values across different developmental phases, as evaluated using the Transport Infrastructure Ireland Carbon Tool. A detailed carbon footprint assessment report can be found in Appendix 9.1.

9.58 Table 9.4 shows a summary of the carbon emissions generated by the proposed development.

Table 9.3: Carbon footprint assessment summary table

Project Phase	Activity/Description	tCO ₂ e Emissions
Pre-construction (Removal of forest/vegetation)	Land use change and vegetation loss 12.1 ha of mixed forest	1,197.9
	Land use change and vegetation loss 0.84 ha of natural grassland	19.2
	Clearance activities for mixed forest over 12.1 ha	15.94
	Clearance activities for grassland over 0.84 ha	0.34
	Total Pre-Construction Phase	1,233.39
Construction (Soil Stripping)	Excavation of 93,000 m ³ topsoil	67.98
	Travel emissions of two workers	6.6
	Screening berms planted with mixed forest over a 20 year period	-4,443.12
	Landscape planting	-201.96
	Total Construction Phase	-4,570.5
Operational (Extraction of sand and gravel)	Annual energy use by office facilities (10,000 kWh p.a.)	3.01
	Carbon emissions from processing aggregate and reuse off site (250,000 tonnes p.a.)	627.3
	Transport emissions from moving aggregate off-site (HGVs travel 675,000km p.a.)	724.2
	Travel emissions of ten workers	33.24

	Total Emissions for Operational Phase (20 years)	27,755
Inert Waste Facility	Carbon emissions from processing 3,200,000 tonnes of soil and stone	3,989.5
	Transport emissions from importation of 3,200,000 tonnes of soil and stone	24,622.8
	Travel emissions of two workers (over 34 years)	224.4
	Total Emissions for Restoration Phase (34 years)	28,612.3
Proposed Planting	Native woodland planted and kept for 20 years (assumed - most likely perpetuity)	-20,592
	Retained berm and landscape planting area	-2,614.8
	Total Emissions for Planting (assumed 20 years)	-23,206.8
Total	Proposed Development	29,823.39

9.59 Based on the scale and extent of proposed activities, GHG emissions are assessed as not making a significant contribution to the global atmosphere. Although the project does not make a significant contribution to global greenhouse gas emissions it is important that all developments implement measures to reduce their emissions where possible.

Mitigation

Climate Change/Weather Events

9.60 The mitigation measures proposed are designed to increase the resilience of the proposed development to climate change and increased extreme weather events. The mitigation measures increase the projects capacity to absorb climate change related weather events.

9.61 Based on the climate change risk assessment mitigation measure to improve the resilience of the proposed development are provided in table 9.4.

Table 9.4: Mitigation Measures related to weather events

Weather Event	Risks and Likely Effects	Mitigation Measures
Flooding	Flooding from rising groundwater levels and extreme rainfall events could result in asset damage, with the potential for subsequent loss of containment of fuel or other substances stored and handled on Site. The frequency of these natural events could increase as a result of climate change.	No additional mitigation proposed.
High Wind Speeds	Potential accidents caused by severe winds could include impact damage from windblown debris.	The Proposed Development will be designed in accordance with the appropriate geotechnical design standards to withstand the forces generated by wind on the systems and structures.
Temperatures Extremes	Fluctuations in temperature might lead to a need for more frequent maintenance or upgrades of equipment to handle these extremes.	No additional mitigation proposed.
Lightning	<p>Direct or indirect lightning strikes have the potential to cause a major accident due to electrical energy which can result in fires and equipment damage.</p> <p>This can cause harm to people working at the Proposed Development, damage to the Site infrastructure and harm to the environment in the event of a major fire.</p> <p>Lightning could also present a source of ignition to flammable materials resulting in a major fire. which could harm people both onsite and offsite.</p>	Safety in design is the key mitigation and the proposed development will be constructed in accordance with all relevant safety codes, standards and Directives.

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Carbon Emissions

9.62 Below are some potential mitigation measures to be implemented to reduce the proposed developments carbon emissions:

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- Use of energy efficient machinery.
- Don't leave plant machinery idling for long periods.
- Replace old machinery and vehicles with newer, energy-efficient models.
- Install solar panels on-site to power operations.
- Use software or tracking tools to find the shortest and most efficient routes.
- Plant native trees and grasses in areas no longer used for extraction, which can act as carbon sinks.
- Implement systems to recycle waste materials.
- Engage with local communities, governments, and environmental bodies to stay updated on best practices and new technologies.
- Invest in carbon offset projects to compensate for the GHG emissions the quarry produces.

Conclusion

9.63 The proposed development is at low risk to increased weather events associated with climate change as detailed in the climate change risk assessment. The impacts of weather events on the proposed development after mitigation measures are implemented will be slight or negligible.

9.64 The carbon footprint assessment shows that the proposed development will not make a significant contribution to global carbon concentrations.

APPENDICES

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Appendix A - Climate Change Risk Assessment Methodology

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Introduction

- 9.1 The IEMA guidance document is used to carry out a climate change risk assessment. The methodology for how the climate change risk assessment is carried out is provided in appendix 1 of the guidance document.
- 9.2 The following steps are used to carry out the assessment:
- identifying potential climate change risks to a scheme or project;
 - assessing these risks (potentially prioritising to identify the most severe); and
 - formulating mitigation actions to reduce the impact of the identified risks.
- 9.3 The guidance note states:
- 'Definitions of likelihood and magnitude will vary from scheme to scheme and should be tailored to a specific project. It is not within the scope of this guidance to prescribe a single approach to the assessment of likelihood and magnitude of climate impacts.'*
- 9.4 Table 9.A1 shows the severity scores used in Canadian Risk Assessment methodology PIEVC. This severity scoring system will be used as part of the assessment on the proposed development.

Table 9.A2: Severity scores

Score	Severity
0	Negligible or Not Applicable
1	Very Low/Unlikely/Rare/Measurable Change
2	Low/Seldom/Marginal/Change in Serviceability
3	Occasional Loss of Some Capacity
4	Moderate Loss of Some Capacity
5	Likely Regular/Loss of Capacity and Loss of Some Function
6	Major/Likely/Critical Loss of Function
7	Extreme/Frequent/Continuous/Loss of Asset

- 9.5 Table 9.A2 shows the probability scores used in Canadian Risk Assessment methodology PIEVC. This probability scoring system will be used as part of the assessment on the proposed development.

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Table 9.A2: Probability scores

Score	Probability	
0	<0.1%	< 1 in 1,000
1	1%	1 in 100
2	5%	1 in 20
3	10%	1 in 10
4	20%	1 in 5
5	40%	1 in 2.5
6	70%	1 in 1.4
7	>99%	> 1 in 1.01

9.6

9.7 Table 9.A3 shows the risk rating matrix.

Table Risk matrix

	7	0	7	14	21	28	35	42	49
	6	0	6	12	18	24	30	36	42
	5	0	5	10	15	20	25	30	35
	4	0	4	8	12	16	20	24	28
	3	0	3	6	9	12	15	18	21
	2	0	2	4	6	8	10	12	14
	1	0	1	2	3	4	5	6	7
	0	0	0	0	0	0	0	0	0
	0	0	1	2	3	4	5	6	7

Severity

Probability

Low Risk

Medium Risk

High Risk

9.A2: rating

Assessment Results

9.8 Table 9.A4 shows the weather events that have potential to impact the proposed development. The assessment shows risk of different weather events impacting the proposed development.

Table 9.A2: Summary table of weather events assessment

Weather Event	Probability Score	Severity	Risk rating
Temperature Extremes	4	1	4
Flooding	3	3	9

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High Wind Speeds	3	2	6
Fire	1	5	5
Landslide	1	4	4
Lightning	2	3	6

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Appendix B - Carbon Footprint Assessment Report

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Report on Carbon Footprint Assessment of Proposed Sand and Gravel Pit Development in Kilmeage, County Kildare

Introduction

9.1 This report presents the findings of a carbon footprint assessment for the proposed development of a sand and gravel pit located in Kilmeage, County Kildare, Ireland. The carbon footprint is calculated using the Transport Infrastructure Ireland Carbon Tool, which is designed to comply with the revised Environmental Impact Assessment (EIA) Directive 2014/52/EU. The assessment covers the pre-construction, construction, operational, and decommissioning phases of the development to determine its environmental impact.

Pre-construction Phase

9.2 In the pre-construction phase, an area of mixed forest spanning 12.1 hectares and grassland spanning 0.84 ha will be removed, resulting in a carbon sink removal of 1,197.9 and 19.2 tCO₂e respectively. The clearance activities for the removal of both the mixed forest area and the grassland area is estimated to be 16.28 tCO₂e.

9.3 Figure 9.B1 shows the areas to be removed during the pre-construction phase.

Figure 9.B1: Areas to be removed during the pre-construction phase



Construction (Soil Stripping and landscape planting) Phase:

9.4 During the construction phase, the general excavation of topsoil, amounting to 93,000 cubic meters, will generate 67.98 tCO₂e of emissions. Additionally, the total distance travelled by workers during the soil stripping phase, which takes 300 days, will result in 6.6 tCO₂e emissions.

Assuming two workers are present on-site, each traveling 50 km a day, the cumulative emissions from their travel are 6.6 tCO₂e.

- 9.5 A screening berm will be planted with native trees which will cover an area of 1.32 Ha (mixed forest), this results in the carbon drawdown of 130.68 tCO₂e over 1 year. Given the lifespan of the proposed development is 34 years the amount of carbon sequestered during this period is 4443.12 tCO₂e.
- 9.6 There will be landscape planting adjacent to the access road which will result in carbon drawdown of 201.96 tCO₂e over the lifespan of the proposed development.
- 9.7 The total emissions generated during the soil stripping phase is estimated to be -4,570.5 tCO₂e.

Figure 9.B2: Construction Phase



Operational (Excavation of Sand and Gravel) Phase:

- 9.8 The operational phase involves the excavation of sand and gravel from the pit. Office facilities within the site will consume 10,000 kWh of energy annually, resulting in 3.01 tCO₂e emissions.
- 9.9 For the aggregate exported off-site, 627.3 tCO₂e is emitted during the processing phase. This assumes an annual extraction quantity of 250,000 tonnes and that the aggregate will be reused off-site. Additionally, the transport emissions associated with exporting the aggregate off-site via Heavy Goods Vehicles (HGVs) amount to 724.2 tCO₂e. The HGVs are estimated to travel a distance of 675,000 km annually. The emissions caused by employees travelling to the site is 33.24 tCO₂e, assuming there is 10 employees each travelling 50km each day.
- 9.10 Considering the above, the cumulative emissions for the entire operational phase, assuming it the extraction of material is 20 years, are estimated to be 27,755 tCO₂e.

Figure 9.B3: Operational Phase



Decommissioning Phase

9.11 The decommissioning phase involves the importation of 3.2 million tonnes of soil and stone using HGVs. The carbon emissions associated with waste processing during this phase amount to 3,989.5 tCO₂e. Additionally, the annual transport emissions associated with importing the material on-site via Heavy Goods Vehicles (HGVs) amount to 724.2 tCO₂e. Thus, the total emissions for the site restoration phase are 28,612.3 tCO₂e.

9.12 The emissions created by two workers during the restoration phase will result in 6.6 tCO₂e emissions p.a.

Planting

9.13 It is proposed that the site will be planted with native woodland. This will result in a carbon drawdown of 1,029.6 tCO₂e over one year assuming the woodland exists for 20 years the total carbon sequestered from the proposed woodland will be 20,592 tCO₂e.

9.14 The screening berms and landscape planting area will be retained resulting in the drawdown of 2,614.8 tCO₂e

Table 9.B4: Woodland Planting



Conclusion

9.15 The carbon footprint assessment of the proposed sand and gravel pit development in Kilmeague, County Kildare, shows the carbon emissions across each stage of the proposed development. The operational phase results in the highest carbon emissions.