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INTRODUCTION

Background

9.1 This Chapter of the Environmental Impact Assessment Report (EIAR), prepared by SLR Consulting Ireland, addresses the potential climate related impacts associated with the proposed inert landfill and C&D waste recovery facilities at Balinclare, Kilbride, Co. Wicklow.

9.2 The application site is located 6km south west of Wicklow Town. The village of Coolbeg is located approximately 1km to the north east of the application site and the M11 Dublin to Wexford Motorway is located just less than 0.5km to the east. The proposed development provides for the following:

- Backfilling of the existing void at Ballinclare Quarry to original ground level by developing and operating an inert waste landfill facility with a total intake capacity of approximately 6,165,000 tonnes of inert soil and stone waste and (non-waste) soil and stone by-product and its progressive restoration to long-term scrub / grassland habitat thereafter
- Continued use of established site infrastructure and services including, site office, staff welfare facilities, weighbridge (with dedicated office), wastewater treatment system, workshop, wheelwash, hardstand areas, fuel and water storage tanks to service the proposed development;
- Installation of a new weighbridge along the inbound lane of the quarry access road;
- Decommissioning of any remaining fixed plant and infrastructure associated with former rock processing and with aggregate, concrete and asphalt production activities at the application site;
- Decommissioning of any remaining fixed plant and infrastructure associated with former rock extraction activities or with aggregate, concrete and asphalt production activities at the application site;
- Off-site removal of any materials or bulky wastes associated with the former quarrying and production activities;
- Construction of an industrial shed (portal frame structure) at the paved blockyard area to house crushing and screening equipment and to process / recycle inert C&D waste (principally concrete, bricks, ceramics and solid bituminous waste mixtures);
- Use of any external paved area surrounding the C&D waste processing shed as a hardstanding area for the external handling and storage of both unprocessed and processed C&D wastes;
- Separation of any intermixed C&D wastes (principally metal, timber, PVC pipes and plastic) prior to its removal off-site to authorised waste disposal or recovery facilities;
- Installation and operation of a soil washing plant at the former concrete / asphalt production yard to recover sand and gravel and secondary aggregates from soil waste for subsequent use in the production of construction materials
- Construction of an on-site (passive) wetland treatment system and attendant drainage infrastructure to treat surface water run-off / groundwater collecting in the sump / floor of the quarry area during landfilling operations and any surface water run-off from the C&D waste recovery area prior to its discharge off-site;
- Re-use of an existing storage shed as a dedicated waste inspection and quarantine facility to inspect and store suspect waste consignments as required;

- Upgrading and ongoing maintenance of established internal haul roads across the application site;
- Temporary stockpiling of topsoil pending re-use as cover material for phased and/or final restoration of the inert landfill / backfilled quarry; and
- Environmental monitoring of noise, dust, surface water and groundwater for the duration of the landfilling and restoration works and C&D waste recovery activities, and for a short period thereafter.

9.3 It is envisaged that working hours will be in line with those in the existing planning permission (Ref. 14/2118) within the extractive sector, between 08:00 hours and 18:00 hours Monday to Friday, 08.00 hours and 14.00 hours on Saturday, and closed on Sundays and Public / Bank Holidays.

9.4 Further details on the proposed development (site infrastructure, operations, environmental management systems, and controls etc.) are provided in Chapter 2 of this EIAR.

Scope of Work

9.5 The following sections of this Chapter describe the potential climate change impacts associated with the proposed backfilling / soil waste recovery activities at the application site at Balinclare. The issues identified below 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.

Consultations / Consultees

9.6 A pre-planning consultation meeting was held between officials of Wicklow County Council and representatives of Kilsaran Concrete and SLR Consulting Ireland on 7th February 2019 at the offices of Wicklow County Council in Wicklow Town. Staff from the roads, water and environment services departments of Wicklow County Council were also in attendance.

9.7 Details of the proposed development were presented at the meeting and issues of potential concern to the Planning Authority were identified and discussed. Although no specific concerns were raised in respect of climate issues, there was a concern to ensure that any related environmental impacts would be fully assessed.

9.8 As this development constitutes Strategic Infrastructure Development (SID), a formal consultation exercise was also undertaken with statutory consultees and nearby residents / members of the general public between October and December 2020. Details of these consultations and the feedback obtained therefrom is provided in a separate report submitted in support of the SID application to An Bord Pleanála. Only one consultee raised a concern specifically about climate emissions which would arise indirectly as a result of the proposed development due the haulage of soil / C&D waste materials to the application site. This aspect is addressed later in this Chapter.

Contributors / Author(s)

9.9 SLR Consulting Ireland undertook the impact assessment presented in this chapter of behalf of Kilsaran Concrete. The lead consultant for the study was Aldona Binchy MSc. Eng PIEMA Environmental Engineering.

Limitations / Difficulties Encountered

9.10 There are currently no published guidelines and established methodology providing specifically for assessment of climate impacts from extraction / inert soil landfilling/ waste recovery activities in Ireland. This Chapter of the EIAR has therefore been prepared on the basis of general cross-sectoral guidance.

Legislative Framework/ Policy Context

9.11 In recent years, there has been increasing public awareness about the implications of past, ongoing and continued future emissions of greenhouse gases on the earth's climate. The implications of such change will potentially have significant impact on local communities and national populations across the world. The ever increasing awareness and acceptance of this reality has, in recent years, prompted significant public policy development around emissions and climate change.

9.12 An overview of the legislative framework and policy context which informs this assessment of potential climate impacts of the proposed landfilling and C&D waste recovery activities at Ballinclare Quarry is presented in Appendix 9-A and provides background detail in respect of the following :

- National Policy on Adaption to Climate Change
  - Sectoral Adaption Plans
  - Local Level Adaption
- Regulation / Control of Greenhouse Gas Emissions
  - Paris Agreement (2015)
  - Kyoto Protocol (2008-2012)
  - EU 2020 Targets for Non-ETS Sector Emissions
  - Energy White Paper (2015)
- Future Management of Flood Risk
- EIA Directive 2014/52/EU
- Published Guidelines
  - Guidance on Integrating Climate Change and Biodiversity into EIA
  - Assessing Greenhouse Gas Emissions and Evaluating their Significance
  - Climate Change and Major Projects
  - Sector Planning Guidelines for Climate Change Adaption
  - Local Authority Strategy Development Guidelines.

RECEIVING ENVIRONMENT

Climate Environmental Baseline

Regional Context

9.13 Observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising sea level are unequivocal evidence of warming of the climate system globally. Global mean temperature has increased by 0.8°C compared with pre-industrial times for land and oceans, and by 1.0°C for land alone. Most of the observed increase in global average temperatures is very likely due to increases in anthropogenic greenhouse gas concentrations.

9.14 In future years, landmasses are expected to warm more than the oceans, and northern, middle and high latitudes. Despite possible reductions in average summer precipitation over much of Europe,

precipitation amounts exceeding the 95th percentile are very likely in many areas; thus episodes of severe flooding may become more frequent despite the general trend towards drier summer conditions. In an ensemble-based approach using outputs from 20 global climate models (GCMs), the Mediterranean, north-east and north-west Europe are identified as warming hot spots but with regional and seasonal variations in the pattern and amplitude of warming.

9.15 Regional climate models (RCMs) also project rising temperatures for Europe until the end of the 21st century, with an accelerated increase in the second half of the century. For precipitation, the larger-scale summer pattern shows a gradient from increases in Northern Scandinavia to decreases in the Mediterranean region. By contrast, increases in wintertime precipitation primarily north of 45°N are a consistent feature of RCM projections over Europe, with decreases over the Mediterranean. Overall, then, there are consistent projections of change for northern and north-west Europe, including Ireland.

9.16 Ireland has a typical maritime climate, with relatively mild and moist winters and cool, cloudy summers. The prevailing winds are south-westerly in direction. The climate is influenced by warm maritime air associated with the Gulf Stream which has the effect of moderating the climate, and results in high average annual humidity across the country. The area of least precipitation is along the eastern seaboard of the country, in the rain shadow of the Leinster uplands.

9.17 Mean seasonal temperature will change across Ireland. A number of studies have applied selected IPCC Special Reports on Emissions Scenarios (SRESs) to model climatic changes across Ireland at a regional scale. Despite the different methods and scenario combinations used, there is agreement in projected changes in temperature for Ireland. However, there are more disparities in the magnitude and sign for the precipitation changes projected for the island.

9.18 Table 9-1 summarises climate impact projections for Ireland, estimates of projections confidence are derived from published projection data from the Local Authority Adaptation Strategy Development Guidelines.

Table 9-1
Climate Impacts Projections: 30-year overview[1]

Variable	Summary	Confidence	Projected Changes
Sea Levels Rise	Strong increase	High	Projections of sea level rise to 2100 suggest a global increase in the range of 0.09-0.88m with a mean value of 0.48m. For 2050, it is reasonable to assume a sea level rise in the region of 25cm above present levels. It should be noted that due to a limited understanding of some important effects that contribute to rates of increase, these estimates of sea level rise may prove optimistic, and estimates of up to 4-6 m have been projected by some models.

[1] Local Authority Adaptation Strategy Development Guideline, EPA 2016

Variable	Summary	Confidence	Projected Changes
Storm surge	Strong increase	Medium	An increase in the number of intense cyclones and associated strong winds are expected over the north - east Atlantic. By the 2050s, storm surge heights in the range of 50-100cm are expected to increase in frequency for all coastal areas with exception of the southern coast.
Costal Erosion	Moderate increase	Low	Currently approximately 20% of Ireland's coastline is at risk of costal erosion, particularly areas of the south and east coast and also in isolated areas on the west coast. Rates of increase will be determined by local circumstances; however, it is expected that areas of the south-west are likely to experience the largest increase.
Cold Snaps/ Frost	Moderate decrease (winter/night)	High	By mid-century, minimum temperatures during winter are projected to increase by ~2^{0}C in the southeast and ~2.9^{0}C in the north. This change will results in fewer frost days and milder nigh-time temperatures.
Heatwaves	Strong increase (summer)	High	Seven significant heatwaves (defined as 5+ days@>25^{0}C) have been recorded in Ireland over the past 30 years, resulting in approximately 300 excess deaths. By mid-century, a projected increase in summer maximum daily temperature of approximately 2^{0}C will likely intensify heatwaves, with maximum temperatures increasing and heatwave duration lengthening.
Dry Spells	Strong increase (summer)	Medium	There have been seven periods of insignificant rainfall in Ireland in the past 40 years. Of these, the events of 1976 and 1995 were the most severe, averaging 52 and 40 days in duration respectively across Irish rainfall stations. An approximate 20% decrease in summer precipitation in many areas is strongly indicated under a high emissions scenario. This decrease is likely to result in progressively longer periods without significant rainfall, posing potentially severe challenges to water sensitive sectors and regions.

Variable	Summary	Confidence	Projected Changes
Extreme Rainfall	Strong increase (winter)	Low	Heavy precipitation days (in which more than 20mm of rainfalls) are likely to increase in frequency in winter. By the 2050s an increase in the number of heavy precipitation days of around 20% above the level of 1981-2000 is projected under both low- medium and high emissions scenarios. This may have serious consequences for flood risk in sensitive catchments.
Flooding	Moderate increase (winter)	Low	An Irish Reference Network of hydrometric stations has been established to assess signals of climate charge in Irish hydrology. This network has detected an increasing trend in high river flows since 2000. Projections of future flows are beset by uncertainty at the catchment scale, but a broad signal of wetter winters and drier summers is evident across a number of independent studies.
Wind Speed	Minor increase (winter)	Medium	Observed wind speed over Ireland has not changed significantly in recent times, but it is anticipated that the distribution of wind will alter slightly in future, with winters marginally winder and summers marginally less so. Though the average wind speed is anticipated to change in only a minor way over the coming decades, the frequency of extreme windstorms is expected to increase due to alternations in the origin and track of tropical cyclones.

Local Context

9.19 The closest weather station to the application site and are considered representative of conditions experienced at the application site is that at Casement Aerodrome in Baldonnel, which is located approximately 45km to north-west of the application site.

9.20 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 7.9°C to 19.7°C and mean daily minimum temperatures are typically between 2.1°C to 11.0°C for the area surrounding Casement Aerodrome, refer to Table 9-2.

Table 9-2
Casement Aerodrome 1971-2010 Temperature Averages

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Daily Max	7.9	8.2	10.0	12.1	15.0	17.8	19.7	19.4	17.0	13.6	10.1	8.3
Mean Daily Min	2.1	2.0	2.7	3.5	6.0	8.8	11.0	10.6	8.8	6.6	3.9	2.7
Mean Temperature	5.0	5.1	6.4	7.8	10.5	13.3	15.3	15.0	12.9	10.1	7.0	5.5

9.21 The east of Ireland, which is sheltered from Atlantic frontal systems, is sunnier than the west. The sunniest months are May and June. The mean daily duration recording of sunshine for the area around Casement Aerodrome is 3.7 hours. December is the dullest month, with 1.5 hours of mean daily duration. May is the sunniest month, with 5.9 hours of mean daily duration, explained largely by its long days and finer weather.

9.22 For the period 1970-2010, mean monthly total for year rate of precipitation was 736.5 mm / year at Casement Aerodrome, with winter months receiving the heaviest amounts, refer to Table 9-3.

Table 9-3
Average Precipitation Casement Aerodrome (mm) 1971-2010

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean Monthly Total	65.9	49.3	50.8	48.6	56.0	59.1	55.2	68.5	61.2	77.0	70.9	74.0	736.5

9.23 Results from the synoptic meteorological station at Casement Aerodrome at Baldonnell over a ten-year period indicate that the main wind direction is from a west and south-westerly direction, with an annual incidence of 48% for winds between 200° and 280°. The lowest frequency is for winds blowing from the north and north-east direction. A windrose for the wind data recorded at Casement Aerodrome is presented in Figure 9-1.

Study Area

9.24 The application site and Kilsaran property holding at Ballinclare Quarry straddles two townlands, Ballinclare and Carrigmore, which lie to the north-west of a small settlement at Kilbride, Co. Wicklow, approximately 2.5 kms to the east and the village of Glenealy approximately 3km to the north.

9.25 The overall landownership area is c.36 ha (89 acres), while the application area is 32.5ha (78.3 acres). The application area extends across all of the former quarry footprint and includes the former concrete / asphalt production area, the recently installed concrete block yard, established site buildings and infrastructure and a network of settling ponds in the north-western corner. It excludes a compound / yard area leased to Wicklow County Council in the north-western corner of the landholding.

9.26 The area surrounding the application site is typically rural in character and dominated by forestry and undulating agricultural land. Ground level in the vicinity generally lies between 60mOD and 70mOD. Ground levels rise in a south-westerly direction to c.270mOD at Westaston Hill (approximately 2km SW) and in a northerly direction to 217mOD at Ballincooley Hill (approximately 1.75km N).

9.27 Potters River flows approximately 450m beyond the northern boundary of the application and then turns south-eastwards to flow approximately 250m to the east of the property. Thereafter it continues south-eastward and eventually discharges to the sea at Brittas Bay.

9.28 Residential property in the vicinity of the application site generally comprises farmsteads and isolated / one off houses along the local road network. The nearest dwellings to the landholding site boundary are those located to the south, west and north of the site, along the local county road network.

9.29 There is another quarry located in Kilmacurragh West, on the opposite side of the L1157 Local Road. It is understood that this quarry is not currently active.

9.30 The principal tourism / amenity facility in the vicinity of the quarry is the Kilmacurragh Botanic Gardens, an outpost of the National Botanic Garden in Glasnevin, Dublin, which is located just under 1km to the south-west.

9.31 Deputy's Pass Nature Reserve SAC [Site Code 000717] is located approximately 1.6km to the north-west of the application site, while Glenealy Woods pNHA [Side Code 001756] is located approximately 1.0km to the north-west.

9.32 The lands surrounding the existing quarry comprise farm fields, forestry and existing quarry industrial lands. The application site is not subject to any statutory or non-statutory nature conservation designations.

9.33 Dwellings in the vicinity of application site are generally located along the local road network, both as isolated farmhouse structures or in small clusters.

IMPACT ASSESSMENT

Methodology

9.34 In Ireland some sectors have independently begun the process of identifying key vulnerabilities for their activities. The report by the Irish Academy of Engineering, Ireland at Risk Critical Infrastructure – Adaptation for Climate Change (The Irish Academy of Engineering, 2009) and the report by the Heritage Council and Fáilte Ireland (the National Tourism Development Authority), Climate Change, Heritage and Tourism, Implications for Ireland's Coast and Inland Waterways (ed. Kelly and Stack, 2009) are examples of initiatives of this kind.

9.35 Other research work on adaptation in specific sectors has been carried out or commissioned by other Government Departments / bodies such as the OPW, CoFoRD (programme of competitive forest research for development research programme, etc. (e.g. CLIMADAPT).

9.36 A National Climate Change Vulnerability Scoping Study (Sweeney and Coll, 2012) was undertaken to identify first generation vulnerabilities for Ireland based on a sensitivity analysis across key sectors. The analysis identified a clustering of impacts and their importance in relation to an assessment of likely resilience by sector. The assessment methodology used was an impacts-first, science-first classical approach. The priority sectors identified are: biodiversity and fisheries; water resources and the built coastal environment; forestry and agriculture.

9.37 As each sector develops its sectoral adaptation plan (under the Climate Action and Low Carbon Development Act 2015), detailed vulnerability and risk analysis will be required. Some preliminary work has been undertaken on costing the impacts of climate change in Ireland. This is now being supported by more detailed analysis of the current and future costs of flood risk management.

9.38 The implementation of adaptation is being supported by the development of a suite of guidelines, tools and approaches. These include the Local Authority Adaptation Strategy Development Guidelines and the Irish climate information platform "Climate Ireland", which includes data, information, tools and approaches for local level adaptation decision making. Work is ongoing to develop sectoral decision-making tools and supports.

9.39 The EPA is currently funding a research project called Urb-Adapt which aims to identify the impact of climate change on Dublin city and surrounding towns within the greater Dublin region. The project aims to identify possible risks to the population living in that area and future risks posed to it by the changing climate.

9.40 There are no specific tools developed for assessing climate change for the extraction / waste recovery industries. The Climate Change and Major Project guidelines on how to make vulnerable investments resilient to climate change provide methodology for undertaking a vulnerability and risk assessment.

9.41 Climate change adaptation and mitigation are to be integrated in the preparation and approval of planned development. Adaptation seeks to ensure adequate resilience of development to the adverse impacts of climate change, based on vulnerability. Mitigation seeks to reduce the emission of greenhouse gases.

Development Vulnerability

9.42 The aim of the vulnerability assessment is to identify the relevant climate hazards for the proposed integrated inert waste management facility at Ballinclare Quarry. Main steps in include identifying and combining the sensitivity and exposure of the project which will describe the vulnerability, the risk will be defined as likelihood and impact.

9.43 Adaptation through project options, appraisal, and planning will depend on the assessed project vulnerability and risk.

9.44 Timescale for the project vulnerability and risk assessment shall correspond to the lifespan of the project. During the lifespan, there could be significant changes in frequency and intensity of weather events due to climate change, which should be taken into account. Detailed methodology charts for development vulnerability assessment are presented in Appendix 9-B.

Green House Gases Emissions

9.45 All projects have the potential to emit greenhouse gas (GHG) emissions to atmosphere during the construction, operational and decommissioning phase of the development. Direct GHG emissions may be caused by operational activities, and project decommissioning. Indirect GHG emissions may be due to increased demand for energy and indirect GHG activities. Indirect GHG activities are linked to the implementation of the proposed project and may include transport, office space heating of buildings or loss of habitats that provide carbon sequestration, (e.g. through land-use change).

9.46 The significance of project's GHG emissions should be based on its net impact, which may be positive or negative. Where GHG emissions cannot be avoided, significance of project's emissions shall be reduced by mitigation or project design. Where GHG emissions remain significant, but cannot be reduced further approaches to compensate project emissions should be considered.

9.47 Currently in Ireland, there is no set methodology to evaluate significance criteria or a defined threshold for GHG emissions for extraction / backfilling / soil recovery activities. Due to the inconsistences between the different methods and their assumptions for assessment, there is no single agreed method by which to assess a project carbon budget. The method of assessment varies according to the type and scale of the development.

9.48 Due to a lack of guidelines and an established methodology, the assessment of significance of the GHG emissions is based on whether the development's GHG emissions cumulatively represent a considerable contribution to the global atmosphere and whether the development as continued or extended will replace existing development that would have a higher GHG profile.

9.49 Where the GHG emissions cannot be avoided, the mitigation should aim to reduce the development emissions at all stages.

Assessment

Development Vulnerability

9.50 The aim of the vulnerability assessment is to identify the relevant climate hazards for the project at the foreseen location. Detailed development vulnerability assessment for the proposed backfilling ad soil waste recovery activities at Balinclare is presented in Appendix 9-C.

9.51 Based on the development vulnerability assessment, measures to improve the resilience of the project to extreme rainfall, flash flood, storms, and winds are required.

Greenhouse Gas Emissions

9.52 For purpose of this assessment, GHG emissions have been calculated for the proposed development based on energy use at the proposed inert waste management facility at Ballinclare Quarry in future years.

9.53 The proposed rate of import is of the order of maximum of 750,000 tonnes of soil and stone and 50,000 tonnes of construction and demolition (C&D) waste per annum. The combined annual intake of 800,000 tonnes per annum is equivalent to an average of 145 loads per day (assuming 50 weeks, 5.5 days and 20 tonnes per load). The total number of trips per year will be approximately 40,000. It has been assumed that average distance travelled for one trip will be 110km (ie. return to / from principal markets around Dublin).

9.54 Total annual GHG emissions for the proposed development are presented in Table 9-4 below.

Table 9-4
Annual GHG Emissions Calculations

Type	Value	Distance Travelled	Conversion Factor	Calculated	Total Annual CO_2e kg
Traffic (Movements)	40,000 No.	110km	0.71266	3,135,704	-
Energy (Placement Fill)	90,000[a] litres		2.60016[b]	234,014	
Energy (C&D Recovery)	50,000[c] litres		2.60016	130,008	
Energy (Soil Washing)	1,400,000[d] kWh		0.4	560,000	
Site Vehicles	2500[e] litres		2.60016	6,500	
				TOTAL	**4,066,218**

[a] *Assumed 300 l /day consumed for 300 working days / annum (1 bulldozer and occasional excavator).*
[b] *Conversion factor for 2017 for Scope 1 Protocol for fuels: diesel.*
[c] *Assumed 1 litre of diesel fuel consumed to recycle 1 tonne of C&D waste (up to 50,000 tonnes p/a)*
[d] *Assumed 200,000 tonnes soil washed p/a, at rate of 100t/hour = 2,000 hours p/a and 700 kW plant*
[e] *Assumed 50 litres / week for site vehicles*

9.55 Based on a calculated total annual emission 4,066,218 CO_{2e} kg (4,066 CO_{2e} tonnes) and a comparison to Ireland's 2017 emissions value of 60.74 MTonnes of CO_{2e}, it is assessed that the proposed backfilling and recovery activity at Ballinclare Quarry would represent a maximum of just 0.0065% of Ireland's annual CO_{2e} emissions for the duration of these activities.

9.56 Based on the scale and extent of the proposed future landfilling and C&D waste recovery operations, GHG emissions are assessed as not making a significant contribution to the global atmosphere.

MITIGATION

9.57 Mitigation is designed to increase the resilience of the development, or wider environmental receptors, to climate change and focuses on increasing capacity to absorb climate related shocks.

Project Adaptation against Expected Climate Change Effects

9.58 In the context of climate change, measures to increase the adaptive capacity of the proposed waste recovery facility and disaster risk reduction strategies can be developed with a view to reducing vulnerability and increasing the resilience of the planned development. Significant incidents related to the climate change that affect operation of the proposed waste recovery facility should be recorded for future analysis.

9.59 Based on the development vulnerability assessment (refer to Appendix 9-B), measures to improve the resilience of the project to extreme rainfall, flash flood, storms, wildfires and winds are required. Table 9-5 details specific mitigation measures for the proposed waste recovery facility relating to climate change adaptation.

Table 9-5
Mitigation Measures Related to Climate Change Adaptation

Main Concerns Related To:	Proposed Alternatives Or Mitigation Measures
Extreme Rainfall, Flash Flood	Consider changes / flexibility in construction / operations that allow for rising water levels and groundwater levels. Consider weather warnings and create plans adequate to warning intensity.
	Design / provide adequate surface water drainage.
Wildfire	Design / provide adequate procedures for wildfire scenarios.
Storms and Winds	Ensure design can withstand increases in high winds and storms. Ensure the choice of equipment is weather efficient. Consider weather warnings and create plans adequate to warning intensity
Risk Reduction Mechanism	Secure insurance for damage of assets / site incidents

Future Reduction of GHG Emissions

9.60 The Applicant will adopt a GHG monitoring programme at the proposed inert waste management facility. Based on the GHG monitoring results the Applicant shall establish short, medium, and long-term objectives and targets for a GHG reduction programme and energy management plan.

9.61 Table 9-6 details specific mitigation measures for the proposed waste facility in respect of the GHG reduction programme.

Table 9-6
Mitigation Measures Related to GHG Reduction Programme

Main Concerns Related To:	Proposed Alternatives or Mitigation Measures
Increased demand for energy	Consider using renewable energy sources / suppliers. Consider clean energy production on site.
Direct GHG emissions	Use energy efficient machinery.
GHG emissions related to transport	Unnecessary equipment/ transport journeys should be avoided by management of transport and travel demands. Equipment should not be left idling. Use backloading to dispatch recycled aggregates off site (ie. ensure inbound HGVs transport outbound materials on return leg of trip when required)
GHG mitigation training programme	Training programme for GHG mitigation to be provided for employees/ contractors.

MONITORING

Project Adaptation against Expected Climate Change Effects

9.62 A framework and set of indicators shall be developed to assess project preparedness for adaptation against climate change. Provision shall be made for a periodic review of plans and the allocation of reporting responsibilities for a regime to measure and evaluate progress on adaptation.

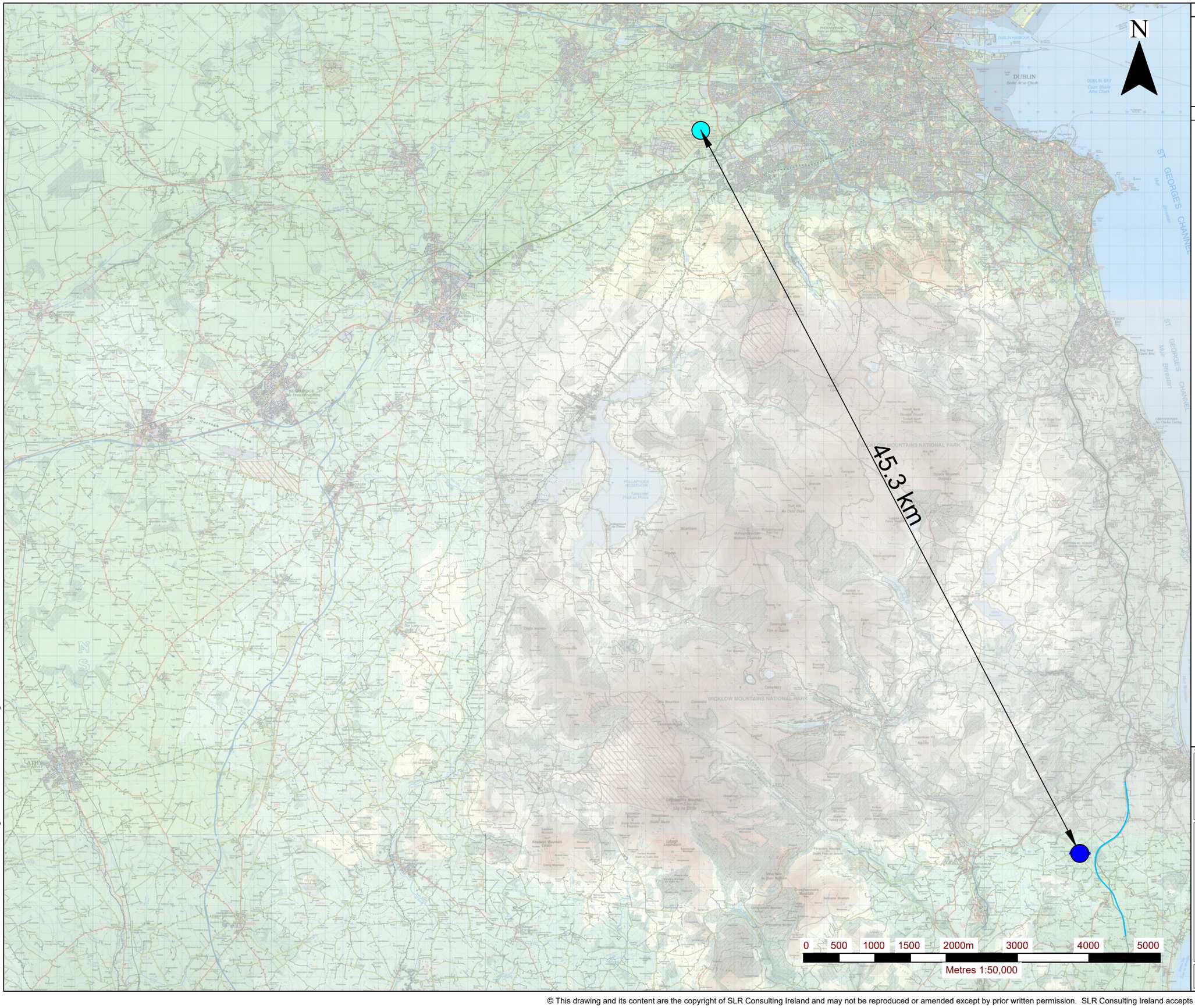
9.63 This process shall include regular feedback and/or updates from the implementation efforts. Enhancement and monitoring related to the projects' predicted impacts with respect to climate change should be set out in an Environmental Management Plan.

Future GHG Emissions

9.64 Monitor report and review GHG reduction progress.

FIGURES

Figure 9-1
Windrose For Casement Aerodrome



NOTES

1. EXTRACT FROM ORDNANCE SURVEY 1:50,000 DISCOVERY SERIES MAPPING SHEET NO. 56, 62 & 69

2. ORDNANCE SURVEY IRELAND LICENCE NO. CYAL50167032 (C) ORDNANCE SURVEY IRELAND/ GOVERNMENT OF IRELAND

LEGEND

BALLINCLARE QUARRY

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KILSARAN CONCRETE

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

BALLINCLARE QUARRY RESTORATION &
INERT LANDFILL & C+D WASTE RECOVERY FACILITY
KILBRIDE (N11), CO. WICKLOW

METEOROLOGICAL STATION LOCATION

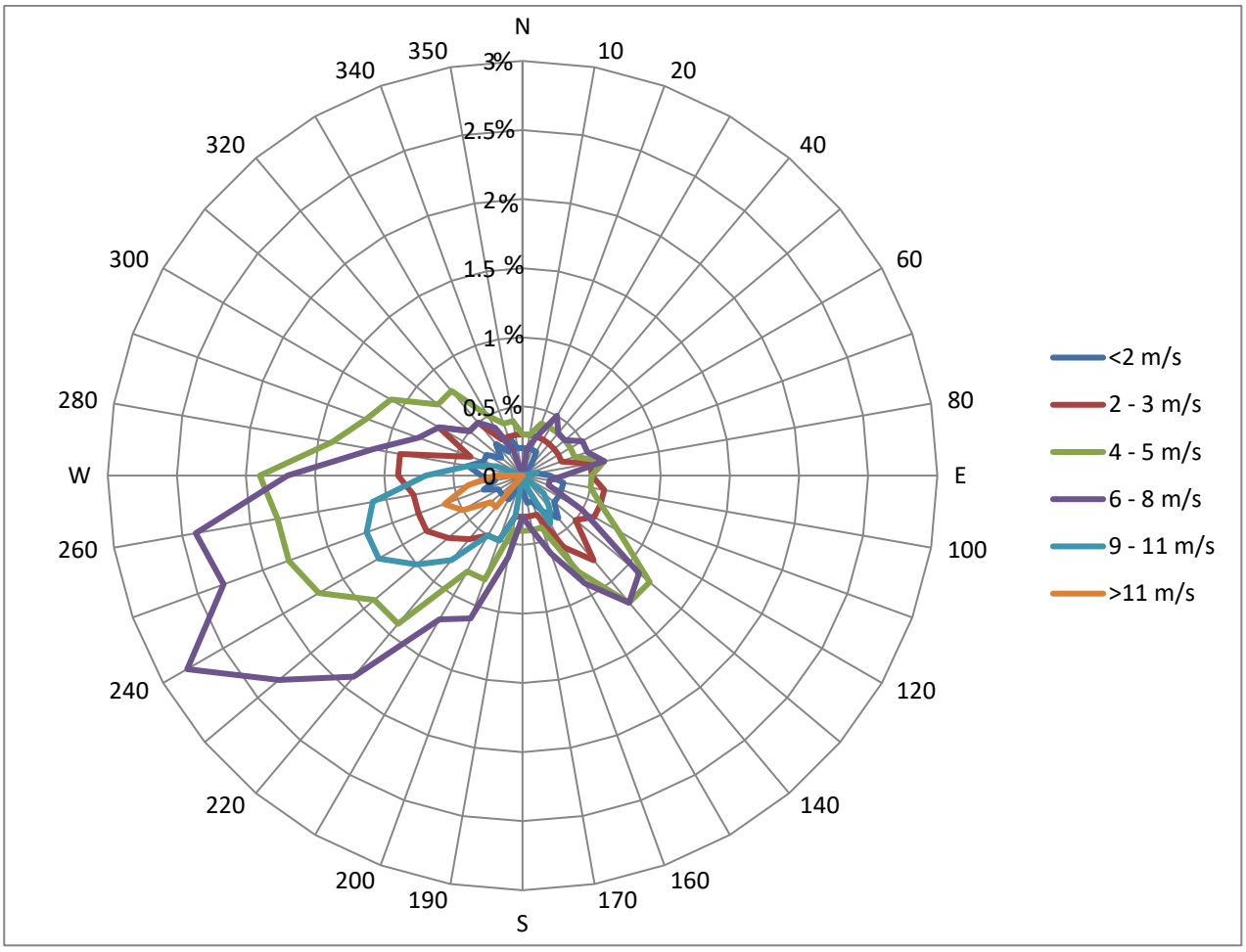
FIGURE 9-2

Scale: 1:50,000 @ A3

Date: MARCH 2021

00036.00080.0.16.FIG 9-2.0.Meterolgical Satation Location.dwg

WINDROSE FOR CASEMENT AERODROME METEOROLOGY STATION



APPENDIX 9-A

CLIMATE CHANGE : LEGISLATIVE FRAMEWORK / POLICY CONTEXT

Introduction

In recent years, there has been increasing public awareness about the implications of past, ongoing and continued future emissions of greenhouse gases on the earth's climate. The implications of such change will potentially have significant impact on local communities and national populations across the world. The ever increasing awareness and acceptance of this reality has, in recent years, prompted significant public policy development around emissions and climate change.

An overview of the legislative framework and policy context which informs this assessment of the potential climate impacts of the proposed inert landfill and C&D waste recovery activities at Ballinclare Quarry is presented herein below.

National Adaptation to Climate Change

The Irish National Policy Position establishes the fundamental national objective of achieving transition to a competitive, low carbon, climate-resilient and environmentally sustainable economy by 2050. It sets out the context for the objective; clarifies the level of GHG mitigation ambition envisaged; and establishes the process to pursue and achieve the overall objective. Specifically, the National Policy Position envisages that policy development will be guided by a long-term vision based on:

- an aggregate reduction in carbon dioxide (CO_2) emissions of at least 80% (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors;
- in parallel, an approach to carbon neutrality in the agriculture and land-use sector, including forestry, which does not compromise capacity for sustainable food production.

The evolution of climate policy in Ireland will be an iterative process based on the adoption by Government of a series of national plans over the period to 2050. Greenhouse gas mitigation and adaptation to the impacts of climate change are to be addressed in parallel national plans – respectively through National Mitigation Plans and National Climate Change Adaptation Frameworks. The plans will be continually updated, as well as being reviewed on a structured basis at appropriate intervals, and at a minimum, every five years. This will include early identification and ongoing updating of possible transition pathways to 2050 to inform sectoral strategic choices.

The Climate Action and Low Carbon Development Act 2015[2] was enacted in December 2015. The Act identified and provided for the development and submission to Government of national mitigation and adaptation plans. It also established the institutional and governance framework within which these plans can be developed and implemented on a cyclical basis.

The Department of Communications, Climate Action and Environment (DCCAE) published a National Adaptation Framework (NAF) in January 2018[3]. The NAF sets out the national strategy to reduce the vulnerability of the country to the negative effects of climate change and to avail of positive impacts.

The NAF builds on the work already carried out under the National Climate Change Adaptation Network (NCCAF, 2012). Under the NAF a number of Government Departments will be required to prepare sectoral adaptation plans in relation to a priority area that they are responsible for. Local authorities are required to prepare local adaptation strategies NAF also aims to improve the enabling environment for adaptation through ongoing engagement with civil society, the private sector and the research community.

Sectoral Adaptation Plans

[2] https://www.dccae.gov.ie/en-ie/climate-action/legislation/Pages/Climate-Action-and-Low-Carbon-Development-Act-2015.aspx

[3] https://www.dccae.gov.ie/en-ie/climate-action/topics/adapting-to-climate-change/national-adaptation-framework/Pages/default.aspx

Under the National Adaptation Framework (NAF), Government Departments have to prepare Sectoral Adaptation Plans. Twelve sectors under 7 Government Departments will prepare plans. The deadline for submitting plans to Government is 30 September 2019. The sectors are :

- Seafood - Department of Agriculture, Food and the Marine;
- Agriculture - Department of Agriculture, Food and the Marine;
- Forestry - Department of Agriculture, Food and the Marine;
- Biodiversity - Department of Culture, Heritage and the Gaeltacht;
- Built and Archaeological Heritage - Department of Culture, Heritage and the Gaeltacht;
- Transport infrastructure - Department of Transport, Tourism and Sport;
- Electricity and Gas Networks - Department of Communications, Climate Action and Environment;
- Communications networks - Department of Communications, Climate Action and Environment;
- Flood Risk Management - Office of Public Works;
- Water Quality - Department of Housing, Planning and Local Government;
- Water Services Infrastructure - Department of Housing, Planning and Local Government;
- Health - Department of Health.

The aggregate and extractive industries were not specifically required under the National Adaptation Framework (NAF) to prepare sectoral adaptation plans in line with the requirements of the Climate Action and Low Carbon Development Act.

Under the non-statutory 2012 Framework, four Government Departments prepared draft sectoral plans covering 5 sectors. These plans are :

- Sectoral Adaptation Plan for Flood Risk Management (OPW, 2015);
- Adaptation Planning - Developing Resilience to Climate Change in the Irish Agriculture and Forest Sector (DAFM, 2017);
- Adaptation Planning - Developing Resilience to Climate Change in the Irish Transport Sector (DTTAS, 2017);
- Adaptation Plan for the Electricity and Gas Networks Sector (DCCAE, 2017).

Government Departments must develop statutory sectoral adaptation plans in accordance with the NAF and with a six-step adaptation planning process described in Sectoral Planning Guidelines for Climate Change Adaptation. This Department published the guidelines for the use of the sectors required to prepare statutory sectoral adaptation plans under the Framework. The guidelines aim to ensure that a coherent and consistent approach to adaptation planning will be adopted by the key sectors in Ireland. Completed plans could include actions that :

- Integrate adaptation into key sectoral plans and policies;
- identify and understand the key vulnerabilities, risks, and opportunities facing their sectors. This should include major cross cutting risks;
- ensure that plans related to emergencies assigned to a sectoral department as lead Government department under the Strategic Emergency Planning Guidelines are climate proofed;
- identify and collect information on the costs and benefits of adaptation within their sectors;
- build capacity within their sectors to cope with climate change;

- identify and address key research gaps within their sectors;
- improve co-ordination with the local government sector;
- develop appropriate monitoring and verification systems within their sectors.

Local Level Adaptation

The National Adaptation Framework identifies the critical role to be played by local authorities in addressing climate change adaptation. This will effectively build on their existing expertise and experience as first responders in emergency planning scenarios. Under the NAF each local authority will also be developing their own adaptation strategies in line with guidelines developed for the sector. Local authorities had been set a deadline for the completion of local adaptation strategies of 30 September 2019.

The NAF explores how local authorities might adopt a joint or regional approach to adaptation planning. In January 2018 the DCCAE entered into a five-year financial commitment of €10m to establish four Climate Action Regional Offices (CAROs). Building on a business case prepared by the local government sector itself, this commitment recognises the significant obligation which has been placed on local government to develop and implement its own climate action measures, as well as the need to build capacity within the sector to engage effectively with climate change – both in terms of mitigation and adaptation.

The Climate Action Regional Offices are being operated by a lead local authority in four different regions that have be grouped together based on a climate risk assessment with a focus on the predominant risk(s) in each geographical area. The establishment of these offices will enable a more coordinated engagement across the whole of government and will help build on the experience and expertise which exists across the sector.

Table 9A-1 summarises the adaptation actions to climate change in Ireland.

Table 9A - 1
Summary of Adaptation to Climate Change Actions in Ireland[4]

Item	Status	Programs
National Climate Adaptation Strategy	Legislation enacted. Statutory Framework adopted	Climate Action and Low Carbon Development Act 2015 National Adaptation Framework
Action Plans	Sectoral Adaptation Plans in development. Local authority plans in development.	Local Authority Adaptation Strategy Development Guidelines (2016) Sectoral Planning Guidelines for Climate Change Adaptation Local Authority Adaptation Support Tool

[4] http://climate-adapt.eea.europa.eu/countries-regions/countries/ireland

Item	Status	Programs
Impacts, Vulnerability and Adaptation Assessments	National Vulnerability Assessment	2012 National Climate Change Vulnerability Scoping Study Climate Change Impacts on Biodiversity in Ireland (2013) Climate change Impacts on Phenology in Ireland(2013) COCOADAPT (2013) 2013 HydroDetect Project Robust Adaptation to Climate Change in the Water Sector in Ireland (2013) Ensemble of Regional Climate Projections for Ireland(2015) Urb-ADAPT Sectoral Adaptation Plan for Flood Risk Management (OPW, 2015) Adaptation Planning - Developing Resilience to Climate Change in the Irish Agriculture and Forest Sector (DAFM, 2017) Adaptation Planning - Developing Resilience to Climate Change in the Irish Transport Sector (DTTAS, 2017) Adaptation Plan for the Electricity and Gas Networks Sector (DCCAE, 2017)
Research Programs	EPA Research Programme (Climate Pillar)	http://www.epa.ie
Climate services / Met Office	Established	http://www.met.ie
Web Portal	Established	http://www.climateireland.ie
Monitoring, Indicators, Methodologies	In development	
Training, Education	Ongoing / in development	http://www.climateireland.ie

Regulation / Control of Greenhouse Gas Emissions

Ireland is a party to both the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, which together provide an international legal framework for addressing climate change.

In December 2015, an ambitious new legally binding, global agreement on climate change was agreed in Paris. The Paris Agreement aims to restrict global temperature rise to well below 2°C above pre-industrial levels, and to pursue efforts to limit the temperature increase to 1.5°C. It aims to increase global ability to adapt to the adverse impacts of climate change and to foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten sustainable food production. It also seeks to achieve a balance between anthropogenic emissions by sources, and removals by sinks, of greenhouse gases in the second half of this century.

The first Irish National Mitigation Plan[5] represents an initial step to set us on a pathway to achieve the level of decarbonisation required. It is a whole-of-Government Plan, reflecting in particular the central roles of the key Ministers responsible for the sectors covered by the Plan – Electricity Generation, the Built Environment, Transport and Agriculture, as well as drawing on the perspectives and responsibilities of a range of other Government Departments.

The measures that will be implemented through the plan will lay foundations for transitioning Ireland to a low carbon, climate resilient and environmentally sustainable economy by 2050. To support this ongoing work, the Plan also includes over 100 individual actions for various Ministers and public bodies to take forward.

Emissions reduction measures and actions set out in this National Mitigation Plan are aligned with and build upon commitments made in the 2015 Energy White Paper. This paper will be guided by the following strategic objectives :

- policy will contribute to reductions in Ireland's greenhouse gas emissions and enhancement of sinks in a manner that achieves the optimum benefits at least cost;
- a stable and predictable policy and regulatory framework will be underpinned by rigorous analysis and appraisal, supported by strong research and analytical capacity;
- the Government will pursue investment, innovation and enterprise opportunities towards building a competitive, low carbon, climate-resilient and environmentally sustainable economy; and
- the citizen and communities will be at the centre of the transition.

Paris Agreement

The Paris Agreement which entered into force on 4 November 2016 aims to tackle 95% of global emissions through 188 Nationally Determined Contributions (NDCs) which will increase in ambition over time. Ireland's contribution to the Paris Agreement will be via the NDC tabled by the EU on behalf of its Member States. This is a binding target for an overall reduction of at least 40% in greenhouse gas emissions by 2030 (relative to 1990 levels). The target will be delivered by the EU by 2030 through reductions in the Emissions Trading Scheme (ETS) and non-ETS sectors of 43% and 30% respectively (relative to 2005).

Kyoto Protocol (2008 – 2012)

The EPA has overall responsibility for the national greenhouse gas inventory in Ireland's national system, which was established in 2007 under Article 5 of the Kyoto Protocol[6]. The EPA's OCLR[7] performs the role of inventory agency in Ireland and undertakes all aspects of inventory preparation and management as well as the reporting of Ireland's submissions annually in accordance with the requirements of Decision 280/2004/EC and the UNFCCC.

Ireland currently accounts for GHG emissions under the Kyoto Protocol. The Kyoto Protocol required Ireland to limit total national greenhouse gas emissions to 314.2 Mtonnes of CO_{2eq} over the five-year period 2008 – 2012 which is equivalent to 62.8 Mtonnes of CO_{2eq} per annum. The Kyoto Protocol limit is calculated as 13% above Ireland's 1990 baseline value which was established and fixed at 55.61Mtonnes of CO_{2eq} following an in-depth review of Ireland's 2006 greenhouse gas inventory submission to the UNFCCC.[8]

[5] https://www.dccae.gov.ie/en-ie/climate-action/topics/national-mitigation-plan/Pages/default.aspx

[6] http://unfccc.int/kyoto_protocol/items/2830.php

[7] http://www.epa.ie/mobile/about/org/oclr/

[8] http://unfccc.int/files/national_reports/annex_i_natcom/submitted_natcom/application/pdf/nc6_br1_ire.pdf

EU 2020 Targets for non-ETS sector emissions[9]

Under the EU Commission's Climate and Energy Package, Ireland is required to deliver a 20% reduction in non-ETS greenhouse gas emissions by 2020 (relative to 2005 levels). In addition, Ireland also has binding annual emission limits for the period 2013-2020 to ensure a gradual move towards the 2020 target.

The non-ETS sectors cover those sectors that are outside the EU Emissions Trading Scheme and includes agriculture, transport, built environment (residential, commercial/institutional), waste and non-energy intensive industry. Member States are permitted to meet their annual targets through a number of mechanisms which include carry forward of a quantity of its annual emission allocation from the following year, use of transfers from other Member States and the limited use of international credits from project activities as long as certain criteria are met.

2015 Energy White Paper

The White Paper on Energy Policy, Ireland's Transition to a Low Carbon Energy Future 2015-2030, published in 2015, sets out a framework to guide energy policy in the period to 2030. The White Paper recognises that a radical transformation of our energy system is required to meet our national, EU and international climate objectives and sets a course for an energy sector where the State will provide the supports that enable consumers to become active energy citizens. It posits a policy approach where our energy system will change from one that is almost exclusively led by Government and utilities to one where individuals and communities are agents of change in the way Ireland generates, transmits, stores, conserves and uses energy. It sets out a vision, a framework and over 90 actions for Irish energy policy up to 2030 as we transition to a low carbon society and economy by 2050.

Future Management of Flood Risk

The Catchment Flood Risk Assessment and Management (CFRAM) Programme[10] (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

Directive 2014/52/EU[11] 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.

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.

[9] http://www.epa.ie/climate/emissionsinventoriesandprojections/nationalemissionsprojections/

[10] https://www.cfram.ie/

[11] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0052

Published Guidelines

Guidance on Integrating Climate Change and Biodiversity into EIA (EC, 2012)[12]

EU Guidelines provide recommendations on 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 include an 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)[13]

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.

Climate Change and Major Projects (EC, 2016)[14]

This publication provides guidance for assessing vulnerability and risk from Climate Change for major projects funded by the European Regional Development Fund (ERDF) and the Cohesion Fund and listed in the concerned operational programmes.

Sectoral Planning Guidelines for Climate Change Adaptation[15]

The guidelines aim to ensure that a coherent and consistent approach to adaptation planning is adopted by the key sectors in Ireland. Sectors preparing sectoral adaptation plans under the NAF are required to prepare their plans in line with the process described in these guidelines while also being aware of the overall requirements regarding the development of sectoral adaptation plans.

Local Authority Adaptation Strategy Development Guidelines[16]

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;

[12] http://ec.europa.eu/environment/eia/pdf/EIA%20Guidance.pdf

[13] https://www.iema.net/policy/ghg-in-eia-2017.pdf

[14] https://ec.europa.eu/clima/sites/clima/files/docs/major_projects_en.pdf

[15] https://www.dccae.gov.ie/en-ie/climate-action/topics/adapting-to-climate-change/national-adaptation-framework/Pages/Sectoral.aspx

[16] https://www.dccae.gov.ie/en-ie/climate-action/topics/adapting-to-climate-change/national-adaptation-framework/Pages/Localadaptation.aspx

- 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.

APPENDIX 9-B

DEVELOPMENT VULNERABILITY ASSESSMENT METHODOLOGY

DEVELOPMENT VULNERABILITY ASSESSMENT METHODOLOGY

The scale for assessing the likelihood of a climate hazard is presented in Table 9B-1. The output of the likelihood analysis is an estimation of the likelihood for each of the essential climate variables and hazards.

Table 9B-1
Scale of Likelihood of Climate Hazard

TERM	QUALITATIVE	QUANTITATIVE
Rare	Highly unlikely to occur	5%
Unlikely	Unlikely to occur	20%
Moderate	As likely to Occur	50%
Likely	Likely to Occur	80%
Almost certain	Very likely to occur	95%

The scale for assessing the potential impact of a climate hazard is presented in Table 9B-2. The impact analysis provides an assessment of the potential impact of each of the essential climate variables and hazards.

Table 9B-2
Example Table for Climate Hazard Impact Analysis

RISK AREAS	INSIGNIFICANT	MINOR	MODERATE	MAJOR	CATASTROPHIC
Asset damage, engineering, operational					
Safety and Health					
Environment					
Social					
Financial					
Reputation					

The matrix for assessing the sensitivity of project to climate hazards is presented in Table 9B-3. The sensitivity is summarised, along with the ranking of the relevant climate variables and hazards relating to the project.

Table 9B-3
Example Table for Sensitivity of Project to Climate Hazards

	EXTREME RAINFALL, FLASH FLOOD	FLOOD	HEATH	DROUGHT	WILDLIFE FIRES	STORMS AND WINDS	LANDSLIDES	COLD SPELLS AND SNOW	FREEZE –THAW DAMAGE	RISING SEA LEVELS
On site assets										
Inputs - Water										
Inputs - Energy										
Outputs - product										
Transport links										

The matrix for assessing exposure of a project to climate hazards is presented in Table 9B-4. The exposure analysis ranks climate variables and hazards as low, medium or high based on current and future climate.

Table 9B-4
Example Table of Exposure of the Project to Climate Hazards

	EXTREME RAINFALL, FLASH FLOOD	FLOOD	HEAT	DROUGHT	WILDLIFE FIRES	STORMS AND WINDS	LANDSLIDES	COLD SPELLS AND SNOW	FREEZE –THAW DAMAGE	RISING SEA LEVELS
Current Climate										
Future Climate										

An example of the vulnerability of a project to climate hazards is presented in Table 9B-5. The vulnerability combines the sensitivity and the exposure analysis.

Table 9B-5
Example Table for Vulnerability Analysis of Project to Climate Hazards

SENSITIVITY	EXPOSURE (CURRENT & FUTURE CLIMATE)		
	Low	Medium	High
Low			
Medium			
High			

APPENDIX 9-C
DEVELOPMENT VULNERABILITY ASSESSMENT

DEVELOPMENT VULNERABILITY ASSESSMENT

The likelihood analysis of the proposed development to climate hazards is presented in Table 9C-1.

The proposed development has been assessed to be moderate affected by extreme rainfall, flood, flash flood, storms, and winds. The proposed development would be unlikely affected to cold spells, landslides and snow. The proposed development would not be affected by heat, drought, wildlife fires and freeze –thaw damage. The proposed development will not be affected by rising sea level.

Table 9C-1
Analysis of Likelihood of Climate Hazards

	EXTREME RAINFALL, FLASH	FLOOD	HEAT	DROUGHT	WILDLIFE FIRES	STORMS AND WINDS	LANDSLIDES	COLD SPELLS AND SNOW	FREEZE –THAW DAMAGE	RISING SEA LEVELS
Rare			✓	✓					✓	✓
Unlikely		✓					✓	✓		
Moderate	✓				✓					
Likely						✓				
Almost certain										

Table 9C-2 shows the climate hazard impact analysis of the proposed development. It was assessed that climate hazards will have major impacts on health and safety, the environment and financial areas, moderate impacts on asset damage and engineering, operational, social and reputation areas.

Table 9C-2
Climate Hazard Impact Analysis

RISK AREAS	INSIGNIFICANT	MINOR	MODERATE	MAJOR	CATASTROPHIC
Asset damage, engineering, operational			✓		
Safety and Health				✓	
Environment				✓	
Social			✓		
Financial				✓	
Reputation			✓		

Table 9C-3 below assesses the sensitivity of the project to climate hazard. It was assessed that site assets, energy inputs and transport links are of high sensitivity to extreme rainfall, flood, flash floods, storms and winds; water inputs will be highly sensitive to droughts. On site assets will be medium sensitive to cold spells and snow and freeze – thaw damage. Transport links will be medium sensitive to cold spells and snow.

Table 9C-3
Sensitivity of Project to Climate Hazards

	EXTREME RAINFALL, FLOOD	FLOOD	HEATH	DROUGHT	WILDLIFE FIRES	STORMS AND WINDS	LANDSLIDES	COLD SPELLS AND SNOW	FREEZE –THAW DAMAGE	RISING SEA LEVELS
On site assets	High	Low	Low	Low	Low	High	Low	Medium	Medium	Low
Inputs - Water	Low	Low	Low	High	Low	Low	Low	Low	Low	Low
Inputs - Energy	High	Low	Low	Low	Low	High	Low	Low	Low	Low
Transport Links	High	Low	Low	Low	Low	High	Low	Medium	Low	Low

In Table 9C-4, the exposure of the project to climate hazards was assessed. In the current climate, the exposure of the project extreme rainfall, flash flood, wildlife fires, storms and winds has been assessed to be medium. The project was assessed to have high exposure to future climate: rainfall, flood, flash flood, storms, and winds.

Table 9C-4
Exposure of the Development to Climate Hazards without Mitigation

	EXTREME RAINFALL, FLOOD	FLOOD	HEAT	DROUGHT	WILDLIFE FIRES	STORMS AND WINDS	LANDSLIDES	COLD SPELLS AND SNOW	FREEZE –THAW DAMAGE	RISING SEA LEVELS
Current Climate	Medium	Low	Low	Low	Medium	Medium	Low	Low	Low	Low
Future Climate	High	Low	Low	Low	Low	High	Low	Low	Low	Low

Table 9C-5 shows the vulnerability analysis of the project to climate hazards; it combines the sensitivity and the exposure analysis. The project was assessed to be most sensitive to extreme rainfall, flash flood, storms, and winds.

Table 9C-5
Vulnerability Analysis of Project to Climate Hazards

SENSITIVITY	EXPOSURE (CURRENT & FUTURE CLIMATE)		
	Low	Medium	High
Low	Flood, Rising sea levels, Landslides, Freeze – thaw damage, Drought, Heat, Cold Spells and Snow		
Medium		Wildlife Fires	
High			Extreme rainfall, flash flood, Storms and winds