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INTRODUCTION

Background

9.1 This EIAR Chapter prepared by SLR Consulting Ireland, provides supporting information to accompany a Planning Application to Meath County Council by Kilsaran Concrete Unlimited Company (also referenced as Kilsaran or Kilsaran Concrete) in respect of a proposed new sand and gravel extraction operation at Naul townland, Ford-de-Fine, County Meath and primarily addresses potential climate change related impacts from the proposed development.

9.2 The proposed development being applied for under this planning application comprises of:

- Extraction and processing on site, to include washing (with associated closed recycled washing plant and lagoon system), screening and crushing plant; storage; stockpiling and haulage of sand and gravel to service the existing readymix concrete plant operated by Kilsaran on the eastern side of the R108 regional road and permitted under P. Ref. 80/572 & 22/153 (ABP-314881-22);
- The total extraction proposal extends to an area of c. 6.2 hectares and will be worked (extracted and restored) on a phased basis for a period of 11 years plus 1 year to complete final restoration works (total duration of 12 years);
- Phased stripping and storage of topsoil and overburden materials for reuse in the restoration works. Restoration of the site will be to a beneficial agricultural after-use;
- Access to the site will be through the existing agricultural enterprise site entrance onto the R108 regional road with upgrade of same to consist of setting-back of the existing boundary wall to the north of the site access, and provision for the upgrade of the existing internal access track and sections of a new access track which will include a new weighbridge; and
- All associated site ancillary works within an overall application area of c. 14.9 hectares.

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

Scope of Work

9.4 The following sections of this chapter describe the potential climate change impacts associated with the proposed extraction and processing development. The following headings are addressed separately:

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

Consultations / Consultees

9.5 In preparing the previous planning application (P. Ref. AA191263), a pre-planning consultation meeting was held between officials of Meath County Council and the applicant on the 2nd August 2019 at the offices of the Planning Authority. As the site is adjacent to the Meath-Dublin border, pre-planning consultation was also carried out with Fingal County Council at the time.

9.6 Although this planning application is for development broadly covering the same development as applied for previously under P. Ref. AA191263, owing to the lapse in time between planning applications, a further formal pre-planning meeting was held with Meath County Council Planning Department via Teams on the 30th May 2024.

9.7 Following a review of published development plans and the site survey, it was considered that there was no requirement for a separate formal consultation to be carried out regarding the potential climate impacts of the proposed development.

Contributors / Author(s)

9.8 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 and Conor Hughes MSc. Energy Science.

Limitations / Difficulties Encountered

9.9 There are currently no published guidelines and established methodology providing specifically for assessment of climate impacts from quarrying activities in Ireland. This chapter of the EIA Report has therefore been prepared based on general cross-sectoral guidance.

Legislative Framework / Policy Context

9.10 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 impacts 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.

9.11 An overview of the legislative framework and policy context which informs this assessment of potential climate impacts of the proposed activities at Naul is presented in **Appendix 9-A**. This 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 2021-2030 Targets for non-ETS sector emissions- Effort Sharing Regulations
  - 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.

Meath County Council Climate Adaption Strategy

9.12 Meath County Council are taking proactive steps by adopting a Climate Change Adaptation Strategy (2019)[1] to build resilience and respond effectively to the threats posed by climate change.

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

- ensure a 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 functions of Meath County Council.

9.14 In 2024 Meath County Council initiated a pathway for proactive climate action with the introduction of the Meath County Council Climate Action Plan 2024-2029[2] which sets out the aims to be a climate resilient, biodiverse rich, environmentally sustainable and climate neutral economy that supports healthy lifestyles and jobs growth.

9.15 The Council has set out five high goals based around thematic areas which identify the desired outcomes anticipated through the effective implementation of the climate change action plan, consisting of:

- **Governance and Leadership** "Develop appropriate structures and processes for directing and managing effective climate action".
- **Built Environment and Transport** "Achieve local government carbon emission and energy efficiency targets for 2023".
- **Natural Environment and Green Infrastructure** "Protect and enhance Meath's natural environment by supporting biodiversity and increasing climate resilience".
- **Communities: Resilience and Transition** "Mobilise climate action in location communities, whilst achieving a just transition".
- **Sustainability and Resource Management** "Create a culture of sustainability, promoting a circular economy throughout the County".

[1] Meath County Council launches Climate Action Strategy | Meath.ie
[2] Climate Action Plan | Meath.ie

RECEIVING ENVIRONMENT

Climate Environmental Baseline

Regional Context

9.16 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 compared with pre-industrial times for land and oceans. Most of the observed increase in global average temperatures is very likely due to increases in anthropogenic greenhouse gas concentrations. According to an ongoing temperature analysis led by scientists at NASA's Goddard Institute for Space Studies (GISS)[3], the average global temperature on Earth has increased by at least 1.1° C (1.9° Fahrenheit) since 1880 with the majority of the warming having occurred since 1975, at a rate of roughly 0.15 to 0.20°C per decade.

9.17 In future years, landmasses are expected to warm more than the oceans at 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. 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.

9.18 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.

9.19 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.

9.20 Mean seasonal temperature will change across Ireland. Several 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 (i.e., +/-) for the precipitation changes projected for the island.

9.21 **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.

[3] https://earthobservatory.nasa.gov/world-of-change/global-temperatures

Table 9-1
Climate Impacts Projections: 30-Year Overview[4]

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 0.09-0.88 m with a mean value of 0.48 m. For 2050, it is reasonable to assume a sea level rise in the region of 25 cm 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.
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 50-100 cm are expected to increase in frequency for all coastal areas with exception of the southern coast.
Coastal Erosion	Moderate increase	Low	Currently approximately 20% of Ireland's coastline is at risk of coastal 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°C in the southeast and ~2.9°C in the north. This change will result in fewer frost days and milder night-time temperatures.
Heatwaves	Strong increase (summer)	High	Seven significant heatwaves (defined as 5+ days@>25°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°C will likely intensify heatwaves, with maximum temperatures increasing and heatwave duration lengthening.
Dry Spells	Strong increase (summer)	Medium	There have been eight periods of insignificant rainfall in Ireland in the past 40 years. Of these, the events of 1976, 1995 and 2018 were the most severe, averaging 52, 40 and 54 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.
Extreme Rainfall	Strong increase (winter)	Low	Heavy precipitation days (in which more than 20 mm of rain falls) 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.

[4] Local Authority Adaptation Strategy Development Guideline, 2018. gov.ie - Local Authority Adaptation Strategy Development Guidelines (www.gov.ie)

Variable	Summary	Confidence	Projected Changes
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 windier 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

9.22 The meteorological station at Dublin Airport which is located approximately 18 km to the south of the application site is considered representative of conditions experienced at the application site.

9.23 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 8.1 to 19.5°C and mean daily minimum temperatures are typically between 2.3 to 11.7°C for the area surrounding Dublin Airport (refer to **Table 9-2**).

9.24 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 Dublin Airport is 3.9 hours. December is the dullest month, with 1.7 hours of mean daily duration. May is the sunniest month, with 6.2 hours of mean daily duration, explained largely by its longer days and finer weather.

Table 9-2
Temperature Averages Dublin Airport 1981-2010

Temperature (°C)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean Daily Max	8.1	8.3	10.2	12.1	14.8	17.6	19.5	19.2	17	13.6	10.3	8.3	13.3
Mean Daily Min	2.4	2.3	3.4	4.6	6.9	9.6	11.7	11.5	9.8	7.3	4.5	2.8	6.4
Mean Temperature	5.3	5.3	6.8	8.3	10.9	13.6	15.6	15.3	13.4	10.5	7.4	5.6	9.8

9.25 Results from the synoptic meteorological station at Dublin Airport, over the period 1990-2010, indicate that the main wind direction is from a west and south-westerly direction, with an annual incidence of 52% for winds between 200° and 280°. The lowest frequency is for winds blowing from the north and north-east direction. Moderate to high winds (>2 m/s) occur 94% of the time. A windrose for the wind data recorded at Dublin Airport station is presented in **Figure 9-1** for the period 2002 – 2022 inclusive.

9.26 During the period 1981-2010, long-term monthly rates of precipitation were between 48.8 mm and 79mm at the Dublin Airport station, with winter months receiving the heaviest amounts. The mean of the Met Eireann records indicates that average annual rainfall around the application site is

approximately 758 mm / year. The average rainfall data indicates that the greatest daily total (73.9 mm) falls in the month of June; refer to **Table 9-3**.

Table 9-3
Precipitation Averages Dublin Airport 1981-2010

Rainfall (mm)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean Monthly Total	62.6	48.8	52.7	54.1	59.5	66.7	56.2	73.3	59.5	79	72.9	72.7	758
Greatest Daily Total	27.1	28.1	35.8	30.4	42.1	73.9	39.2	72.2	40.6	53.2	62.8	42.4	73.9

IMPACT ASSESSMENT

Methodology

9.27 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.

9.28 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).

9.29 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.

9.30 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.

9.31 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 Guideline; 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.

9.32 There are no specific tools developed for assessing climate change for extraction industry. The Climate Change and Major Project guidelines on how to make investments resilient to climate change provides a methodology for undertaking a vulnerability and risk assessment.

9.33 Climate change adaptation and mitigation are to be increasingly integrated in the preparation and approval of proposed development. Adaptation seeks to ensure adequate resilience of proposed

development to the adverse impacts of climate change based on Vulnerability. Mitigation seeks to reduce the emissions of greenhouse gases.

Development Vulnerability

9.34 The aim of the vulnerability assessment is to identify the relevant climate hazards foreseen at the development location. Main steps include identifying and combining the sensitivity and exposure of the project which will describe the vulnerability, while the risk will be determined by likelihood and impact.

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

9.36 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 considered. Detailed methodology charts for development vulnerability assessment are presented in **Appendix 9-B**.

Greenhouse Gases Emissions

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

9.38 The significance of a project's GHG emissions should be based on its net impact, which may be positive or negative. Where GHG emissions cannot be avoided, the significance of a 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.

9.39 Currently in Ireland, there is no set methodology to evaluate significance criteria or a defined threshold for GHG emissions for the mineral extraction industry. 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.

9.40 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.

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

Development Vulnerability Assessment

9.42 The aim of the vulnerability assessment is to identify the relevant climate hazards for the project at the foreseen location. A development vulnerability assessment for the proposed development is presented in **Appendix 9-C**.

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

Greenhouse Gas Emissions Assessment

Traffic Movements (to existing Concrete Batching Facility)

9.44 For the purposes of this climate assessment, it has been assumed that the projected traffic movements associated with the sand and gravel and related activities will generate 36 HGV movements per day for 249 days per year, based on an annual aggregate consumption rate of 120,000 tonnes per annum.

9.45 Existing aggregate haulage from Annagor to Naul (via the M1) is c. 20km one-way and from Ballynamona to Naul (via the R122) is c. 40km one-way. Based on the average annual HGV one-way movements from Annagor (c. 5,333) and Ballynamona (c. 3,555) which represents a 60:40 split, this equates to annual travel distances from the two locations being 106,660km (one-way) and 142,200km (one-way) respectively.

9.46 The proposed development will therefore result in a total annual road distance saving of 248,860km with a consequential and beneficial reduction in carbon emissions of c. 177,353 kg CO2eq .

On-Site Sand and Gravel Extraction Activities

9.47 For the purpose of this assessment, GHG emissions have been calculated for the proposed development based on energy use at the proposed development at Naul in future years. Assuming an average extraction rate of 120,000 tonnes per year, this would correspond to an average of 4,444 loads per annum. It has been assumed that average distance travelled for one trip will be 1.5km (i.e. return to/from concrete batching facility). It is estimated that c. 300 litres of gas oil will be consumed each day to power on-site loading plant and equipment and the aggregate processing plant, weighbridge and pumps for site operations, will collectively consume 2,750 kWh of electrical power per week.

9.48 Total annual GHG emissions associated with the proposed on-site extraction and processing activities are presented in **Table 9-4**.

Table 9-4
GHG Emissions Calculations

Type	Annual Value	Distance (km) Travelled	Conversion factor	Calculated	Total annual CO_2e kg
Traffic (trips)	4,444 No.	1.5	0.71266	4,750	-
Energy Gas Oil (Processing Machinery)	74,700 litres[5]		2.60016 kg/litre[a]	194,232	-
Electrical Power (Weighbridge/Plant)	134,750 kWh[6]		0.35 kg CO_2eq/kWh[b]	47,163	
Total					246,145

[a] *Conversion factor for 2020 Primary Energy Conversion SEAI: diesel (kg/litre)*

[b] *Conversion factor for Irish power grid 0.3458 kg CO_2 / kWh (Conversion Factors | SEAI Statistics | SEAI)*

9.49 The proposed sand and gravel extraction (120,000 tonnes per annum) from the application site will negate the need to extract these materials at the Annagor and Ballynamona sites thus reducing

[5] Based on average usage for equivalent Kilsaran site: 300l/day consumed for 249 full working days/annum (1 excavator / 1 bulldozer).
[6] Based on average usage for equivalent Kilsaran site: 2,750 kWh of electrical power per week (49 weeks per year)

carbon emissions from these sites. In effect, the sand and gravel extraction operations can be considered to be neutral in terms of carbon emissions.

9.50 Combining on-site extraction operations and a reduction in carbon emissions associated with transportation of the aggregates to the existing concrete batching plant, the proposed development will have a positive contribution in terms of reducing carbon emissions over the lifetime of the proposed development.

MITIGATION

9.51 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

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

9.53 Based on a development vulnerability assessment (refer to **Appendix 9-C**), measures to improve the resilience of the project to extreme rainfall, flash flood, storms, and winds are required. **Table 9-5** details specific mitigation measures for the proposed development 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, Flood, Flash Flood	Consider changes / flexibility in operations that provide for increased run-off across paved areas and possible increases in seasonal groundwater levels.
	Design / provide adequate surface water drainage / discharge to ground.
Storms and Winds	Ensure activities / production can proceed safety during high winds and storms
	Ensure the choice of equipment deployed on the project is weather efficient.
Risk Reduction Mechanism	Secure insurance for damage of assets / site incidences.

Proposed Reduction of GHG Emissions

9.54 The Applicant will implement a GHG monitoring programme at Naul. Based on the GHG monitoring results, the company will establish short, medium, and long-term objectives and targets for a GHG reduction programme and energy management plan.

9.55 **Table 9-6** details specific mitigation measures for the application site 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. Use low carbon construction materials where possible.
Direct GHG emissions	Use energy efficient machinery / energy.
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.

Accidents, Malfunctions and Unplanned Events

9.56 Accidents, malfunctions, and unplanned events refer to events or upset conditions that are not part of any activity or normal operation of the proposed development planned by the Applicant. Even with the best planning and the implementation of preventative measures, the potential exists for accidents, malfunctions or unplanned events to occur during the proposed extraction and concrete production activities.

9.57 Many accidents, malfunctions and unplanned events are, however, preventable and can be readily addressed or prevented by good planning, design, emergency response planning, and mitigation. In terms of climate change impact, the following unplanned events could influence the local area:

- equipment malfunction;
- vehicle collision;
- accidental material spillages during transport.

9.58 In relation to climate change, the impacts of any unplanned events are considered to be negligible.

Monitoring

Project Adaptation against Expected Climate Change Effects

9.59 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.

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

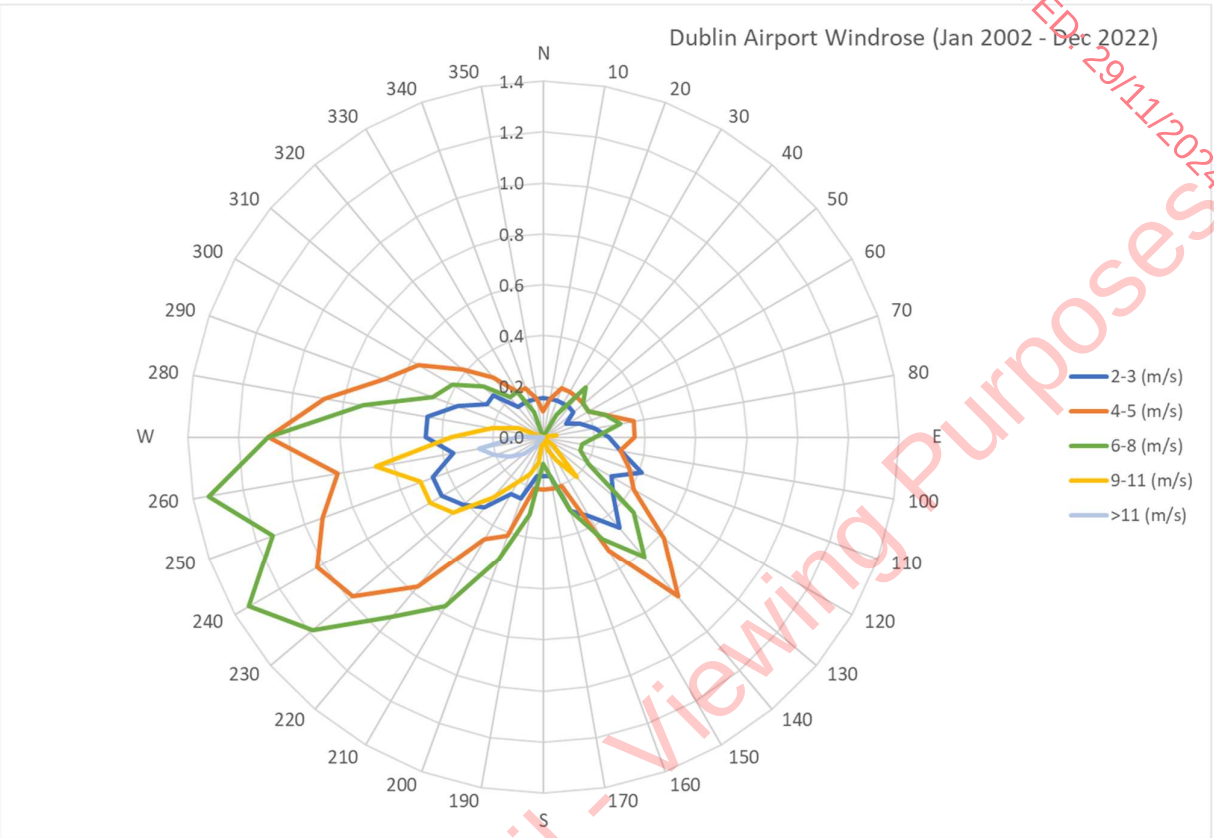
GHG Emissions

9.61 Monitor, report and review progress in achieving GHG reductions at the sand and gravel pit.

FIGURES

Figure 9-1
Windrose for Dublin Airport Meteorology Station

Figure 9-1
Windrose for Dublin Airport Meteorology Station



APPENDICES

Appendix 9-A
Climate Change: Legislative Framework / Policy Context

Appendix 9-B
Development Vulnerability Assessment Methodology

Appendix 9-C
Development Vulnerability Assessment

APPENDIX 9-A

CLIMATE CHANGE: LEGISLATIVE FRAMEWORK / POLICY CONTEXT

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 development 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; and
- 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[7] 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[8]. 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 several 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

[7] https://www.dccae.gov.ie/en-ie/climate-action/legislation/Pages/Climate-Action-and-Low-Carbon-Development-Act-2015.aspx
[8] https://www.dccae.gov.ie/en-ie/climate-action/topics/adapting-to-climate-change/national-adaptation-framework/Pages/default.aspx

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

Under the National Adaptation Framework (NAF), Government Departments must 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[9]

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

[9] 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 Hydro Detect 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[10] 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,

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

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[11]. The EPA's OCLR[12] 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.[13]

[11] http://unfccc.int/kyoto_protocol/items/2830.php
[12] http://www.epa.ie/mobile/about/org/oclr/
[13] http://unfccc.int/files/national_reports/annex_i_natcom/submitted_natcom/application/pdf/nc6_br1_ire.pdf

EU 2021-2030 Targets for non-ETS sector emissions- Effort Sharing Regulations

Under the EU Commission's Climate and Energy Package, sectors of the economy not covered by the EU ETS must reduce emissions by 30% by 2030 compared to 2005 as their contribution to the overall 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.

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[15] (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[16] 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 several 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.

[14] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32018R0842
[15] https://www.cfram.ie/
[16] 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)[17]

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)[18]

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)[19]

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[20]

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[21]

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;

[17] http://ec.europa.eu/environment/eia/pdf/EIA%20Guidance.pdf
[18] https://www.iema.net/policy/ghg-in-eia-2017.pdf
[19] https://ec.europa.eu/clima/sites/clima/files/docs/major_projects_en.pdf
[20] https://www.dccae.gov.ie/en-ie/climate-action/topics/adapting-to-climate-change/national-adaptation-framework/Pages/Sectoral.aspx
[21] https://www.dccae.gov.ie/en-ie/climate-action/topics/adapting-to-climate-change/national-adaptation-framework/Pages/Localadaptation.aspx

- 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.

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, flood, flash 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, flood , flash 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, flash (pluvial) 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	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, flash 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 planned development to climate hazards was assessed. In the current climate, the exposure of the development to extreme rainfall, flood, flash flood, storms and winds has been assessed to be medium. In the future, the development was assessed to have high exposure to rainfall, flash flood, storms, and winds.

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

	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	Medium	Low	Low	Low	Low	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	Rising sea levels, Flood, Landslides, Freeze –thaw damage, Drought, Heat, Wildlife Fires		
Medium		Cold Spells and Snow	
High			Extreme Rainfall, Flash Flood, Storms and Winds