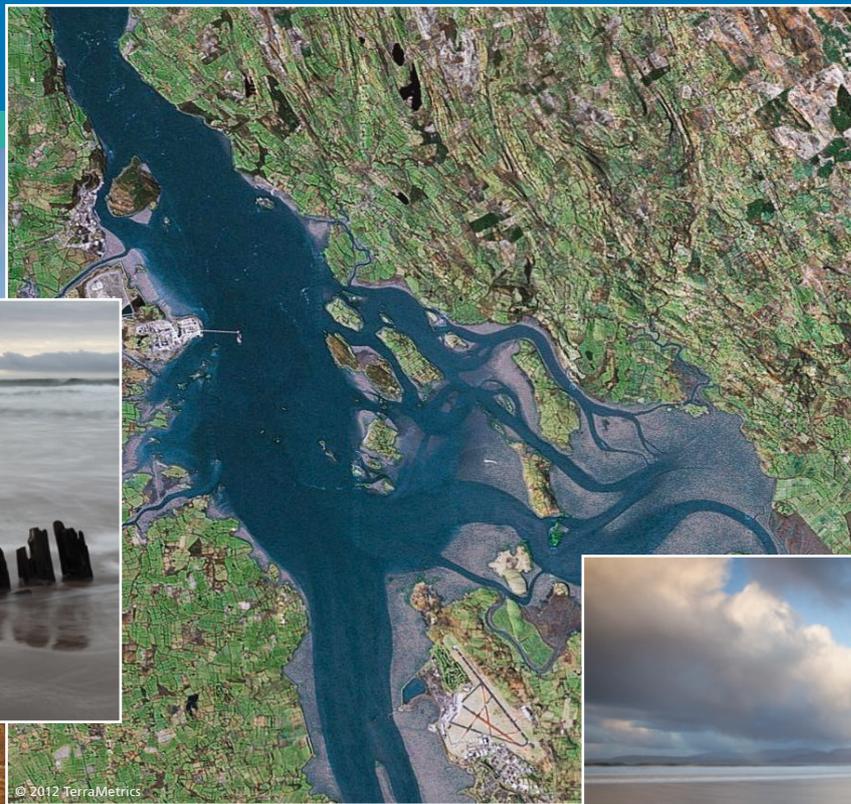


# Integrating Climatic Factors into the Strategic Environmental Assessment Process in Ireland

A Guidance Note (updated June 2019)



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# Environmental Protection Agency

The Environmental Protection Agency (EPA) is a statutory body responsible for protecting the environment in Ireland. We regulate and police activities that might otherwise cause pollution. We ensure there is solid information on environmental trends so that necessary actions are taken. Our priorities are protecting the Irish environment and ensuring that development is sustainable.

The EPA is an independent public body established in July 1993 under the Environmental Protection Agency Act, 1992. Its sponsor in Government is the Department of the Environment, Community and Local Government.

## OUR RESPONSIBILITIES

### LICENSING

We license the following to ensure that their emissions do not endanger human health or harm the environment:

- waste facilities (e.g., landfills, incinerators, waste transfer stations);
- large scale industrial activities (e.g., pharmaceutical manufacturing, cement manufacturing, power plants);
- intensive agriculture;
- the contained use and controlled release of Genetically Modified Organisms (GMOs);
- large petrol storage facilities;
- waste water discharges.

### NATIONAL ENVIRONMENTAL ENFORCEMENT

- Conducting over 2,000 audits and inspections of EPA licensed facilities every year.
- Overseeing local authorities' environmental protection responsibilities in the areas of – air, noise, waste, waste-water and water quality.
- Working with local authorities and the Gardaí to stamp out illegal waste activity by co-ordinating a national enforcement network, targeting offenders, conducting investigations and overseeing remediation.
- Prosecuting those who flout environmental law and damage the environment as a result of their actions.

### MONITORING, ANALYSING AND REPORTING ON THE ENVIRONMENT

- Monitoring air quality and the quality of rivers, lakes, tidal waters and ground waters; measuring water levels and river flows.
- Independent reporting to inform decision making by national and local government.

### REGULATING IRELAND'S GREENHOUSE GAS EMISSIONS

- Quantifying Ireland's emissions of greenhouse gases in the context of our Kyoto commitments.
- Implementing the Emissions Trading Directive, involving over 100 companies who are major generators of carbon dioxide in Ireland.

### ENVIRONMENTAL RESEARCH AND DEVELOPMENT

- Co-ordinating research on environmental issues (including air and water quality, climate change, biodiversity, environmental technologies).

### STRATEGIC ENVIRONMENTAL ASSESSMENT

- Assessing the impact of plans and programmes on the Irish environment (such as waste management and development plans).

### ENVIRONMENTAL PLANNING, EDUCATION AND GUIDANCE

- Providing guidance to the public and to industry on various environmental topics (including licence applications, waste prevention and environmental regulations).
- Generating greater environmental awareness (through environmental television programmes and primary and secondary schools' resource packs).

### PROACTIVE WASTE MANAGEMENT

- Promoting waste prevention and minimisation projects through the co-ordination of the National Waste Prevention Programme, including input into the implementation of Producer Responsibility Initiatives.
- Enforcing Regulations such as Waste Electrical and Electronic Equipment (WEEE) and Restriction of Hazardous Substances (RoHS) and substances that deplete the ozone layer.
- Developing a National Hazardous Waste Management Plan to prevent and manage hazardous waste.

### MANAGEMENT AND STRUCTURE OF THE EPA

The organisation is managed by a full time Board, consisting of a Director General and four Directors.

The work of the EPA is carried out across four offices:

- Office of Climate, Licensing and Resource Use
- Office of Environmental Enforcement
- Office of Environmental Assessment
- Office of Communications and Corporate Services

The EPA is assisted by an Advisory Committee of twelve members who meet several times a year to discuss issues of concern and offer advice to the Board.

SEA and Climate Change

# Integrating Climatic Factors into the Strategic Environmental Assessment Process in Ireland

**A Guidance Note (updated June 2019)**

**Editor**

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# Executive Summary

## Executive Summary

One of the key responses for responding to the challenges posed by climate change, is to integrate (or mainstream) climate change considerations into all levels of decision-making, including the preparation of plans and programmes. The European Commission (EC) describes mainstreaming as the functional integration of climate change mitigation and adaptation policy priorities into everyday planning and management. Strategic Environmental Assessment (SEA) is becoming recognised as perhaps the most flexible and capable instrument for climate policy integration available internationally and nationally. It provides a coherent framework for assessing and managing a broad range of environmental risks, which facilitates the integration of climate change considerations into plans and programmes. The integration of climate change mitigation and adaptation aspects into strategic planning through the application of the SEA Directive (2001/42/EC) should lead to better informed, evidence-based plans and programmes that are more sustainable in the context of a changing climate.

In Ireland, SEA has been carried out for both spatial and non-spatial plans and programmes, and at different levels in the planning hierarchy. These plans and programmes range from detailed small-scale local area plans to broad-based national-level strategies.

This document does not constitute statutory guidance. It is intended to serve as a good practice guidance note on how to practically incorporate climate change into plans and programmes in Ireland that fall under the remit of the SEA Directive. It is aimed at plan-making authorities and SEA practitioners who, in implementing the requirements of the SEA Directive, need to consider how non-climate specific plans and programmes, such as local authority development plans or transport strategies, may affect, or be affected by, climate change either directly or indirectly. It presents information on the causes and consequences of climate change; how these causes and consequences can be described, evaluated and incorporated into the SEA; and where appropriate information can be found.

This guidance provides updated climate-related information and supersedes an earlier version published in 2015. It also acknowledges recent plan and programme-related developments that have occurred since then. It has been prepared by the EPA SEA Section in collaboration with the EPA Climate Services Unit. It was informed by a literature review of existing good international practices, external review, and reconfiguration of existing guidance on climate change in a format that should be usable by SEA practitioners.

In the case of climate-specific plans, such as climate adaptation strategies, plan-makers should ensure that these are prepared in accordance with the relevant departmental guidelines and any updates of these guidelines that may subsequently arise, including:

- Local Authority Adaptation Strategy Development Guidelines (DCCA, 2018)
- Sectoral Planning Guidelines for Climate Change Adaptation (DCCA, 2018)

Plan-makers are also advised to use available SEA process guidance and resources available on the EPA and DHPLG websites.

# Introduction

# 1. Introduction

## Chapter 1 Summary

*Summary of Key Findings for Ireland's Climate*

*Climate Mitigation and Adaptation Definitions*

*Climate Change and SEA Overview*

The Intergovernmental Panel on Climate Change (IPCC) has reiterated that “warming of the climate system is unequivocal” (IPCC 2013). Anthropogenic greenhouse gas (GHG) emissions have already triggered substantial and long-lived change, bringing about atmospheric CO<sub>2</sub> concentrations that are “unprecedented in at least the last 800,000 years”.

Climate policy must move to limit carbon emissions as a matter of urgency. The Paris Agreement sets out the objective of holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognising that this would significantly reduce the risks and impacts of climate change. The IPCC, in October 2018, published the *Special Report on Global Warming of 1.5°C* (IPCC, 2018). In brief, the report finds that attaining the 1.5°C objective is technically feasible, although very challenging. The 1.5°C goal is also worthwhile in terms of avoiding significant adverse impacts of climate change, even though there is a seemingly small difference between warming of 1.5°C and warming of 2.0°C. In addition, if delivered through a coherent and consistent set of policies and measures, action on climate will also enable and enhance progress on wider sustainable development goals.

Even if global climate change is constrained to between 1.5°C and 2.0°C of warming, inertia within the climate system ensures that climate change and its impacts will continue to occur for the foreseeable future; sea levels will rise and heat waves, droughts, extreme precipitation events, storms and floods will all likely increase in frequency and intensity. With these factors in mind, taking steps to foster the adaptation of human and natural systems to a changing climate is now essential.

The National Policy Position on Climate Change published (DECLG, 2014) sets out Ireland's national objective to transition to a competitive, low-carbon, climate-resilient and environmentally sustainable economy by 2050. This transition is to be guided by a long-term vision of low-carbon transition based on:

- an aggregate reduction in CO<sub>2</sub> emissions of at least 80% by 2050 (compared with 1990 levels) 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, that does not compromise capacity for sustainable food production (DCCAE, 2017)

From the National Policy Position on Climate Change, has come the Climate Change and Low Carbon Development Act (2015), the National Mitigation Plan (2017) and the National Adaptation Framework (2018) and Climate Action Plan (2019). Sectoral adaptation plans, and local authority climate change adaptation strategies have also been recently prepared. Plan-makers need to consider and incorporate the relevant aspects of climate-specific plans in the course of their plan-making.

One of the key mechanisms available to sectoral and local planners in helping understand how human and natural systems will respond to and be affected by climate change is Strategic Environmental Assessment (SEA). This guidance note seeks to outline how climate change can be successfully incorporated into the practice of SEA in Ireland. The findings of the IPCC Fifth Assessment Report (IPCC, 2013) and Special Report on Global Warming of 1.5°C (IPCC, 2018) are summarised in Table 1.1.

*Table 1.1 – Short summary of the IPCC Fifth Assessment Report findings (IPCC, 2013) and the Special Report on Global Warming of 1.5°C (IPCC, 2018)*

Climate aspect	Summary of findings
<b>Observed Changes in the Climate System</b>	Warming in climate system is unequivocal. Human activities are estimated to have caused approximately 1.0oC of global warming since pre-industrial levels (likely range 0.8-1.2°C). Global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate.
<b>Atmosphere</b>	Each of the past three decades has been successively warmer at the Earth’s surface than any preceding decade since 1850.
<b>Oceans</b>	“Virtually certain” that upper ocean (0-700 m) has warmed from 1971 to 2010.
<b>Sea Level</b>	Rate of sea level rise since mid-19th century higher than mean rate during the previous two millennia (high confidence). Over period 1901-2010, global mean sea level rose by 0.19 (ranging from 0.17-0.21) m. Global sea level rise of between 0.26 m and 0.82 m is likely, depending on the effectiveness of global efforts to reduce emissions.
<b>Carbon and Other Biogeochemical Cycles</b>	Atmospheric concentrations of CO <sub>2</sub> , methane and nitrous oxide have increased to levels unprecedented in 800,000+ years. CO <sub>2</sub> concentrations have increased by 45% since pre-industrial times, primarily from fossil fuel emissions and secondarily from net land use change. Oceans have absorbed about 30% of the emitted anthropogenic CO <sub>2</sub> , causing ocean acidification.

Climate aspect	Summary of findings
<b>Water Cycle</b>	Contrast between wet and dry regions and between wet and dry seasons expected to increase (with regional exceptions possible). Oceans will continue to warm during 21st century. Heat will penetrate from the surface to deep ocean and affect circulation.
<b>Detection and Attribution of Climate Change</b>	It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century.

The *Working Group II Contribution to the IPCC Fifth Assessment Report – Climate Change 2014: Impacts, Adaptation and Vulnerability* (IPCC, 2014a) includes information on observed climate change inputs and vulnerability adaptation. It also considers future risks and opportunities for adaptation and guidance in relation to managing future risks and building climate resilience. The *Working Group III Contribution to the IPCC Fifth Assessment Report – Climate Change 2014: Mitigation of Climate Change: Summary for Policy Makers* (IPCC, 2014b) assesses approaches to climate change mitigation, mitigation pathways and measures in the context of promoting sustainable development. The *Special Report on Global Warming of 1.5°C* (IPCC, 2018) includes analysis that compares the mitigation and adaptation challenges of a rise of 1.5°C relative to those of a rise of 2.0°C.

Environmental decision-making, planning and investment needs to respond to the challenges posed by climate change. One of the key responses is to integrate (or mainstream) climate change into all levels of decision-making, including plans and programmes. The European Commission (EC) describes mainstreaming as the functional integration of climate change mitigation and adaptation policy priorities into everyday planning and management. The mechanisms for doing so have recently been the focus of considerable research effort and policy focus across Member States. SEA is becoming recognised as perhaps the most flexible and capable instrument of climate policy integration available internationally and nationally (Desmond and Shine, 2012). It provides a coherent framework for assessing and managing a broad range of environmental risks, which contributes to the integration of climate change considerations into plans and programmes. The integration of climate change mitigation and adaptation into strategic planning through the application of the SEA Directive (2001/42/EC) should lead to better informed, evidence-based plans and programmes that are more sustainable in the context of a changing climate (OECD, 2010).

This updated document is a good practice guide on how to practically incorporate climatic factors into plans and programmes, falling under the remit of the SEA Directive. It is aimed at plan-making authorities and SEA practitioners who, in implementing the requirements of the SEA Directive, need to consider that non-climate specific plans and programmes, such as local authority development plans, may be directly or indirectly affected by climate change, or may affect climate change directly or indirectly. This document should also be useful to anyone involved in undertaking or reviewing SEAs. It presents information on the causes and consequences of climate change; how these causes and consequences can be described, evaluated and incorporated into the SEA; and where appropriate information can be found. In Ireland, both spatial and non-spatial plans and programmes have been undertaken by plan-making authorities at different levels in the planning hierarchy, ranging

from detailed small-scale local-area plans to broad-based national-level strategies. It is envisaged that this guidance will provide useful insights into how climate change should be taken into account in the preparation of the SEA and the draft plan or programme.

This updated guidance provides more up to date climate-related information to that used in the earlier version published in 2015. It also acknowledges the recent plan and programme-related developments that have occurred since then. It has been prepared by the EPA SEA Section in collaboration with the EPA Climate Services Unit. It was informed by a literature review of existing good international practices, external review, and reconfiguration of existing guidance on climate change adaptation in a format that should be usable by SEA practitioners.

In the case of climate-specific plans, such as climate adaptation strategies, plan-makers should ensure that these are prepared in accordance with the relevant departmental guidelines and any updates of these guidelines that may subsequently arise, including:

- Local Authority Adaptation Strategy Development Guidelines (DCCA, 2018)
- Sectoral Planning Guidelines for Climate Change Adaptation (DCCA, 2018)

Plan-makers are also advised to use available SEA process guidance and resources available on the EPA and DHPLG websites.

## 1.1 Strategic Environmental Assessment

The SEA Directive requires plan-makers to identify and evaluate whether a plan or programme being prepared is likely to have significant environmental effects. Twelve sectors are specified as falling under the scope of the SEA Directive (Article 3): agriculture, forestry, fisheries, energy, industry, transport, waste management, water management, telecommunications, tourism, town and country planning and land use. Plans in other sectors, for example climate change, may also require SEA (under Article 3(4)). These should be considered on a case by case basis.

In Ireland, the SEA Directive is transposed by the *Planning and Development (Strategic Environmental Assessment) Regulations 2004* (S.I. No. 436 of 2004 as amended by S.I. No. 201 of 2011) for land-use plans and by the *European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004* (S.I. No. 435 of 2004 as amended by S.I. No. 200 of 2011) for all other sectoral plans.

## 1.2 Climate change

### Observed climate change

The signals of climate change are already evident in Ireland and are expected to continue to increase in the coming decades and up to at least the end of the century. These include changes in key meteorological parameters such as average temperature, rainfall intensity and patterns, as well as increased frequency of extreme events such as flooding and storm surges, the latter exacerbated by rising sea levels. These changes will in turn lead to risks and opportunities in all sections of our environment, society and economy.

Table 1.2 summarises changes in Ireland’s climate over time. In general, there has been a trend towards milder winters, higher overall temperatures, drier summers, changes in the frequency of extremes of weather (e.g. cold snaps, heat waves and stormy conditions). Reduced summer precipitation in the mid to latter part of the 21st century, in combination with increased evapotranspiration rates, is likely to result in marked increases in soil moisture deficits and drought stress in Ireland. Murphy et al (2017) has looked at archival records in newspapers for previous droughts in Ireland, while work carried out by Noone et al. (2017) has extended Ireland’s existing drought catalogue to now cover a 250 year period. Significant changes in the severity and frequency of flood events are also likely as winter rainfall increases throughout the century. Sea level rise will likely lead to coastal and low-lying areas being affected by more flooding than at present, particularly where storm surges coincide with high tides and extreme rainfall events. Irish researchers have contributed to recent international flood-related research, which has looked at the occurrence of major floods across North America and Europe from a climate-variability perspective. (Hodgkins et. al. 2017).

The Marine Institute continues to develop and further enhance their tide gauge network. Surveying upgrades, once complete at certain sites, will enable Irish tidal data to further contribute to global sea-level change studies. The Marine Institute is also contributing to ongoing research into climate-related changes in the Atlantic, sea level rise and ‘decadal climate prediction’. This is an emerging field of research, aiming to improve estimates of future climate over a ten-year timeframe, by using the predictability of how oceans respond to climate change. This research should help to better understand how sea levels have been changing around Ireland and the edges of the Atlantic.

Table 1.2 – Key findings for the status of Ireland’s climate (updated from Desmond et al, 2017)

Climatic aspect	Summary of findings
<b>Atmosphere</b>	<p>Mean annual surface air temperature has increased by approximately 0.8°C over the period 1900-2010. Future projections indicate an increase of 1-3°C compared with the 1961-2000 average</p> <p>Annual decrease in number of frost days and annual increase in number of warm days</p> <p>Average rainfall (nationally) increased by c.60mm (5%) in the period 1981-2010. Projections are for wetter winters and drier summers. For spatial variations, results are more uncertain and indicate wetter winters in the west and drier summers in the east</p> <p>CO<sub>2</sub> concentrations globally are currently higher than at any time in the past 400,000 years. The year 2016 was the first full year with a global concentration of CO<sub>2</sub> above 400ppm. In 2018, the World Meteorological Organization found that CO<sub>2</sub> concentrations are currently at 146% above pre-industrial levels (WMO, 2018)</p> <p>Concentrations of methane and nitrous oxide are more than 257% and 122%, respectively, above pre-industrial values (before 1750) (WMO, 2018) and are continually increasing.</p>

Climatic aspect	Summary of findings
<b>Oceans</b>	<p>Mean annual sea surface temperatures are more than 1°C higher than the long-term average for the period 1961-1990. There has been a rise of 0.6°C per decade since 1994; this is unprecedented in the 150-year observational record, with greatest warming in the Irish Sea</p> <p>Sea level in south-west England (Ireland analogue) shows a rise of 1.7cm per decade since 1916. Satellite observations indicate a rise of 4-6cm per decade since the early 1990s</p> <p>Surface ocean acidity has increased by over 30% since the industrial revolution. Subsurface and deep offshore waters around the coast showed increased acidity between 1991 and 2010.</p>
<b>Terrestrial</b>	<p>Major land-use change from grassland/peatland to forestry, leading to the amount of carbon stored/sequestered in forests increasing by 40% since 1990. The National Forestry Inventory Publications Report for 2017 estimates that “Ireland’s forests have removed an average of 3.8Mt of CO<sub>2</sub> equivalents per year from the atmosphere over the period 2007 to 2016” (DAFM, 2017)</p> <p>Ireland’s soil carbon stock decreased by 27 million tonnes between 1990 and 2000 because of changes in the management of peatlands and to lesser extent changes in patterns of agricultural land use and urban development</p> <p>Extension of growing season observed</p> <p>Tendency for increasing annual mean river flows, particularly summer mean flows. Only some stations, those with the longest records, show increases in winter mean flows.</p>

### 1.3 Observed and projected climate change

New global climate model simulations carried out in Ireland by Nolan (2015) provide an update on the expected changes in the Earth’s climate over the 21st century. Data from this new model and other global models have been downscaled over Ireland to update the projections of the future Irish climate. It is strongly encouraged that plan-makers engage with data providers in the assessment and interpretation of these analyses in the context of sector-specific exposure, risk and vulnerabilities. Recent analysis of historical weather patterns, from Murphy *et al.* (2018), suggests that the variability in Ireland’s climate is greater than that captured in conventional assessment, for example by using 30-year records. The authors suggest that decision-makers consider a broader range of climatic variability in their assessments.

In broad terms the projected changes in the Irish climate and related impacts include:

- continued warming, particularly in the winter and summer, with the largest increases seen in the east;
- more extreme weather conditions, including storms and rainfall events;

- an increased likelihood of river and coastal flooding;
- wetter winters and drier summers, with the latter possibly leading to water shortages; and
- changes in the life cycles, types and distribution of species.

Ultimately, the change in climate will depend on future emissions of GHGs. The Paris Agreement represents the commitment by nearly all countries to limit climate change to less than 2.0°C, and as close to 1.5°C as possible. However, projected estimates of global GHG emissions are not consistent with the objectives of the Paris Agreement, with a best estimate of warming of between 2.5°C and 3.5°C possible, even when countries achieve current levels of ambition of emissions reduction. To address the uncertainty associated with future GHG emissions, a number of agreed Representative Climate Pathways (RCPs) have been developed that are consistent with potential global responses to climate change. These range from limited or ineffective responses, which see global emissions of GHGs continue to rise, with unabated use of fossil fuels, to responses that place the global economy on a low-emissions trajectory, consistent with limiting global warming to below 2.0°C.

An important finding is that many climate models project impacts of climate change out to the mid-century to be largely independent of RCPs, and it is historical emissions that will dominate climate change impacts. In the second half of the century, there is dramatic divergence in model output depending on the RCP emissions scenario.

For specific plans, it may be important to consider the risks associated with failures in achieving the objectives of the Paris Agreement, and therefore provide contingency for greater impacts of climate change than projected under low-emissions scenarios.

### Mitigation and adaptation

Mitigation and adaptation are considered equally important policy responses to climate change. Coherence across all policy areas is also critical. Therefore, as far as possible, plans and programmes should avoid increasing GHG emissions (and ideally enable reductions in emissions) and should be resilient to projected climate change.

**Mitigation measures** are actions that reduce the impact that humans have on the climate system by reducing/managing emissions of GHGs or by providing/enhancing carbon sinks. The most abundant GHGs in our atmosphere are water vapour, CO<sub>2</sub>, methane, nitrous oxide, ozone and chlorofluorocarbons. They are called GHGs because they absorb infrared radiation produced by the sun warming the Earth's surface, trapping heat in the atmosphere. Carbon sinks accumulate carbon-containing compounds and include soils, trees and oceans.

Examples of mitigation measures include good practice in land management moving to more sustainable forms of transport, increasing energy efficiency by improving building insulation, using energy generated from renewable sources, and increasing forest cover.

**Adaptation measures** are actions taken to diminish the vulnerability and increase the resilience of a given system or group of systems to existing or anticipated climate change impacts.

Adaptation responses can take the form of “grey” engineered measures to reduce climate hazards, such as the construction of flood defences; “green” ecosystem or nature-based adaptation measures, such as catchment attenuation, upgrading and conserving of existing sea defences and harbour infrastructure, the restoration of dune systems and wetlands to buffer against sea-level rise; and “soft” adaptations that aim to alter the behaviour of the public through policy or economic instruments, such as reusing buildings and reducing demolition, sourcing environmentally sustainable building materials for major infrastructure, offering discounted insurance on homes that retrofit flood defences or early warning systems that communicate directly and effectively to vulnerable communities and enable appropriate local actions in response to limit exposure and damage.

These approaches can be adopted in isolation or can be co-ordinated to complement each other depending on circumstances.

Adaptation measures are essential in plans and programmes to address the impacts of climate change, given that many of the impacts of climate change are unavoidable in the short to medium term, regardless of how successful climate mitigation measures are in reducing future emissions. When proposing specific mitigation/adaptation measures, it is important to assess the likely environmental effects of the measures themselves. For example, building flood defences may alleviate flood risk but may impact negatively on protected habitats and species.

Our response to climate change should include both adaptation and mitigation objectives and consideration of their interactions. Mitigation and adaptation measures can and should, wherever possible, be coherently integrated within the plan or programmes. For instance, increased temperatures will influence the way that buildings are designed but installing air conditioning may reduce building energy efficiency and add to GHG emissions. Strategic national/regional plans (that cover longer time frames) should include commitments for setting climate change targets and objectives. Lower level plans (with shorter time frames) should seek to achieve these targets through specific commitments and implementable actions. Guidance published by the Department of Communications, Climate Action and Environment (DCCA) will assist local authorities and sectors through the process of developing long-term adaptation strategies, accounting for climate change impacts to mid-century and beyond. These can then be implemented via instruments of planning policy such as Local Area Plans and County Development Plans.

## 1.4 Climate change in SEA

The SEA Directive provides plan-makers with a statutory framework to assess the likely significant effects, including climatic factors, that may arise out of the plan. The scope of the SEA should reflect the plan’s likely significant impacts on the various environmental criteria considered. An environmental report is required to describe the impacts of plans and programmes on “biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and the interrelationships between the above factors”.

Annex I of the SEA Directive requires the environmental report to describe the likely significant effects of implementation of the plan or programme, including long-term as well as short- and medium-term

impacts and cumulative and synergistic effects.<sup>1</sup> Plan-makers are required to consider and assess the effects of other on-going plans and programmes as well as their own. Guidance on Cumulative Effects Assessment in SEA, once prepared, will provide information on the assessment of cumulative effects in the context of SEA.

Annex I of the SEA Directive requires that the environmental report describe “*the measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects on the environment of implementing the plan or programme*”, as well as “*an outline for the reasons for selecting alternatives dealt with*”. In the context of climate change, the identification of mitigation and adaptation measures should include alternative development scenarios and coherently account for climate change impacts and responses to them.

Several characteristics of climate change influence the way in which it needs to be considered in SEA including:

- the long-term and cumulative nature of effects;
- the complexity of cause-effect relationships;
- uncertainty.

The monitoring of SEA-related/strategic environmental protection objectives should allow for an assessment of the likelihood of potential significant environmental effects over the lifetime of a plan or programme and beyond. While the SEA regulations refer to monitoring of the ‘*likely significant effects of implementation of the plan or programme*’, monitoring indicators selected may not necessarily be the same as the strategic environmental objective-related indicators. It is worth noting that the EPA is currently preparing a guidance note on SEA monitoring. For many cyclical plans and programmes, a SEA will already have been carried out on an earlier iteration of the plan; this should allow a review of the changes to the environment since the adoption of the previous plans and programmes. Plan-makers should assess and reflect these changes in their subsequent review/update of the plan.

### Complexity of cause-effect relationships

Annex I of the SEA Directive requires the environmental report to describe the impacts of the plan or programme on the interrelationship of environmental factors. The interrelationships between different environmental aspects such as flood risk, land-use, water quality and biodiversity may have significant implications for specific elements of the plans/programme being prepared, such as infrastructural planning proposals or land-use / zoning changes should be assessed with these interrelationships in mind.

### Uncertainty

Annex I of the SEA Directive requires the environmental report to describe the impacts of the plan or programme on the interrelationship of environmental factors. The interrelationships between different environmental aspects such as flood risk, land-use, water quality and biodiversity may have significant implications for specific elements of the plans/programme being prepared, such as infrastructural planning proposals or land-use / zoning changes should be assessed with these interrelationships in mind.

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1 Synergistic effects occur when the interaction between factors or substances leads to an effect that is greater than the sum of the individual effects. An example is when the thawing of permafrost as a result of global warming releases methane, further increasing the concentration of GHGs in the atmosphere.

As with any area of future/forward planning, many of the uncertainties surrounding the timing and distribution of climate change impacts are difficult to predict and should be documented in the environmental report. For instance, using different climate change models may indicate different degrees of change or variation in climate variables, such as precipitation and temperature. Selecting a single projection value against which to assess the impacts of climate change for the plan/programme may understate the range of potential climate impacts and increases the possibility (or risk) of maladaptation. Instead, a range of plausible future climate change projections and climate impacts is recommended to inform the SEA. A clear description of the projections employed, and their limitations should also be provided, to help understand the decision-making process and assessment findings. Modelling and projection work to date indicates that a hugely significant change is underway. Although some of the parameters determining the precise trajectory of that change are subject to scientific uncertainty, there is very little uncertainty with respect to the future climate differing significantly from that of today.

In the short- to medium-term, uncertainties are primarily due to scientific knowledge gaps. These are mostly related to the inherent variability and chaotic nature of natural phenomena (e.g. rainfall and wind regimes). In the longer-term, the dominant uncertainty relates to the level of ambition and effectiveness of future international actions to address the drivers of climate change, i.e. to reduce emissions of GHGs. This will eventually determine the full extent of climate change and the level of adaptation that will be required.

When considering uncertainties in climate change, plans/programmes in different sectors undergoing SEA, may look to assess and address these differently, depending on the potential impacts on the sector, or where specific issues or locational considerations are concerned. Reference material on how to manage uncertainty in decision-making includes Willows and Connell (2003) and Walker et al. (2013). Additionally, SEA-related research in Denmark (Larsen et al., 2013), looked at how climate change uncertainties are considered within the Danish planning system. This research proposed a model for considering climate change uncertainty, based on awareness of uncertainty, acknowledgement of uncertainty and action on uncertainty. Posas (2011) researched climate change criteria for use in SEA. This research included information on climate change implementation principles specific to SEA (similar to Fischer et al, 2011). From an uncertainty perspective, these principles include identifying approaches to assess future vulnerability and adaptation needs to characterise future climate related risks. These approaches can also help assess future socio-economic conditions and capacity to adapt.

### **Hierarchy of plans and programmes in integrating climatic factors**

This section provides information on the level at which plans and programmes can effectively take account of both climate change mitigation and climate adaptation measures. Table 1.3, taken from *Considerations of Climatic Factors within Strategic Environmental Assessment* (Scottish Government, 2010), shows some typical influences on climatic factors from land-use development plans. It also provides a useful approach/methodology for the assessment of climate change impacts on spatial planning using a hierarchy of plans and programmes. Many similar tables showing typical influences on climatic factors from transport plans, energy and resource plans and other types of plans are also provided in the above guidance and, rather than replicating these tables in full here, the reader is encouraged to review and adapt these resources in the preparation of specific plans and programmes to suit their own specific plan type.

Table 1.3 – Considerations of Climatic Factors in Strategic Environmental Assessment (adapted from Scottish Government, 2010)

Plan Type	Climate Change Mitigation				Climate Change Adaptation			
	Reduce all GHG emissions	Reduce impact of transport through reduction in the need to travel and modal shift	Reduce energy use, increasing energy efficiency and enabling renewable energy generation	Reduce resource use (e.g reducing waste to landfill)	Reduce carbon loss from soils	Resilience to changed frequency and intensity of precipitation, flood risk and flooding	Resilience to changes in patterns of high winds and storminess	Resilience to changes in patterns of droughts and heat waves
Development Plans (SDPs), Local Development Plans (LDPs) and Supplementary Guidance (SG) as indicated	Make efficient use of existing infrastructure to reduce the need for additional facilities with associated emissions from pumping/treatment (SDP/LDP)	Promote development patterns that reduce need to travel (SDP/LDP)	Provide spatial framework for renewables development in appropriate locations (LDP/SG)	Provide spatial framework for new waste facilities such as recycling, composting and thermal treatment (SDP/LDP)	Protect high carbon soils from loss/sealing through new development (LDP)	Avoid building in flood risk areas (LDP)	Avoid development patterns that fragment habitat corridors for movement of species and seek to enhance where possible (SDP/LDP)	Avoid development in areas at risk from erosion including coastal erosion (SDP/LDP)
	Promote high energy efficiency standards (LDP)	Promote mixed use development (LDP)	Support provision of micro-renewables on buildings or in developments (LDP/SG)	Help to reduce waste in development of new buildings and encourage the re-use of construction waste (LDP/SG)	Restrict commercial peat extraction (LDP/SG)	Increase resilience to floods through use of SuDS (LDP/SG)	Encourage design for environmental performance – reduce need for cooling and help to address urban heat island effect (LDP/SG)	Protect and expand native woodland cover (SDP/LDP/SG)
	Use solar gain through layout and design (LDP/SG)	Allocate sites close to existing public transport routes (LDP)	Encourage Combined Heat and Power (SDP/LDP/SG)			Ensure that any new essential infrastructure and service development are not at flood risk (LDP/SG)	Encourage the greater use of green roofs, protect and expand green space and tree cover (SG)	
	Small housing at higher density (LDP/SG)	Prioritise re-use of existing buildings (including underused upper stories) and brownfield land (SDP/LDP)	Promote consolidation and enhancement of existing settlements – cities, towns and villages (SDP/LDP/SG)			Permeable surfaces and green space in new development (LDP/SG)	Consider future water needs and availability when planning new development (SDP/LDP)	
	Tree planting and protection (LDP/SG)	Support car free developments (LDP)					Encourage use of rainwater and grey water (LDP)	

# SEA Process and Climate Change (Mitigation and Adaptation)

## 2. SEA Process and Climate Change (Mitigation and Adaptation)

### Chapter 2 Summary

*Tables for use in considering climatic factors in Screening, Scoping, Alternatives Assessment, Environmental Report, Consultation and Monitoring phases*

Table 2.1 shows a broad overview of the key stages of the SEA Directive requirements and how climatic factors should be considered. Further information on each of the key stages is provided in the other tables in this chapter. For links to EPA SEA guidance and resources, see Appendix B. The Department of Housing, Planning and Local Government is currently updating its existing 2004 SEA Guidelines for Regional Authorities and Plan-making authorities (DHPLG, 2004).

*Table 2.1 – High-level summary of SEA stages and climate change considerations*

<b>Screening</b>	<ul style="list-style-type: none"> <li>■ Establish the characteristics of the plan/programme</li> <li>■ Consider any related energy/emissions/infrastructure etc. demands of the plan</li> <li>■ Consider compatibility of plan with higher level plan climate change commitments</li> <li>■ Assess potential for likely significant effects</li> <li>■ Early consultation</li> <li>■ Determine whether SEA is required</li> </ul>
<b>Scoping</b>	<ul style="list-style-type: none"> <li>■ Establish the environmental (climatic) baseline</li> <li>■ Develop climate change related Environmental Protection Objective(s)</li> <li>■ Consider if the plan is likely to have a significant effect on climatic factors.</li> <li>■ Set out an approach to ensure climate impacts are appropriately assessed.</li> <li>■ Identify environmental vulnerabilities possibly affected significantly by climate change</li> <li>■ Consider adaptation and mitigation options to achieve the plan aims/goals</li> <li>■ Early scoping consultation</li> </ul>
<b>SEA Alternatives</b>	<ul style="list-style-type: none"> <li>■ Consider “reasonable” SEA alternatives to meet plan objectives, while looking to maximise climate resilience where possible</li> <li>■ Select alternatives that avoid or minimise environmental impacts</li> <li>■ Assess energy demands of alternatives, land-use zoning options in spatial plans, transportation/commuting, etc</li> </ul>

<b>SEA Environmental Report</b>	<ul style="list-style-type: none"> <li>■ Assess the plan for likely significant effects, including cumulative effects of climate change on environmental vulnerabilities</li> <li>■ Establish and recommend appropriate climate change mitigation/adaptation measures and fully integrate SEA recommendations into the plan</li> <li>■ Consider whether extending the consultation period, over that specified in the regulations, is warranted.</li> </ul>
<b>Monitoring</b>	<ul style="list-style-type: none"> <li>■ Develop a monitoring programme to monitor the significant environmental effects of plan implementation, to identify early unforeseen adverse effects and undertake appropriate remediation. This monitoring should consider climatic factors.</li> <li>■ Review updated baseline information available throughout the lifetime of the plan at appropriate intervals to determine how effectively the plan is responding to climate change.</li> </ul>
<b>SEA Statement</b>	<ul style="list-style-type: none"> <li>■ Summarise how climatic factors have been integrated into the plan</li> </ul>

Tables 2.2-2.8 set out the main stages in the SEA process where climatic factors can be addressed/assessed and usefully integrated. The format used in this chapter follows the steps involved in the SEA process. The tables in Chapter 3 – Climate Change Baseline should be used in conjunction with these tables, where relevant and appropriate.

*Table 2.2 – Consideration of climatic factors in the SEA Screening stage (modified from Scottish Government, 2010)*

SEA Process	How climatic factors could be considered in the process
<p><b>Stage A:</b> Screening – Determine whether the likelihood for potential significant environmental effects may necessitate SEA.</p>	<ul style="list-style-type: none"> <li>■ Determine whether the plan/programme is likely to significantly increase or reduce greenhouse gas emissions, either directly or indirectly.</li> <li>■ Identify whether the plan/programme is likely to significantly affect the ability to adapt to the effects of climate change, in the area, in the future.</li> <li>■ To estimate the magnitude of the likely effects, the influence of the plan/programme on other plans should be considered.</li> <li>■ Determine whether SEA is required.</li> </ul>

Table 2.3 – Consideration of climatic factors at the SEA Scoping stage (modified from EA, 2011)

SEA Process	How climatic factors could be considered in the process
<p><b>Stage B:</b> Scoping – establish the baseline and decide the scope</p> <ul style="list-style-type: none"> <li>■ Identify other relevant plans, programmes and environmental protection objectives.</li> <li>■ Collect baseline information</li> <li>■ Identify environmental problems.</li> <li>■ Develop SEA objectives.</li> <li>■ Consult on the SEA scope.</li> </ul>	<ul style="list-style-type: none"> <li>■ Identify other relevant plans that have climate change impacts or contain climate change mitigation and adaptation measures that could affect the options being considered.</li> <li>■ Describe the current and likely future climate change baseline based on relevant observations/projections. Multiple scenarios/projections may need to be considered (see Chapter 3 for Environmental Baseline).</li> <li>■ Identify the key likely significant impacts and opportunities created by climate change.</li> <li>■ Consider whether the plan/programme is likely to have likely significant effects on climatic factors and set out an assessment method to assess these in an appropriate way.</li> <li>■ Describe the “<i>likely evolution of the environment</i>” without implementation of the plan/programme. The cumulative climate change effects are particularly important regarding the evolving baseline.</li> <li>■ GIS can be used to overlay maps showing different environmental vulnerabilities. This may indicate areas where vulnerabilities/sensitivities overlap and may require significant protection. The EPA’s GISEA Manual can assist in this process. An Environmental Sensitivity Mapping tool to help plan-making authorities with environmental assessments is now available (EPA/UCD). See <a href="http://www.enviromap.ie">www.enviromap.ie</a></li> <li>■ Develop climate change objectives and indicators for mitigation, adaptation and, where relevant, links between them. The objectives and indicators should take account of the uncertainty of future climate change.</li> <li>■ Consult early with stakeholders on climate change issues to incorporate climate change from the outset.</li> </ul>

Table 2.4 – Climatic factors considerations in developing alternatives (modified from EA, 2011)

SEA Process	How climatic factors could be considered in the process
<p><b>Stage C:</b> Develop and refine reasonable/realistic alternative scenarios and assessing effects.</p> <ul style="list-style-type: none"> <li>■ Test the plan objectives against the SEA objectives.</li> <li>■ Develop strategic alternatives.</li> <li>■ Predict the effects of the plan including pragmatic alternatives.</li> <li>■ Avoid and minimise adverse impacts.</li> </ul>	<ul style="list-style-type: none"> <li>■ Suggest plan alternatives which consider key climate change-related problems (both mitigation and adaptation).</li> <li>■ Develop alternatives based on a “win-win” or “low-regret” approach (see Chapter 7).</li> <li>■ Assess the effects of plan alternatives on the climate change objectives and indicators.</li> <li>■ Consider whether there is the potential for cumulative effects on climatic factors, for example in allowing multiple developments in a specific area, taking account of existing environmental sensitivities (capacity of the environment to absorb further development).</li> <li>■ Avoid “point in-time” predictions: consider trends and environmental conditions with and without the proposed plan (and its alternatives).</li> <li>■ Begin to integrate climate change mitigation and adaptation measures into the plan.</li> <li>■ Refer to EPA guidance on <i>Developing and Assessing Alternatives in SEA</i> (EPA, 2015) for more information.</li> </ul>

Table 2.5 – Climatic factors considerations in SEA Environmental Report and associated consultations (modified from EA, 2011)

SEA Process	How climatic factors could be considered in the process
<p><b>Stage D:</b> Prepare and consult on the Environmental Report (and the draft plan or programme).</p> <ul style="list-style-type: none"> <li>■ Write the draft Environmental Report, including the results of the assessment.</li> <li>■ Consult the public and Consultation Bodies on the draft plan and the Environmental Report</li> <li>■ Assess significant changes</li> <li>■ Make informed decisions and provide information</li> </ul>	<ul style="list-style-type: none"> <li>■ The Environmental Report and Draft plan should clearly explain how climate change issues have been identified and managed, including how uncertainty has been factored into the decision-making process.</li> <li>■ Climate Change mitigation and monitoring related aspects of SEA preparation are covered in detail in Chapter 7.</li> <li>■ Carry out early consultation with authorities responsible for climate change management and others who can provide advice on good practices (see Stage A in Table 2.2).</li> <li>■ Fully integrate climate change mitigation and adaptation measures into the final plan.</li> </ul>

Table 2.6 – Climatic factors considerations in SEA/plan monitoring (modified from EA, 2011)

SEA Process	How climatic factors could be considered in the process
<p><b>Stage E:</b> Monitor the significant effects of implementing the plan on the environment.</p> <ul style="list-style-type: none"> <li>■ Develop aims and methods for monitoring.</li> </ul>	<ul style="list-style-type: none"> <li>■ Monitor the identified significant environmental effects of the plan, including on climatic factors.</li> <li>■ Monitor the effectiveness of mitigation measures in reducing greenhouse gas emissions. Effectiveness of adaptation measures can be difficult to monitor, however whether identified adaptation measures are in place/are being implemented can be monitored.</li> <li>■ Consider the latest climate change science and predictions and how they may relate to the significant effects of implementing the plan.</li> <li>■ Be prepared to respond to any adverse impacts identified.</li> <li>■ Consult EPA guidance note on SEA-monitoring once published.</li> </ul>

Table 2.7 – Climatic factors considerations in SEA Statement preparation (modified from Scottish Government, 2010)

SEA Process	How climatic factors could be considered in the process
<p><b>Stage F:</b> Prepare SEA Statement</p> <ul style="list-style-type: none"> <li>■ Summarise and explain how the findings of the SEA have been addressed</li> </ul>	<ul style="list-style-type: none"> <li>■ Describe how climatic factors has been brought into the plan/programme.</li> <li>■ Describe the relevant commitments related to climate resilience, climate adaptation and climate mitigation.</li> <li>■ Consult EPA guidance note on SEA-monitoring once published</li> </ul>

# Climate Change Baseline

### 3. Climate Change Baseline

#### Chapter 3 Summary

Summary of climate change-related baseline described

The publication *Ireland's Environment 2016 – An Assessment* (EPA, 2016) provides a high-level summary on the status of GHGs and climate change in an Irish context. It describes the key drivers and pressures and responses to climate change that may occur, providing an outlook of GHG projections to 2020, and identifies future challenges to be addressed.

Climate science is continually evolving, with insights emerging from new, advanced modelling and analysis on a regular basis. It is recommended that decision-makers consider the best available analysis. The Climate Ireland web-portal is a useful resource in this respect. (<https://www.climateireland.ie/#!/>).

Tables 3.1 through to Table 3.3 describe more recent information on the observed and projected environmental changes resulting from climate change on a national scale (while Appendix B provides links to baseline data about climate change). These form the “business as usual” scenarios. The “Scientific confidence”<sup>2</sup> and “Projected changes” columns serve as a guide in assessing how climate change should be taken into account in the preparation of plans and programmes.

*Table 3.1 – Observed and projected changes in temperature and precipitation (adapted from Desmond et al. 2017 and Nolan 2015)*

Climate variable	Observed changes	Scientific confidence	Projected changes	Scientific confidence in projection
<b>Air temperature</b>	Mean annual surface air temperature has increased by approximately 0.8°C, over the period 1900-2010	High	Average temperatures will rise by 1-1.6°C by mid-century with largest increase in the east of the country.	Medium (depends on scenario), medium for extremes.
	All seasons are warmer but more so in winter.	High	All seasons are projected to warm (0.9-1.7°C) Strongest signals in winter and summer. Continued night-time warming.	Medium

<sup>2</sup> “Scientific confidence” is confidence in changes observed to date. Confidence projection refers to confidence in projected changes into the future.

Climate variable	Observed changes	Scientific confidence	Projected changes	Scientific confidence in projection
<b>Heat waves</b>	Only one station recorded a significant increase in the heat wave duration index.	High	Highest daytime temperatures are projected to rise by up to 2.6°C Increased frequency of heat waves	Medium
<b>Cold snaps/ frost days/ nights</b>	Less frost; trend of decreasing number of frost nights and decrease in duration (14% to 88% decrease in number; median of 30-40%).	High	Decrease in number of frost and ice days frequency.	Medium
<b>Precipitation</b>	A 5% increase in the period 1981-2010 relative to 1961-1990. In general, larger increases recorded in the western half of the country. Seasonally, small increase across all seasons although spatial distribution and intensity vary.	Medium (low confidence for local details and very low confidence for extremes).	Decrease in mean annual, spring and summer precipitation; however, wetter winters in the west. Spatially, however, there remains a high level of disagreement. Frequency of heavy precipitation events during winter shows increases of up to 20%. Number of extended dry periods is projected to increase. Changes in precipitation are likely to have significant impacts on river catchment hydrology.	Medium
	Fewer snow days.	High	Less snow throughout.	Medium/high

Climate variable	Observed changes	Scientific confidence	Projected changes	Scientific confidence in projection
	Drier summers.	Medium (2007 and 2008 were anomalous but did not reverse the trend).	Drier summers: 5-25% less rainfall in 2021-2060 compared with 1961-2000. Drier summers in the south-east	Low
<b>Extreme events</b>	There is evidence of an increase in the frequency of days with heavy rain (10 mm or more) over the period 1981-2010 relative to the period 1961-1990.		Increase in the frequency of heavy rainfall, particularly in winter.	

Table 3.2 – Observed and projected changes in phenology, hydrology and soils (adapted from Desmond et al. 2017)

Climate variable	Observed changes	Scientific confidence	Projected changes	Scientific confidence in Projection
<b>Phenology</b> <sup>3</sup>	Terrestrial: Longer growing season; earlier spring development in some species. Ocean: Expansion of growth season in upper trophic levels  Changes in timing of lifecycle events observed in many flora and fauna.	High/Medium	Further changes consistent with changes in climate triggers likely  Longer growing season; earlier spring.	High
<b>Extreme weather Events: Storms</b>	There is no evidence of a sustained long term trend in storminess	Low	Fewer, but more intense storms,	Low

3 Phenology is the study of cyclic and seasonal natural phenomena, especially in relation to climate and plant and animal life. Trophic levels represent different hierarchical levels in an ecosystem, consisting of organisms sharing the same function in the food chain and the same nutritional relationship to the primary sources of energy.

Climate variable	Observed changes	Scientific confidence	Projected changes	Scientific confidence in Projection
<b>Flooding</b>	Some evidence for generally higher flow rates in rivers.	Medium	Generally higher flow rate in winter, with greater risk of flooding. Lower flow rates in summer months. Note that this has not been observed to date.	Medium
<b>Ground and surface water run-off</b>	Greater variability in flow rates. Some evidence of shorter flood return periods.	Low, very low for extremes	Intensification of the hydrological cycle leading to increased.	High
<b>Surface freshwater temperatures</b>	Probably consistent with observed changes in air and soil temperature.	Low/Medium	Consistent with air and soil temperatures.	Low/Medium
<b>Soil temperature</b>	Consistent with the observed changes in air temperature.	Medium	Consistent with air temperature: warmer in southeast.	Medium
<b>Ecosystem Carbon</b>	It is difficult to separate the impact of climate on carbon emissions and removals underlying the larger impact of land management.	Low	Longer growth season and wetter conditions may encourage uptake of carbon. However, prolonged dry periods will have an adverse impact.	Low

Table 3.3 – Observed and projected changes for sea temperature, sea chemistry and sea level rise (adapted from Desmond et al. 2017)

Climate variables	Observed changes	Scientific confidence	Projected changes	Scientific confidence in projection
<b>Sea temperature</b>	Irish coastal water temperature increased by 0.85°C since 1950, with 2007 likely to be the warmest year on record (2018 analysis not available). Greater warming has occurred inshore. Greatest warming in the Irish Sea.	High	Ongoing increase in mean sea temperature. Increased intensity of storms.	Medium
<b>Sea chemistry (pH and salinity)</b>	Increased seawater acidity observed; salinity changes vary with region. Atlantic waters freshened from 1960 to 1990 and are now becoming more saline. Associated changes in water mass formation/circulation. No significant changes observed on shelf.	High for acidity, low for salinity	Acidity is projected to increase; salinity changes vary with region. Changes in rainfall will affect coastal salinities.	High for acidity, low or salinity
<b>Sea-level rise &lt;1 m</b>	During the satellite era, sea-level rise of 4-6 cm per decade has been observed.	Low to medium	Rise of 60 cm to 2100. Changes in sea level predicted to magnify impacts of storm surges and wave patterns in coastal areas.	Medium
<b>Sea-level rise &gt;1 m</b>			Sea level rise may exceed 1m if there is a considerable melting of land ice (polar shelves and glaciers).	Low to medium

# Sectoral Impacts of Climate Change

## 4. Sectoral Impacts of Climate Change

### Chapter 4 Summary

*Sector-specific guidance including for agriculture, biodiversity, peatlands, forests and water quality*

A short summary of the potential impacts of climate change on specific sectors is shown below. Further detailed information is available in the report entitled *A Summary of the State of Knowledge on Climate Change Impacts for Ireland* (Desmond et al., 2017) and the National Adaptation Framework (DCCA, 2018).

Under the National Adaptation Framework (NAF), a number of Government departments must prepare 'Sectoral Adaptation Plans'. Once these are available, plan-makers should ensure that any relevant measures and recommendations are incorporated into their plans and programmes. It is also worth noting that the sectoral planning guidelines for climate change adaptation includes recommendations for SEA and AA Screening.

National level sectoral adaptation plans have been prepared for the following sectors:

- 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

## 4.1 Built Environment

Critical infrastructure represents those national infrastructure assets that are essential for the functioning of the country and the delivery/maintenance of vital societal functions. It includes: energy, transport, communication networks, water services and health services. Ireland’s critical infrastructure could be at risk from projected changes in climate and increasing temperatures, sea-level rise, changing rainfall patterns and the increased occurrence of extreme weather events. The existing built environment requires separate consideration as much of this consists of historic buildings and other structures. Table 4.1 provides a summary of climate impacts, climatic variables and possible adaptation options. Tables 4.2 and 4.3 provide climate change impact and adaptation information for different sectors, which may be of use.

### 4.1a Historic Built Environment

The built environment also includes historic buildings and settlements including cities, towns and villages. Much of the historic built environment is of significance for its heritage value but it also represents a considerable stock of embodied energy which has stood the test of time and requires sensitive repair and/or adaptation to ensure its continued contribution to society. The reuse of existing buildings and infrastructure represents a carbon neutral outcome.

*Table 4.1 – Summary of impacts, climatic variables and adaptation options (Desmond et al, 2017)*

Sector	Changes in climatic variables	Impacts	Adaptation options
<b>Transport: road, rail, sea, aviation, ports</b>	Temperature increases in summer and more intense heatwaves	Thermal expansion of roads and rail lines, leading to degradation and disintegration  Impacts of heat on passenger comfort (especially for rail)	Assess vulnerability of infrastructure and design climate-resilient infrastructure  Improved carriage and vehicle design
	Decrease in cold snaps and frost and ice days and nights	May reduce minor accidents and reduce personal and motor insurance costs.	Improved communication of travel conditions and timely advice
	Sea-level rise:	Infrastructure located on low lying coastal areas (e.g. rail lines on east coast, port infrastructure on the East and South coasts, Shannon Airport  Damage to infrastructure(all) and service disruption	New infrastructure managed and controlled to avoid areas susceptible to coastal flooding and erosion  New infrastructure designed to cope with changing weather patterns and extreme events

Sector	Changes in climatic variables	Impacts	Adaptation options
	Extreme events (flooding, winds)	Possible impact on road and rail embankment and verge stability  Changing patterns of siltation for ports	Improved design, monitoring and maintenance.  Improved design, monitoring and maintenance.
<b>Energy: supply and grid</b>	Temperature increases	More energy demands are possible for cooling  Water cooling of power stations including cooling water availability	Review of current and future energy demands
	Sea level rise	Infrastructure; power stations and storage facilities located on the coast are vulnerable Potential damages to offshore wave and tidal energy generation systems	Avoid development in high risk areas such as flood plains unless justifiable.  Enhance design criteria; update disaster preparedness
	Extreme events	Potential damage to power generation and infrastructure	Enhance design criteria; update disaster preparedness
	General Wind Characteristics	Wind generation will deliver at least 35% of electricity demand by 2020 and even more by 2030. Changes in wind regimes over Ireland will have a significant effect on electricity generation.	Effective grid management; investment in diverse renewable energy generation and storage.
<b>Built environmental /construction</b>	Temperature Increases	Changes in energy demand (in both winter and summer when demand for heating and cooling needs may change)	Enhance design criteria to meet changing energy demands
	Changes in precipitation patterns	Vulnerability to groundwater contamination has implications for the location, performance and durability of building stock, waste water treatment and quality of ground water	Building materials must be designed and selected for future exposure conditions  In exposed zones, restrict permissions to sheltered areas
	Sea level rise	Implications for the location, performance and durability of housing stock in low-lying, coastal or flood-prone areas.	Changes in planning regulations, changes in building design, materials, codes and standards.

Sector	Changes in climatic variables	Impacts	Adaptation options
	Extreme events (including wind driven rain)	Implications for the location, performance and durability of housing stock	Buildings must be located to avoid future exposure conditions  Insurance industry to encourage policy holders to cut risk exposure
<b>Built environment /built and archaeo-logical heritage</b>	Temperature increases	Increased microbiological growth  Soil shrinkage affecting foundations and structural stability  Increased risk of fires  Increased pressure to retrofit air-conditioning systems leading to vulnerability to maladaptation  Loss of trees and other features of designed landscapes	Build capacity in construction industry and professions for correct skills in conservation repair and/ or adaptation of historic structures
	Changes in precipitation patterns	Risks of flooding, salt weathering, saturation of building fabric, subsidence,  Damage from ill-advised clean-up and repair works  Changes in relative humidity affecting organic building elements	Increased maintenance and repair regimes to build resilience  Build capacity in construction industry and professions for skills in conservation repair and/ or adaptation of historic structures  Build capacity in insurance industry and in emergency management for dealing with historic built environment  Installation of flood defences to individual buildings or on an area-wide basis  Replacement of existing rainwater goods with those of larger capacity

Sector	Changes in climatic variables	Impacts	Adaptation options
	Sea level rise	<p>Salt contamination, erosion of sites and damage to foundations</p> <p>Rising water table leading to saturation of building fabric</p> <p>Damage to coastal heritage structures and sites</p>	<p>Increased maintenance and repair regimes to build resilience</p> <p>Installation of coastal defences to protect significant sites</p> <p>In some cases, record vulnerable structures and sites with a view to eventual abandonment and loss</p>
	Extreme weather events	<p>Physical damage, loss and collapse</p> <p>Wind throw and other damage to features of cultural landscapes</p> <p>Wind-driven rain and waves saturating building fabric and deterioration of surfaces</p>	<p>Increased maintenance and repair regimes to build resilience</p>

Table 4.2 – Climate change impacts on industry and insurance (Taken from Desmond et al, 2017)

Sector	Changes in climatic variables	Impacts	Adaptation options
<b>Industry</b>	Extreme events	<p>Food, drinks and construction industries impacted</p> <p>Reduced productivity because of compromised supporting infrastructures such as road, rail and communications</p> <p>Chemical and pharmaceutical industries are often located by the coast. May be prone to flooding and sea-level rise.</p>	<p>Plan-making authorities to consider further legislative restrictions on new builds in risk areas</p> <p>Climate change incorporated into long-term planning, design, investment and maintenance of all actors in the transport sector</p>

Sector	Changes in climatic variables	Impacts	Adaptation options
	Temperature increases	<p>Impacts on Information and communication technology (ICT) with additional cooling requirements.</p> <p>ICT/Pharmaceuticals: Rising ambient air temperatures, variations in water quality and availability of cooling water can have effects on chemical processes</p> <p>Heatwaves could damage industrial plants and materials; storms may damage larger industrial infrastructure and mobile machinery.</p>	<p>The establishment of district cooling should be actively considered.</p> <p>Changes in long-term planning, standards and building regulations; use of new building materials</p>
	Changes in precipitation patterns	Impacts on water resources, significant for pharmaceuticals, Information and Communications Technologies, food and drinks.	
<b>Insurance</b>	Extreme events	<p>Financial services impacted by domestic and global extreme events</p> <p>Insurance sector sensitive to weather and climate risks; limits to capacity of global financial markets to absorb risk and to re-insurance capacity</p> <p>Increased risk of industrial contamination of water systems as a result of flooding.</p>	<p>Need a knowledge base of the potential insurance implications for business of climate change.</p> <p>Irish Insurance Federation could develop risk assessment for business insurance</p> <p>Enhanced protection systems mandated under operating licences.</p>

Table 4.3 – Climate change impacts on tourism (Taken from Desmond et al, 2017)

Sector	Changes in climatic variables	Impacts	Adaptation options
Tourism	Temperature	Lengthening of tourism season  Diversification of tourist activities, particularly water-based sports	Respite tourist opportunities (heat refugees from severe heat in other parts of Europe, e.g. the 2015 heatwaves)
	Precipitation	There may be greater demand for winter breaks abroad	Product diversification and innovation
	Extreme weather	Prolonged heatwaves and droughts may put stress on the water supply and tourism products  Storm surges, floods and increased wave heights may damage tourist and heritage sites depending on location	Consider the heritage officer model to address local climate change  Integrated coastal zone management can provide a co-ordinated method of coastal management  Develop tourism infrastructure that is sustainable and climate proof

## 4.2 Agriculture

In recent years, the agriculture sector has experienced adverse impacts from episodes of extreme weather events (storms) and atypical seasonal precipitation and temperatures (flooding, drought, heatwaves and cold snaps). Although, no single event can be attributed to climate change, the exposure and vulnerability of large sections of agriculture to these events is a cause of concern (e.g. fodder crisis of 2013/14, fodder shortage of 2017/18).

Food Harvest 2020 and FoodWise 2025 are industry-led plans to increase agricultural efficiency/productivity across a range of agri-sectors, supported by the Department of Agriculture, Food and the Marine. They include a commitment to reduce carbon intensity of agricultural activities and enhance carbon sinks. In recent years, GHG emissions within the livestock sector have increased significantly, with emissions projected to increase further based on current policies and measures.

Grassland productivity may be reduced over large parts of the south and east of the country as a result of summer droughts, and grass silage may be replaced by maize. Increased problems with slurry storage and spreading in the wetter western parts of the country may occur. The drying out of soils in response to climate change (including in wetlands) could result in the deterioration of soil quality and emission of CO<sub>2</sub>. Increased rainfall may cause increased soil erosion. Subsidence and soil heave may be caused by alternate dry summers and wet winters. Table 4.4 provides climate change adaptation and impacts for agriculture.

Table 4.4 – Key Impacts for Agriculture: Adapted from Desmond et al. (2017)

Sector	Changes in climatic variables	Impacts	Adaptation options
Dairy	Temperature Increases	Extension of growing season by over 35 days per year	Adoption of earlier planting and harvesting
		Extended grazing season	
		All year growth in coastal and sheltered areas.	
		Possible increase in viruses and diseases, e.g Foot and Mouth, Blue tongue viruses in cattle and sheep and aphids in winter crops (Flood 2013).	Introduce and/or increase vaccination and disease control
		Extended viability of disease vectors throughout the year	
	Changes in precipitation patterns	Changes in soil moisture-(increases and decreases) will impact on plant/crop growth	Modification of animal diet
		Impacts on soil carbon stores/sequestration potential	Increased need to cultivate drought and heat resistant crops
	Extreme events (heatwaves): Mid-century projections indicate the warmest 5% of daily maximum summer temperatures are projected to increase by up to 2.6°C	More frequent and intense heatwaves may put water stress on both animals and plants	Protection from the elements. Improved availability of water and shade.
	CO <sub>2</sub> Concentration	Improved net biomass production (possible lower nutrient value). There remains significant uncertainty as to the regional impact on crops and grass	On-going review of plant species

Sector	Changes in climatic variables	Impacts	Adaptation options
<b>Tillage</b>	Temperature Increase:	Increased Irish agricultural production as global agriculture is under stress	Protection from the elements
		Projections for future crop and grass production showed a decrease of up to 9% in cereal crops, increase in maize crops of up to 43-97% and grass production increased up to 49-56%	Adoption of earlier planting and harvesting
	Changes in precipitation	Nutrient leaching, soil erosion and pollution may result (higher risk in winter precipitation?)	Increased drainage to compensate for winter precipitation; possible negative impact of carbon stocks in soils.
	Heavy rainfall:	Water stress in summers Impeded land access because of heavy winter precipitation Water contamination during flooding/heavy rainfall.	Recognise and account for the variability of soil and its capacity to deliver on different soil functions and the use of land is managed in such a way that maximises soil functions
	Drier summers with episodic heavy rainfall events	May cause enhanced nitrous oxide emission events	Nutrient management plans should include options to respond to meteorological conditions
	CO <sub>2</sub> concentration: observed decrease in nutrients and protein in C3 and to a lesser extent C4 crops in high CO <sub>2</sub> growing conditions	Enhanced net biomass production (possible lower nutrient value)	

Sector	Changes in climatic variables	Impacts	Adaptation options
<b>Horticulture</b>	Temperature increases (air and soil)	Changes in the risk of pests and diseases	Pest control
		High temperatures and water stresses may turn carbon sinks into carbon sources	
	Changes in precipitation patterns:	Large volume of research links to nutrient leaching.	Water harvesting (investment in local storage) in winter
		Less rainfall in the summer and increased winter rainfall increase nitrate leaching and impact water quality	Implementation of water management strategies
		Aridity is projected to increase from 40%-120% from 2020 to 2080. Possible increase in irrigation requirement	Adjust herd size in certain regions Grow crops such as maize rather than potato Implications for the total abatement of extended grazing
		Increase in water demand for spray irrigation of 15% in 2020 up to 45% in 2080 under the medium emission scenario and 36% in 2020 up to 58% in 2080 under the high emission scenario	Explore the potential to exploit the variability of soil and capacity to deliver on different soil functions
	Extreme events (Storms, cold events, heatwaves,)	Impact of multiple extreme climate events (e.g. Fodder Crisis 2013)	Some crop and fruit species may need to be adapted to avoid the adverse impact of lack of frost, which triggers phenological phases.
		Reduction in cold snaps and frost days will impact pest die-off and subsequent plant health	
		More frequent and intense heatwaves may put water stress on both animals and plants	May increase the need for irrigation in certain parts of the country.
		Lowland livestock may benefit from less exposure to harsh conditions	

### 4.3 Biodiversity

The EC's Guidance on *Integrating Climate Change and Biodiversity into Strategic Environmental Assessment* (EC, 2013) sets out how biodiversity and climate change aspects can be integrated into the SEA process, including the long-term/cumulative nature of impacts, complexity of issues, cause-effect relationships and uncertainty. Table 4.5 provides a summary of climate change impacts and possible adaptation options related to terrestrial biodiversity.

Table 4.5 – Key aspects for terrestrial biodiversity (adapted from Desmond et al. 2017)

Sector	Changes in climatic variables	Impacts	Adaptation options
<b>Biodiversity</b>	Temperature increases	<p>Species will move to higher latitudes and altitudes</p> <p>Change in phenology of native species</p> <p>Rate of climate change may exceed the adaptive capacity of some species</p> <p>Degraded raised bogs are predicted to have substantial losses in the southern edge of the distribution</p>	<p>Creation of green infrastructure and maintenance and promotion of connectivity of wider landscapes to ensure that species can reach new climate spaces</p>
	Changes in precipitation patterns	<p>Flora and fauna will respond differently to changes in precipitation; in general, temperate climate species will be adversely impacted by more intense hydrological cycles.</p>	
	Extreme events:	<p>Destruction of species or habitats</p>	<p>Creation of farmland habitats to support named species</p> <p>Strategic national policies to maintain healthy ecosystems</p> <p>Establish more diverse agro-forestry systems</p>

Sector	Changes in climatic variables	Impacts	Adaptation options
	Sea level rise	Destruction of coastal habitats	Coastal defences deployment for key infrastructures and 'high nature value' or heritage sites
		Sea-level rise combines with storm surges to accelerate erosion of vulnerable coastal and estuarine habitats and ecosystems	Managed retreat (abandonment)
	Cumulative effects	Threatened habitats will be further endangered	Strategic national policies to maintain healthy ecosystems
		<p>The terrestrial habitats most vulnerable to climate change are:</p> <ul style="list-style-type: none"> <li>■ Upland habitats (siliceous and calcareous scree, siliceous and calcareous rocky slopes, alpine and subalpine heath);</li> <li>■ Peatlands (raised bog, blanket bog); and</li> <li>■ Coastal habitats (fixed dunes – combined with additional threat of sea-level rise to coastal habitats);</li> </ul> <p>Endangered native species; Invasive Species; expansion in range of foothold species</p>	Establish more diverse agri-forestry systems

#### 4.4 Peatlands

Table 4.6 lists aspects of peatlands to be considered in plans and programmes. The areas identified as being most vulnerable to climate change are those where the peat has been degraded through loss of vegetation and structure (DEFRA, 2012). The National Peatlands Strategy (NPS) has been prepared by the National Parks and Wildlife Service and sets the framework for the management of peatlands at a national level. Lower level plans with the potential to impact on peatlands will need to take the finalised NPS into account.

Table 4.6 – Key aspects for peatlands (adapted from Desmond et al. 2017)

Sector	Changes in climate variables	Impacts	Adaptation options
Peatlands	Temperature	<p>Northern species such as <i>Saxifraga nivalis</i> will probably lose a significant part of their distribution as a result of temperature increase</p> <p>Changing vegetation patterns</p> <p>Possible extension of bog species including mosses and bog myrtle</p> <p>Inability to adapt quickly may threaten many species in peatlands</p> <p>Invasive species out-compete native vegetation leading to destabilisation of ecosystems</p>	<p>Fully protect all remaining raised bog habitats that are near intact or degraded but still capable of natural regeneration</p> <p>Maintenance and conservation of wetlands</p>
	Precipitation	<p>Areas most affected will be those that undergo the most changes in both precipitation and temperature such as the basin peat of the Midlands</p>	<p>Reducing the vulnerability of peatlands by a substantial programme of drainage, blocking and wetting or re-wetting</p>
	Projections indicate an increase of ~24% in the number of very wet days (>30 mm) under the high emission scenario by mid-century	<p>A severe diminution of Irish peatland cover by 2075</p> <p>Increased precipitation could lead to more optimal conditions for carbon sequestration but intense rainfall could enhance peatland erosion in susceptible areas</p> <p>Long period of low precipitation may increase the risk of bog fires, especially in drained and degraded peatlands</p>	<p>Maintenance and conservation of wetlands</p>

Sector	Changes in climate variables	Impacts	Adaptation options
<b>Peatlands and Fens</b>	Combined climate factors	<p>Projected loss of climate space at the southern edge of the distribution is indicated for degraded raised bogs</p> <p>The projected available climate space for active blanket bog is regionally sensitive to loss, notably for lower lying areas in the south and west.</p>	Uncertain

## 4.5 Forests

Table 4.7 lists the likely effects of climate change on forestry forests and aspects of forests to be integrated, as appropriate, into plans and programmes.

Table 4.7 – Key aspects for forests (adapted from Desmond et al. 2009)

Sector	Changes in climate variables	Impacts	Adaptation options
<b>Forestry</b>	Temperature	Exotic pests and pathogens introduced to Ireland Root and butt rot fungus such as Fomes may be a greater threat in warmer climates. Over 50% of the species investigated showed significant changes to the timing of leaf unfolding and leaf fall	<p>Pest control</p> <p>Improved monitoring and enforcement systems for pest control. (Eg. the response to <i>Chalara fraxinea</i>, now known as <i>Hymenoscyphus fraxineus</i>, which causes Ash dieback)</p> <p>Diversity in national forest; employ currently unrepresented species</p>
	CO <sub>2</sub> concentrations	Timber quality may be affected by rapid growth resulting from increased CO <sub>2</sub> emissions	Diversification of biomass market to create competitive income streams for multiple grades of biomass product

Sector	Changes in climate variables	Impacts	Adaptation options
	Precipitation	<p>Reduced summer rainfall may lead to loss of productivity, however, there is also evidence of forest growth being limited by current access to water.</p> <p>Soil moisture in general could become an increasingly relevant issue for this sector.</p>	<p>Consider alternative drought-sensitive species</p> <p>Matching the location of forest species to locations will allow appropriate land use</p>
	Extreme Events (storms, extended dry periods)	<p>Reduction in cold snaps will allow certain tree species such as oak and ash (forestry focus) to grow better but such conditions will be detrimental to those species requiring frost</p>	<p>Matching the location of forest species to locations will allow appropriate land use</p>
	Extended dry periods are expected to increase by 7-28% annually under the medium low emission scenario	<p>Frequent strong winds may affect timber supply, in particular blow-down in exposed sites</p> <p>Increased occurrence of droughts can affect tree growth and survival</p>	

## 4.6 Water Quantity and Quality

The aspects of water quantity and water quality that may be affected by climate change, and the associated effects of climate change are summarised in Table 4.8.

Table 4.8 – Key aspects for water resources (adapted from Desmond et al. 2017)

Sector	Changes in climate variables	Impacts	Adaptation options
<b>Water Resources</b>	Temperature	Increased water temperature leading to increased viability of pathogens	Increased monitoring of water resources
	Precipitation	Decrease in water supply in summer Increase in water resources during winter months, impacting on infrastructure	Incentives and regulations to manage demand are required
	Extreme Weather	Frequency of flooding will increase as will the intensity and areas of flooding. This will mean that areas previously not subject to flooding will be at risk. Flood water contamination of water supplies	Adaptation policies and actions should provide for flexible, “no-regrets” strategies and measures that can be adapted to on-going change through a managed adaptive approach
<b>Water Infrastructure</b>	Temperature	Increased water temperature leading to increased viability of pathogens Greater frequencies of drought	Need for increased treatment of wastewater prior to its discharge.
	Decrease in frost days	Decreased frost days and cold days; reduced risk of burst pipes and associated water leakage (damage) but may make pipes more fragile	Development of a national framework and introduction of a single national water authority with responsibility for system planning, delivery and maintenance

Sector	Changes in climate variables	Impacts	Adaptation options
	Precipitation	<p>Stress on the water grid during summer</p> <p>Risks to groundwater quality from septic tank systems in the context of climate change (particularly increased precipitation)</p>	<p>Incentives and regulations to manage demand are required</p> <p>Dwellings should be connected to mains sewerage where practicable.</p> <p>The groundwater monitoring network for quality and levels should be extended to cover aquifers anticipated to become vulnerable because of climate change</p>
	Extreme Weather	<p>Flood water contamination of water treatment plants</p> <p>Impacts of flooding on "legacy septic tanks" [i.e. constructed under SR6: 1991 legislation, before the EPA's <i>Manual on Treatment Systems for Single Houses</i> (2000) and <i>Code of Practice</i> (2009) came into force].</p>	<p>Amendment of legislation for wastewater management and monitoring</p>

## 4.7 Coastal and Marine Resources and Flood Risk

Table 4.9 provides a summary of the key climate variables, observed and projected changes associated with coastal and marine resources. In-combination effects of high tides, high river levels from prolonged periods of precipitation and stormy conditions may combine to exacerbate flooding risk in low-lying areas.

*Table 4.9 – Observed and Projected Changes for Coastal and Marine Resources and Flood Risk: adapted from Desmond et al. (2017)*

Sector	Changes in climate variables	Impacts	Adaptation options
Coastal	Sea-level rise	<p>Areas of 350 km<sup>2</sup> and 600 km<sup>2</sup> will be vulnerable if sea level rises by 1m and 3m, respectively</p> <p>Coastal wetland flood plains and estuaries at risk from saltwater inundation</p> <p>Ground water may be at risk from saltwater. This is problematic as with projected decreases in summer rainfall, Ireland may become increasingly reliant on ground-waters for water supply</p>	<p>At the national level, the National Planning Framework (adopted in 2018) recognises the need for strategic, co-ordinated and integrated planning of land-sea interactions, as well as consideration of climate mitigation and climate adaptation aspects.</p> <p>Climate adaptation and climate mitigation considerations are also expected to feature prominently in the National Marine Planning Framework (currently being prepared).</p>
	Extreme Weather	<p>Coastal damage to promenades and sea defences by storms</p> <p>Tidal flooding (National Directorate for Fire and Emergency Management, 2014)</p> <p>Risk of death, injury, ill-health or disrupted livelihoods</p>	
	Sea surface temperature	<p>Projected increases in sea surface temperatures are expected to increase the intensity of cyclones, which will result in more extreme storm activity with the potential to bring devastating storm surges to the coast of Ireland'</p>	

Sector	Changes in climate variables	Impacts	Adaptation options
<b>Fisheries</b>	Sea temperature and depth-averaged temperature are expected to increase by 0.89 °C and 1.79 °C by 2090	<p>Warming is expected to push fish stock northwards and possibly reduce abundances of current commercial fish</p> <p>Increasing water temperature may have a negative impact on aquaculture</p> <p>Warmer water to aid algal bloom, subsequently causing nutrient run-off and eutrophic conditions</p> <p>Warmer waters may promote new types of bacteria and pathogenic viruses which can threaten fish and shellfish populations</p>	<p>Diversification of species</p> <p>Establish a dedicated research programme to monitor climate change in Irish waters</p>
	Ocean chemistry (acidity, salinity etc)	Could affect the food web in Irish waters, such as primary producers, cold water coral reefs, shellfish and crustaceans	Establish a dedicated research programme to monitor climate change in Irish waters
	Extreme weather	Heavy precipitation may lead to increased influx to fluvial systems, including increased contamination	
<b>Marine Infrastructure</b>	Sea level rise Extreme events (storms, surges)	<p>Coastal infrastructure (e.g. ports, marinas, etc.) will be impacted;</p> <p>Those working in maritime transport, commercial fisheries and off-shore enterprises at risk</p>	Nationally, climate adaptation considerations are expected to feature prominently in the National Marine Planning Framework (currently being prepared).
<b>Tidal/ocean/offshore energy</b>	Sea level rise	Impact on the location and operation of tidal, ocean/off shore energy infrastructure	Technology is fast developing. Difficult to assess vulnerability of these conditions. Strong need for awareness of climate change impacts (and CO <sub>2</sub> concentrations) on parameters controlling infrastructure performance and longevity.

Sector	Changes in climate variables	Impacts	Adaptation options
	Extreme Weather	Increased storminess and windiness will put maritime transport and off-shore energy infrastructure at risk	Engineering more resilient infrastructure
	Ocean Chemistry	Potential impacts on infrastructure	

## 4.8 Human Health

The potential impacts of climate change on human health may occur at some significant periods of hot or cold weather events. Prolonged heat or cold spells may give rise to heat/cold stresses and associated effects. Prolonged periods of significant icy/flood events may affect emergency services’ ability to deal with emergencies. Table 4.10 shows some of these potential impacts and adaptation options.

Table 4.10 – Key aspects for human health and well-being (adapted from Desmond et al. 2017)

Sector	Changes in climate variables	Impacts	Adaptation options
<b>Health</b>	Temperature	A 1°C increase above 15°C in mean temperature was associated with a 1.5% and 1.6% increase in total mortality in rural and urban areas, respectively	Coordinate approach of the health sector in assessing and preparing for climate change impacts
		Rising temperatures in summer are likely to increase heat-related mortality and morbidity	Public education on appropriate actions to take during warm weather
		Higher temperatures pose risks to health from changes in air quality.	There is little national research on this topic.

Sector	Changes in climate variables	Impacts	Adaptation options
	<p>Temperature: Coldest night time temperature are projected to increase by 1.4°C in the South West of Ireland and by up to 3.1°C in the North under the high emission scenario.</p>	<p>Cold-related mortality may decrease because of increasing winter temperatures; there is a risk of loss of societal learning/ knowledge to appropriately responses to cold weather.</p>	<p>Public awareness and educational programmes</p>
	<p>Temperature: warmer conditions (also combined with wetter conditions)</p>	<p>Food-borne diseases are likely to increase due to enhanced environmental conditions for bacterial growth and viral survival and inadequate food safety practices</p>	<p>Public education on diseases and ways to prevent and combat them should be given. Reviewing and monitoring food safety standards</p>
		<p>Although not necessarily caused by climate change, several vector-borne diseases (i.e. diseases spread by insects and ticks) have emerged and expanded in Europe in recent years. These include vivax malaria, West Nile fever, dengue fever, Chikungunya fever, leishmaniasis, Lyme disease (already present in the UK) and tick-borne encephalitis.</p>	<p>There is very little national level knowledge or research in this potentially emerging area</p>
	<p>Phenology: pollen and other biogenic allergens</p>	<p>Budburst for birch has been observed to have advanced by approximately 26 days in the period 1954-2000  The projected budburst for birch will be earlier by 2100 which has implications for the birch allergy season</p>	<p>Public education on warning systems on ways to prevent and alleviate symptoms</p>

Sector	Changes in climate variables	Impacts	Adaptation options
	Precipitation: number of very wet days will increase annually by 24% under the high emission scenario	Increase in rainfall and flooding may cause more water-borne diseases from contamination of drinking water and inadequate cleaning practices	<p>Practical advice and assistance should be provided to those affected, particularly those most vulnerable, including shelters</p> <p>Evaluate the microbiological quality of water used for washing and irrigation</p>
	Extreme weather:	Heatwaves and warmer drier summers are likely to result in more people sunbathing, possibly leading to more cases of skin cancer	Education with respect to appropriate behaviour and prevention measures should be provided, particularly with respect to identified vulnerable groups and facilities
	Extended dry periods are likely to increase by 12-40% during the mid-century summer months, under both the medium to low and high emission scenarios	Flooding may also give rise to increased cases of infectious diseases	
	Heavy Precipitation: Annual number of very wet days (> 30 mm) are projected to increase by ≈24% under the high emission scenario by mid-century	Some potential to affect mental health	The public should be warned, and safety advice should be provided

## 4.9 The Economy and Society

Flood events and consequent subsidence may damage critical infrastructure such as roads, rail, electricity, water and communications, as well as domestic and commercial buildings. Loss or damage of buildings and sites of significant heritage value could cause reputational damage to the nation and loss of public confidence. This could cause substantial losses to productivity, economic confidence and societal wellbeing. This may lead to increases in insurance premiums because of increases in the number and magnitude of claims being made, in turn diminishing consumer spending power and increasing business overhead costs. Prolonged hot or wet periods may also affect crop yields.

However, opportunities may exist for the Irish economy and society from a changed climate. For example, a warmer climate may make the country a more favourable tourist destination, particularly compared with continental Europe and the Mediterranean region, which may be increasingly affected by severe heatwaves and droughts (Sweeney *et al.*, 2013). Diversification/intensification of food production as a result of a warmer climate for certain crops may also prove beneficial. However, any proposed intensification of agriculture production may itself lead to increases in GHG production, from ruminant sources and increased use of fertilisers, and may adversely impact water quality, soil infiltration rates and biodiversity. Opportunities may also exist in terms of the green economy and business opportunities, such as ecosystem services.

# Considering the Relationship with Other Relevant Plans and Programmes

## 5. Considering the Relationship with Other Relevant Plans and Programmes

### Chapter 5 Summary

*Information on how to take other plans and programmes into account, how the plan or programme can influence (or be influenced by) other plans and programmes and the need to consider potential for cumulative effects on the environment.*

The SEA Directive requires that the environmental report must describe “the relationship with other relevant plans or programmes”. The study *Integrating Climate Change Adaptation into Sectoral Policies in Ireland* (Desmond and Shine, 2012) identified other plans and programmes with relevance to climate change objectives. It identified where climate change has been or could be integrated into a number of relevant policy sectors, including agriculture, water, flooding, coastal and marine and spatial planning.

This study suggested the key stages when climate adaptation is being integrated into sectoral decision-making. Table 5.1 shows an example of the information provided in considering the integration of climate adaptation in energy-related decision-making.

Plans and programmes should identify, refer to and consider how the hierarchy of relevant climate change-specific plans and programmes, may influence (or be influenced by) the plan or programmes being prepared. The aim should be to coordinate effective implementation and alignment within the planning hierarchy, in adapting to and responding to climate change.

*Table 5.1 – Examples of Entry points for integrating climate change into energy decision-making (adapted from Desmond and Shine 2010)*

Policy Level	Key National Actors	Policy Cycle Sage	Key Entry Points
EU-DG Energy	DCCAIE	All	Review of Energy Policy
National	DCCAIE	Implementation	Engagement with Commission on Energy Regulation to integrate climate adaptation into guidelines and regulations for the energy sector
	DHPLG	Formation/Implementation	Interim Guidelines for Planning Authorities on Statutory Plans, Renewable Energy and Climate Change (DHPLG, 2017)
			Existing Wind Energy Guidelines (DHPLG, 2006) are also currently being reviewed

Policy Level	Key National Actors	Policy Cycle Sage	Key Entry Points
National	DCCAE	Formation/Implementation	Climate change impacts and adaptation could be integrated into future National renewable energy action plans.
	All Government		Climate Action Plan 2019 National Energy and Climate Plan National Adaptation Framework National Mitigation Plan National Planning Framework
	Relevant parent department		Sectoral Adaptation Plans
National	DCCAE/ Infrastructure owners	Implementation	Review of codes and standards for the design and safety of structures, power plants, electricity and gas network substations, oil storage and dams based on climate change projections.
	Department of Transport, Tourism and Sport (DTTAS)	Implementation	National Policy Framework for Alternative Fuels Infrastructure for Transport
National	DCCAE/ Infrastructure owners	Implementation	National Energy and Climate Plan;
Local	Infrastructure owners	Implementation	Energy plant output could be reviewed in context of climate change e.g. outputs from wind, wave and hydropower.
	Local Authorities	Formation/Implementation	Local authority adaptation strategies/climate change action plans
Sectoral Research	DCCAE	Implementation	Review of wind and wave atlases could take climate impacts and projections into account



# Climate Change Objectives and Indicators

## 6. Climate Change Objectives and Indicators

### Chapter 6 Summary

*Information on climate change objectives, indicators, suggested mitigation and adaptation measures and information sources*

The SEA Directive requires that the environmental report should determine the “*environmental protection objectives, established at international, European Union or national level, which are relevant to the plan and the way those objectives and any environmental considerations have been taken into account during its preparation*”.

Following identification of the key issues associated with the plan or programme, the plan or programme/SEA-making team should develop Climate Change Objectives and Indicators as part of the identification of Strategic Environmental Objectives. A range of climate change objectives and indicators are shown in Tables 6.1 and 6.2. These should be taken into consideration in plans and programmes as appropriate. Table 6.3 provides a summary of the number of adaptation indicators available for different sectors.

*Table 6.1 – Possible SEA climate change objectives (amended from on EA, 2011)*

Section	Possible SEA objectives
<b>Mitigation measures</b>	Minimise future climate change by: <ul style="list-style-type: none"> <li>■ Reducing the need to travel/increased use of public transportation.</li> <li>■ Increasing energy efficiency.</li> <li>■ Utilisation of lower carbon fuels</li> <li>■ Decreasing usage of fossil fuels and increasing renewable resource usage.</li> <li>■ Spatial planning – restriction of inappropriate development/land-use zoning in flood risk zones, inclusion of green infrastructure; sustainable drainage system technologies.</li> <li>■ Controlling abstraction of drinking water (surface and ground water).</li> <li>■ Maintaining/protecting natural carbon sinks (bogs/marshes/forests).</li> </ul>

Section	Possible SEA objectives
<b>Adaptation measures</b>	<p>Reduce vulnerability to the impacts of climate change by:</p> <ul style="list-style-type: none"> <li>■ providing adequate health and critical service infrastructure</li> <li>■ providing adequate surface water drainage infrastructure to adapt to changes in seasonal rainfall; use of sustainable drainage system technologies</li> <li>■ zoning and rezoning of land uses to restrict potentially inappropriate development in flood-prone areas</li> <li>■ supporting the utilisation of energy-efficient and water-efficient building design to better equip homes and businesses to cope during times of shortage and service interruption, such as grey-water recycling, passive houses.</li> <li>■ Increasing maintenance and repair programmes for existing buildings and increasing skills training in the construction industry and associated professions for appropriate adaptation of the historic built environment</li> <li>■ use of integrated coastal zone management</li> <li>■ providing robust transport infrastructure</li> <li>■ use of increased green infrastructure provision in land-use plans</li> <li>■ avoiding situations that limit adaptation to climate change.</li> <li>■ developing ecologically resilient and varied landscapes.</li> <li>■ establishing and preserving ecological networks.</li> <li>■ fostering adaptive management practices in the face of uncertainty, favouring flexible adaptation options and allowing for alteration of plan/programme as monitoring and evaluation data become available.</li> </ul>

Table 6.2 – Suggested climate change indicators and information sources<sup>4</sup> (adapted from EA, 2011)

Aspects of climate change	Possible indicators	Potential information sources
<b>Causes</b>	<ul style="list-style-type: none"> <li>■ Carbon emissions per person</li> <li>■ Greenhouse gas emissions</li> </ul>	<p>DCCAE</p> <p>EPA</p> <p>EEA</p>
<b>Climate variables/ weather</b>	<ul style="list-style-type: none"> <li>■ Sea level</li> <li>■ Precipitation</li> <li>■ Temperature (air, ground, sea surface)</li> <li>■ Flood levels in rivers</li> <li>■ Weather extremes (heatwaves/cold snaps/prolonged heavy rainfall)</li> </ul>	<p>DECLG</p> <p>EPA</p> <p>Met Éireann</p> <p>OPW</p> <p>Marine Institute</p>

4 **Other key resources** include the EPA 'Ireland's Climate Information Platform', (ICIP) which provides a 'one stop shop' resource to assist in: 1) information provision; 2) capacity building; and 3) decision support, associated with actions to meet the challenges of climate change. Recent EPA report, Kopke et al (2018), aims to identify draft adaptation indicator sets; See: [http://www.epa.ie/pubs/reports/research/climate/Research\\_Report\\_263.pdf](http://www.epa.ie/pubs/reports/research/climate/Research_Report_263.pdf)

Aspects of climate change	Possible indicators	Potential information sources
<b>Local impacts of climate/ weather</b>	<ul style="list-style-type: none"> <li>■ Annual hosepipe bans/rationing</li> <li>■ Effects on biodiversity</li> <li>■ Human health (excess deaths attributed to weather)</li> <li>■ No. of cases of subsidence/insurance claims for subsidence</li> <li>■ New instances of recurring flooding</li> <li>■ Surface water flow and quality</li> </ul>	Local Authorities DCHG/NPWS NBDC HSE/HSA Insurance companies OPW EPA Teagasc IFI
<b>Mitigation measures</b>	<ul style="list-style-type: none"> <li>■ Household energy/water usage</li> <li>■ Total electricity and gas usage</li> <li>■ Distance travelled (per person/per year) by public/private transport</li> <li>■ % energy supplied by renewable sources</li> <li>■ % energy efficiency of buildings</li> <li>■ % of homes receiving subsidies for improving energy conservation installations/appropriate fabric upgrade</li> <li>■ % of existing houses achieving a good energy rating</li> <li>■ % of new houses achieving a top energy rating</li> </ul>	DCCAE SEAI NTA TII Bord Gáis ESB
<b>Adaptation Measures</b>	<ul style="list-style-type: none"> <li>■ No. or % of houses on flood plains</li> <li>■ % of roads/railways on flood plains</li> <li>■ No. of planning permissions granted contrary to ABP recommendations on flood risk grounds</li> <li>■ % of developments incorporating sustainable development systems</li> <li>■ % of land zoned for green infrastructure in urban settings (drought resistant)</li> <li>■ Consolidation of historic towns, their buildings and infrastructure</li> <li>■ Enhancement of ecological networks/linkages through habitat creation/restoration</li> </ul>	Local Authorities OPW Iarnród Éireann Irish Water NTA TII DCHG NPWS etc.

Table 6.3 – Summary of number of identified draft adaptation indicators by sector based on available data (From Kopke et al, 2018)

Sector	Total Number of indicators identified	Number of indicators with data available at national and/or organisational level	Number of indicators without evidence of available data
Marine and Fisheries	25	14	11
Agriculture	27	18	9
Coastal Areas	37	19	18
Biodiversity	16	9	7
Water Management	23	8	15
Tourism, Landscape and heritage	31	10	21
Health	30	7	23
Business	19	7	12
Critical Infrastructure	15	3	12
Forestry	26	18	8



# Climate Change (Mitigation and Adaptation) Responses

## 7. Climate Change (Mitigation and Adaptation) Responses

### Chapter 7 Summary

*Examples of mitigation and adaptation measures for spatial and non-spatial plans and programmes*

*Examples of how aspects of climate change can be integrated into plans and programmes*

This chapter provides information on how mitigation and adaptation measures can be incorporated into SEA effectively. Different types of commitments are also described to provide examples of how these measures can be integrated.

### 7.1 Inclusion of Mitigation and Adaptation Measures in SEA

The plan-maker must consider mitigation and adaptation measures if a plan or programme has been assessed to have significant adverse impacts on climatic factors or to result in increased vulnerability to climate change. This should be done as early as possible and be taken into consideration when assessing alternative development scenarios. Although a plan or programme may include proactive initiatives and commitments to avoid climate change impacts, these may not succeed in reducing GHG emissions or vulnerability to climate change. This is because of other factors, such as lifestyle choices affecting car choice, with car usage counteracting even the most well-intentioned plan or programme commitment.

Tables 7.1 and 7.2 suggest a wide range of measures to mitigate and adapt to climate change. The principles to be applied in identifying appropriate mitigation and adaptation measures are as follows.

- **Keep options open and flexible**, so that further measures or strategies can be put in place to meet needs identified in the future. Given the uncertainties inherent in predicting future climate change, consideration should be given to factoring flexibility into plans, through, for example, the provision of buffer zones between developments and sites of ecological importance, avoiding inappropriate development in areas of known flood risk, promoting heritage-led regeneration and reuse of existing cultural assets and ensuring that sufficient flexibility is maintained within plans and programmes to alter course should future climate impacts differ significantly from those anticipated. Where uncertainty exists or baseline data are unavailable, this should be highlighted in the plan or programme. Prioritising addressing data gaps should inform analyses of how the environment is changing within the plan or programme area and allow plans to be reviewed against up-to-date information.
- **Avoid decisions that will make it more difficult to manage climate risk in the future.** One example is inappropriate development in flood risk areas; another could be enhanced drainage works to improve agricultural land that reduce water retention on land but increase flood risk downstream.

- **Consider the level of “regret” involved in implementing the option: will it be effective regardless of how climate change is manifest in the future?**
  - i. **No-regret adaptation options** are those that deliver societal benefits regardless of the future climate impact regime encountered. Examples include capacity-building actions or activities, or savings-targeted activities such as reducing leakage from water systems in drought-threatened areas.
  - ii. **Low-regret adaptation options** are those that carry a relatively low cost but offer the potential for significant climate resilience enhancement. Examples include raising the minimum floor height of new-build dwellings in areas that may be flood-prone in the future or acting to ensure the long-term health and well-being of natural climate-buffering habitats such as dune systems and wetlands.
- **Seek “win-win” measures if possible.** Win-win options are those that serve a dual purpose, enhancing resilience to climate change impacts while also providing an alternative societal benefit, such as providing societal recreational and amenity opportunities as an integral part of new infrastructural development, responding to the threat posed by increased storm intensity and sea-level rise by building an artificial reef, thus dissipating wave energy to prevent coastal erosion and also serving to provide recreational opportunities for surfers and a nursery habitat for inshore fisheries.
- **Choose to implement flexibility/adaptive management in planning for climate change,** staging the implementation of adaptation options incrementally over time wherever possible. Options that score highly in terms of their flexibility are those that allow for changing course as new information becomes available, allowing planners and manager to learn how best to respond to climate impacts without committing resources inappropriately or unnecessarily. This type of adaptation option is typically prefaced by a period of observation and monitoring, which then leads to the commitment of resources to a specific course of action. An example of flexible adaptation would be the prevention of future residential zoning and the de-zoning/rezoning of existing residential lands in areas at significant risk of flooding, particularly in areas where flood alleviation measures are not viable to establish/maintain.

Optimal adaptation policy responses should ideally be based on “win-win” or “co-benefit” decision-making processes. Decision-making, which includes adaptation, mitigation, and wider sustainable development objectives that would generate net social and/or economic benefits, irrespective of how the impacts of anthropogenic climate change unfold, should be encouraged.

## 7.2 Climate Change Mitigation Responses

Mitigation is primarily concerned with limiting the production of GHGs. Table 7.1 shows a range of possible mitigation measures.

Table 7.1 – Categories of Mitigation and Some Examples (Adapted from EA, 2011)

Mitigation Measure	Examples for land use plan	Examples for non-land use plan
<b>Buildings</b>	<ul style="list-style-type: none"> <li>■ Support energy-efficient building design</li> <li>■ Promote building of energy-efficient smaller homes/higher density homes appropriate to demographics and with greatest infrastructure available</li> <li>■ Promote renewable and low carbon energy</li> <li>■ Create or enhance carbon sinks</li> </ul>	<ul style="list-style-type: none"> <li>■ Retrofit existing houses with insulation to increase energy efficiency</li> <li>■ Reuse and repair existing built heritage buildings and infrastructure</li> <li>■ Consolidate the extant fabric and structure of historic towns and villages</li> <li>■ Upskill the construction industry and associated professions in conservation repair and/or adaptation of the historic built environment</li> <li>■ Promote re-use of recyclable building materials with low embodied energy</li> <li>■ Promote renewable energy through plans such as an offshore renewable energy development plan, county wind and renewable energy strategies, Building Design Guidelines (included in County Development Plans), etc.</li> </ul>
<b>Transport</b>	<ul style="list-style-type: none"> <li>■ Support construction of green routes/cycleways/pedestrian routes</li> <li>■ Support car-free developments</li> <li>■ Strengthen public transport linkages and encourage their use</li> <li>■ Support localisation of jobs/shops/services to minimise the need for most common travel patterns</li> </ul>	<ul style="list-style-type: none"> <li>■ National/Regional Transport Strategies such as the Greater Dublin Area Transport Strategy, National Transport Authority Cycle Network Plan, Metropolitan Area Transport Strategies, County/Local Traffic Management Plans, Primary and Secondary Roads Needs Studies, etc.</li> <li>■ Support improved fuel efficiency in vehicles</li> <li>■ Support public transport</li> <li>■ Encourage local holiday destinations; reduce the need for air travel</li> <li>■ Promote purchasing of local foods/farmer's markets etc.</li> </ul>

Mitigation Measure	Examples for land use plan	Examples for non-land use plan
<b>Energy production</b>	<ul style="list-style-type: none"> <li>■ Promote energy-efficient building design</li> <li>■ Promote links between developments and renewable energy resources, for instance by sourcing energy on-site (renewably or from low-carbon fuel sources)</li> </ul>	<ul style="list-style-type: none"> <li>■ Development of Sustainable Energy Action Plans that promote generation of localised electricity, use price incentives that rise with increased energy usage/congestion charging to discourage wasteful energy usage</li> </ul>
<b>Minerals/Waste</b>	<ul style="list-style-type: none"> <li>■ Locate developments strategically (e.g. waste materials) to minimise the need to travel, subject to health aspects/business needs</li> </ul>	<ul style="list-style-type: none"> <li>■ Encourage capture and re-use of landfill gas.</li> <li>■ Encourage home composting and promote provision of brown bin service where possible.</li> </ul>
<b>Agriculture, Land Management and Forestry</b>	<ul style="list-style-type: none"> <li>■ Establish new community woodlands in urban/urban fringe areas</li> <li>■ Support production of sustainable biofuels (farm contributions to localised energy supplies – biofuels/wind energy production)</li> <li>■ Implement higher level plan recommendations/objectives/policies</li> </ul>	<ul style="list-style-type: none"> <li>■ Maintain/enhance natural carbon sinks such as bogs/wetlands/forests</li> <li>■ Reduce carbon loss from agricultural soils</li> <li>■ Support recycling of food waste into biogas/organic fertiliser – anaerobic digestion systems</li> <li>■ Implement River Basin Management Plans/Freshwater Pearl Mussel Sub Basin Management Plans/Biodiversity Action Plans, Nutrient Management Plans, etc., with the aim of protecting biodiversity resources from intensification of agriculture</li> </ul>

### 7.3 Climate Change Adaptation Responses

Adaptation measures are planned responses to the impacts of current and future climate change. Table 7.2 shows a range of examples of measures that can be included in plans and programmes. Specific sectoral adaptation will be detailed in the respective government department sectoral adaptation plans. These should be consulted and integrated, where relevant and appropriate.

Table 7.2 – Categories of adaptation and relevance for plans/programmes (adapted from EA, 2011)

Sector	Examples for land use plan	Examples for non-land use plan
<b>Buildings</b>	<ul style="list-style-type: none"> <li>■ Establish exclusion zones for development in flood risk areas</li> <li>■ Specify design standards that minimise disruption/losses during periods of extreme weather/drought</li> <li>■ Consider effects of building density and mixed developments on energy consumption</li> <li>■ Promote the repair and reuse of existing buildings particularly of underused upper floors in urban areas</li> <li>■ Include green roofs and good ventilation</li> <li>■ Enhance flood resilience of buildings, e.g. elevated work surfaces and storage facilities, raised sockets and electrical infrastructure, enhanced flood boards</li> <li>■ Rezoning/de-zoning flood risk lands</li> <li>■ Assess existing infrastructure for “fitness for purpose” under new climatic conditions</li> <li>■ Consider how to maintain required comfort conditions in buildings, especially hospitals, schools, retirement homes, etc.</li> <li>■ Promote the use of permeable surfaces to decrease run-off rates</li> <li>■ Institute grey-water recycling schemes to decrease abstraction of potable surface water resources, thus reducing water stress during periods of low rainfall</li> <li>■ Maximise water conservation n Plant drought-resistant plants/trees in public amenity areas to provide shade and increase green infrastructure linkages</li> </ul>	<ul style="list-style-type: none"> <li>■ Introduction of water meters and associated charging for water supply</li> <li>■ Promotion of energy and efficiency in building design, materials, transport infrastructure etc.</li> <li>■ Conservation of water resources</li> <li>■ Upskill the construction industry and building professions in the conservation repair and/or adaptation of historic buildings</li> </ul>

Sector	Examples for land use plan	Examples for non-land use plan
<b>Water management</b>	<ul style="list-style-type: none"> <li>■ Increase resilience to flooding through Sustainable Drainage System</li> <li>■ Harvest rainwater/grey water</li> <li>■ Ensure adequate/appropriate water supply and drainage provision.</li> <li>■ Prepare Water Conservation Strategies</li> </ul>	<ul style="list-style-type: none"> <li>■ National Water Resources Plan</li> <li>■ Reduce water leakage and water usage, increase permeability of pavements, parking areas, roadways, etc.</li> <li>■ Limit agricultural/industrial/ domestic discharges to surface waters</li> </ul>
<b>Infrastructure, including flood defences</b>	<ul style="list-style-type: none"> <li>■ Ensure that critical infrastructure and services (particularly emergency services) are resilient to new climatic conditions</li> <li>■ Review land use zoning for compatibility with level of flood risk identified in flood risk management plans.</li> </ul>	<ul style="list-style-type: none"> <li>■ Upgrade Waste Water Treatment Systems to cope with increased intensity of rainfall</li> <li>■ Accept some loss of coastal areas to sea-level rise</li> <li>■ Construct flood/surge defences where feasible and ecologically/ economically rational</li> <li>■ Assess/maintain/upgrade drainage networks, infrastructure design and capacity, road/rail design, undergrounding of cables, etc.</li> </ul>
<b>Agriculture, forestry and land management</b>	<ul style="list-style-type: none"> <li>■ Support diversification of the rural economy to promote crop viability options etc.</li> <li>■ Encourage afforestation (where environmentally appropriate) to enhance interception and infiltration of precipitation within river basin catchments.</li> <li>■ Support restoration of peat bogs when turf cutting has ceased.</li> <li>■ Incorporate recommendations from the National Peatlands Strategy</li> </ul>	<ul style="list-style-type: none"> <li>■ Plant drought-resistant crops/ flood-resistant crops</li> <li>■ Establish low-impact chemical approaches to controlling pests/ diseases in crops arising under new conditions</li> <li>■ Support recommendations of the National Rural Development Programme</li> </ul>
<b>Wildlife and biodiversity</b>	<ul style="list-style-type: none"> <li>■ Create/enhance ecological linkages and buffer zones from development</li> <li>■ Create/protect ecologically resilient and varied landscapes to help support a wide range of species</li> </ul>	<ul style="list-style-type: none"> <li>■ Protect designated sites, habitats and species and associated linkages</li> </ul>

Sector	Examples for land use plan	Examples for non-land use plan
<b>Economy and tourism</b>	<ul style="list-style-type: none"> <li>■ Support opportunities for increased tourism as a result of warmer summers, within the limits of existing infrastructure</li> <li>■ Promote dual-usage (low-regret) adaptation options, such as dune/wetland restorations that buffer against storm surges/ sea level rise while providing enhanced tourism and recreation amenities</li> <li>■ Promote Wetlands Ecosystems Services in developments where relevant and appropriate</li> </ul>	<ul style="list-style-type: none"> <li>■ Develop skills to respond to climate change (emergency planning, develop new goods/ services)</li> <li>■ Take advantage of opportunities for increased tourism as a result of warmer summers</li> </ul>
<b>Human Health, Risk and Insurance</b>	<ul style="list-style-type: none"> <li>■ Provide green infrastructure to provide shade in urban areas</li> <li>■ Provide building methods and materials to reduce the impacts of heat stress</li> <li>■ Appropriate maintenance of surface water drainage infrastructure to avoid flood risk</li> <li>■ Use flood risk assessments to direct development and zoning of lands to appropriate areas based on vulnerability of land use or development function</li> </ul>	<ul style="list-style-type: none"> <li>■ Ensure that health sector has the capacity to meet increased peak demand during periods of heat stress</li> <li>■ Insure against weather and flood loss</li> <li>■ Ensure that emergency services and equipment are able to meet increased risks.</li> <li>■ Increase public awareness about how to cope with flooding and heatwaves</li> <li>■ Install community-based early warning systems for flooding etc.</li> <li>■ Monitor and take steps to prevent the emergence of potentially novel disease vectors as a result of changing climatic conditions and patterns of trade/migration (e.g. minimise conditions supporting development of mosquito larvae)</li> </ul>

Table 7.3 shows examples of how aspects of climate change may be integrated into a plan or programme, either through inclusion of specific commitments in policies/objectives or through reference to higher level plans which need to be integrated as appropriate into the plan or programme.

Table 7.3 – Examples of Climate Change Aspects, Suggested Commitments and Relevant Plans and Programmes (Adapted from EA, 2011)

Climate change aspect	Suggested commitment in plans	Key relevant plans/programmes
<b>Energy conservation</b>	<ul style="list-style-type: none"> <li>■ Improve building energy efficiency/design</li> <li>■ Improve insulation</li> <li>■ Regeneration of housing areas to modernise and increase energy efficiency</li> </ul>	<ul style="list-style-type: none"> <li>■ Sustainable Energy Action Plans</li> <li>■ SEAI (2013) Guidance Documents</li> <li>■ Regeneration Master Plans for local authority (LA) areas (e.g. in Limerick &amp;, Dublin)</li> </ul>
<b>Traffic management</b>	<ul style="list-style-type: none"> <li>■ Identify traffic issues linked to plan area and seek to address in the plan itself or implement higher level Traffic Management Plan aspects as relevant.</li> <li>■ Consider integrated Land Use and Transportation Strategies</li> </ul>	<ul style="list-style-type: none"> <li>■ County and Local Traffic Management Plans,</li> <li>■ Regional/National Transport Strategies,</li> <li>■ Metropolitan Area Transport Strategies, Spatial and Economic Strategies, etc.</li> </ul>
<b>Public transport (PT)</b>	<ul style="list-style-type: none"> <li>■ Promote increased use of PT, upgrade PT infrastructure, support establishment of integrated ticketing for all PT</li> <li>■ Integrate all PT, to facilitate regional, national and international travel</li> <li>■ Provide/upgrade/maintain PT and cycle ways/walkways within area as appropriate, in line with the requirements of higher-level plans</li> </ul>	<ul style="list-style-type: none"> <li>■ Greater Dublin Area Transport Strategy, Regional</li> <li>■ Spatial and Economic Strategies, County Development Plans</li> <li>■ Coordinating/integrating service schedules of all PT (Intercity, city, international), to provide an integrated system and further promote use of PT</li> <li>■ Local authority cycling and Walking Strategies</li> </ul>
<b>Air pollution</b>	<ul style="list-style-type: none"> <li>■ Promote integrated traffic management, to avoid congestion and poor air quality from transport-related GHG emissions</li> </ul>	<ul style="list-style-type: none"> <li>■ National, regional-level, county and local traffic management plans</li> </ul>
<b>Drainage infrastructure</b>	<ul style="list-style-type: none"> <li>■ Assess/maintain/upgrade/map drainage infrastructure within a plan or programme area. Consider implications for increased heavy precipitation events/flooding etc.</li> <li>■ Consider implications for built heritage infrastructure and allow for appropriate upgrade, repair and modification</li> <li>■ Incorporate sustainable drainage system technologies into developments</li> </ul>	<ul style="list-style-type: none"> <li>■ Development Plan/Local Area Plan level</li> <li>■ Arterial Drainage Studies</li> <li>■ Catchment Flood Risk Assessment and Management Studies (CFRAMS)</li> <li>■ Flood Risk Management Guidelines (2009)</li> </ul>

Climate change aspect	Suggested commitment in plans	Key relevant plans/programmes
<b>Transport infrastructure</b>	<ul style="list-style-type: none"> <li>■ Assess/maintain/enhance/upgrade transport infrastructure to determine potential impacts of flooding, slope failure, etc.</li> <li>■ Consider implications for built heritage infrastructure and allow for appropriate upgrade, repair and modification</li> </ul>	<ul style="list-style-type: none"> <li>■ National Roads Authority/Iarnród Éireann/Bus Éireann/Dublin Bus, Luas/Dart Transport plans/programmes</li> <li>■ Local Authority transport plans/programmes</li> </ul>
<b>Flood defence infrastructure</b>	<ul style="list-style-type: none"> <li>■ Support and integrate recommendations of catchment-based flood strategies/coastal zone management plans. Assess, maintain and upgrade flood defences where appropriate</li> <li>■ Consider implications for built heritage infrastructure and allow for appropriate upgrade, repair and modification</li> </ul>	<ul style="list-style-type: none"> <li>■ CFRAMS, Integrated Coastal Zone Management</li> </ul>
<b>Spatial planning</b>	<ul style="list-style-type: none"> <li>■ Be aware of environmental issues, such as flood risk zones in Land Use Plans. Identify public transport linkages when planning the location of civic amenities and services to minimise travel/promote public transport usage</li> </ul>	<ul style="list-style-type: none"> <li>■ Land Use plans/Development plans</li> <li>■ Regional Planning Guidelines</li> <li>■ County Development Plans</li> <li>■ Lower level plans</li> <li>■ Non land-use plans: Offshore</li> <li>■ Renewable Energy Development Plan, GRID25 Implementation Programme, etc.</li> </ul>
<b>Green infrastructure</b>	<ul style="list-style-type: none"> <li>■ Protect and enhance ecological corridors/linkages not only to benefit biodiversity, but also to provide shade and shelter to people during warmer periods in urban areas and locally act as carbon sinks.</li> <li>■ Plant drought-resistant plants/trees in public parks to minimise water use for park maintenance. Care should be taken not to impact significantly on protected species that may use these areas</li> </ul>	<ul style="list-style-type: none"> <li>■ Land Use Plans (Biodiversity</li> <li>■ Action Plans, Heritage Plans, Green Infrastructure Strategies, etc.).</li> <li>■ Habitats Mapping to determine what habitats/species are present within the area to be considered when upgrading/maintaining green infrastructure, and how they may be impacted by Climate Change</li> </ul>
<b>Water conservation</b>	<ul style="list-style-type: none"> <li>■ Recycle grey water within buildings; promote harvesting of rainwater and meter water usage</li> </ul>	<ul style="list-style-type: none"> <li>■ National Water Resources Plan</li> <li>■ County Development Plans.</li> <li>■ Water Services plans/programmes</li> <li>■ Irish Water Metering Installation Programme, etc.</li> </ul>

# Integration of SEA Findings into the plan/programme

## 8. Integration of SEA Findings into the plan/programme

### Chapter 8 Summary

*Reminder to integrate SEA findings into the plan or programme and suggested resources for sector-specific plans.*

The SEA and draft plan or programme should be carried out concurrently, so that the SEA findings can influence the plan or programme as early as possible in the process. High-level commitments should include ensuring that the obligations of the National Adaptation Framework (NAF) are met, whereas lower level plans and programmes may seek to restrict zoning of lands outside flood plains, promote energy and water conservation measures, etc.

When higher level plans and programmes include commitments to address certain environmental aspects, such as energy conservation, it may be sufficient, in lower level plans to explain how the commitments are to be implemented rather than “reinventing the wheel”.

The NAF requires local authorities to prepare specific climate change adaptation strategies (CCAS). These local authority CCAS will need to be prepared with a high degree of cross sectoral coordination and cooperation. They should also be integrated, as appropriate, into local authority plans and programmes, particularly for those plans falling within the scope of the SEA Directive.

Guidelines were prepared by the DCCAE in 2018,<sup>5</sup> based on earlier EPA research in 2016<sup>6</sup> to assist local authorities prepare and implement climate change adaptation strategies. The requirements of the SEA Directive should also be considered and integrated, where appropriate, for these CCAS.

The National Planning Framework and Draft Regional Spatial and Economic Strategies (to be finalised in 2019), set the top-level framework for land use plans in Ireland. Local authority plans and programmes, and new plans and programmes being prepared need to align and be consistent with these high-level plans. This will be achieved through reviewing, and where necessary varying/amending existing plans, or by preparing new plans and programmes. This review process provides a useful opportunity to integrate climate specific plan recommendations at an early stage.

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5 <https://www.dccae.gov.ie/en-ie/climate-action/publications/Pages/Local-Authority-Adaptation-Strategy-Development-Guidelines.aspx> <https://www.dccae.gov.ie/en-ie/climate-action/publications/Pages/Sectoral-Planning-Guidelines-for-Climate-Change-Adaptation.aspx>

6 <http://www.epa.ie/pubs/reports/research/climate/researchreport164.html>

## 8.1 SEA Statement

On completion of the SEA, the SEA Statement should provide information on how the plan or programme incorporates climate change measures. It should outline the key climate change aspects and how the plan or programme has taken these aspects into consideration. The EPA is currently preparing a guidance note to assist plan-makers in preparing SEA Statements. Once published, it will be a useful guide for plan-makers to refer to. Appendix B of this report includes a link where the EPA's SEA resources are available to consult.



# Monitoring, Evaluation and Follow-up

## 9. Monitoring, Evaluation and Follow-up

### Chapter 9 Summary

*The current challenge is to develop appropriate climate change indicators/guidance to allow short and medium-term plans/programmes to incorporate long-term climate change baseline data*

*Reference to summary report for guidance on approaches to climate monitoring and suggested indicator and evaluation considerations*

It is acknowledged that the inclusion of climate change-related monitoring data in SEA is challenging, given that climate change monitoring tends to take a long-term approach whereas many local authority plans and programmes tend to have a much shorter timeframe (typically 6-12 years).

A useful summary report, *Monitoring & Evaluation for Climate Change Adaptation: A Synthesis of Tools, Frameworks and Approaches* (Bours et al., 2013) provides summaries of different models in relation to the use of climate indicators and monitoring and evaluation approaches for different scenarios. Additionally, Mäkinen et al. (2018) provides further insights into national level indicators for climate adaptation in a European context.

The EPA is currently involved in research on climate indicators (CCRP-DS.16 - Policy Coherence in Adaptation Studies: Selecting and Using Indicators of Climate Resilience).

The challenge of developing climate change adaptation indicators is recognised internationally. Most countries across Europe are beginning a process of developing such indicators. Nationally, it is hoped to begin the development of adaptation indicators in conjunction with the implementation of adaptation actions.

Recently, Kopke *et al.* (2018) provided information on climate-related monitoring, reporting and evaluation. Monitoring, reporting and evaluation of adaptation has two overall objectives:

- To facilitate learning from the process of adaptation to ensure that adaptation measures are fit for purpose, and
- To provide some measure of accountability of actions through reporting (OECD, 2015).

Monitoring, reporting and evaluation are three complementary techniques used in reviewing progress in developing plans, strategies and policies for adaptation and the outcomes of these. It is recommended that this report (Kopke *et al.* 2018) be consulted at this stage of the SEA process. The EPA is currently preparing guidance on SEA Monitoring to assist plan-makers when considering and preparing a SEA monitoring programme.

# Acronyms, Abbreviations and Glossary

## Acronyms/Abbreviations

ABP – An Bord Pleanála

CCAS – Climate Change Adaptation Strategies

DCCAIE – Department of Communications, Climate Action and the Environment

DCHG – Department of Culture, Heritage and Gaeltacht Affairs

DHPLG – Department of Housing Planning and Local Government

EA – Environment Agency (UK)

EC – European Commission

EEA – European Environment Agency

EPA – Environmental Protection Agency

ESB – Electricity Supply Board

GHG – Greenhouse Gas

GISEA – Strategic Environmental Assessment Geographic Information System

HSA – Health and Safety Authority

HSE – Health Service Executive

IFI – Inland Fisheries Ireland

IPCC – Intergovernmental Panel on Climate Change

NBDC – National Biodiversity Data Centre

NPWS – National Parks and Wildlife Service

NRA (TII) – National Roads Authority (merged with Railway Procurement Agency to form the Transport Infrastructure Ireland)

NTA – National Transport Authority

OPW – Office of Public Works

SEA – Strategic Environmental Assessment

SEAI – Sustainable Energy Authority of Ireland

SuDS – Sustainable Drainage System

## Glossary

<b>Adaptation</b>	Adaptation “means any adjustment to: any system designed or operated by human beings, including an economic, agricultural or technological system, or any naturally occurring system, including an ecosystem, that is intended to counteract the effects (whether actual or anticipated) of climatic stimuli, prevent or moderate environmental damage resulting from climate change or confer environmental benefits” (Climate Action and Low Carbon Development Act 2015).
<b>Adaptive capacity</b>	“The ability of a system to adjust to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.” (IPCC, 2007).
<b>Adaptive management</b>	“A systematic process for continually improving management policies and practices by learning from the outcomes of previously employed policies and practices. In active adaptive management, management is treated as a deliberate experiment for purposes of learning.” (MEA, 2005).
<b>Climate change</b>	“Refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural processes or external forcing, or to persistent anthropogenic changes in the composition of the atmosphere or in land-use.” (IPCC, 2007).
<b>Confidence levels</b>	Statements of ‘confidence’ for the most part in this report are based on polling expert judgement, rather than on the more analytical approach possible for IPCC global assessment. This is due to variability in Ireland’s climate and a current lack of regional climate model outputs to tease out more robust statistical descriptions. For more information, consult the reference sources where quoted.
<b>Exposure</b>	“...the presence (location) of people, livelihoods, environmental services and resources, infrastructure, or economic, social, or cultural assets in places that could be adversely affected by physical events and which, thereby, are subject to potential future harm, loss, or damage.” (IPCC, 2012).
<b>Impacts</b>	“The effects of climate change on natural and human systems. Depending on the consideration of adaptation, one can distinguish between potential impacts and residual impacts: Potential impacts: all impacts that may occur given a projected change in climate, without considering adaptation. Residual impacts: the impacts of climate change that would occur after adaptation.” (IPCC, 2007).
<b>Low regret Options</b>	Low-regret adaptation options are those that carry relatively low cost but offer the potential for significant climate resilience enhancement.
<b>Mitigation</b>	“An anthropogenic intervention to reduce the anthropogenic forcing of the climate system; it includes strategies to reduce greenhouse gas sources and emissions and enhancing greenhouse gas sinks.” (IPCC 2007).

<b>No-regret options</b>	No-regret adaptation options are those that deliver societal benefits regardless of the future climate impact regime encountered.
<b>Resilience</b>	<p>“Refers to three conditions that enable social or ecological systems to bounce back after a shock. The conditions are: ability to self organize, ability to buffer disturbance and capacity for learning and adapting.” (Tompkins et al., 2005). See also: Ecological resilience.</p> <p>Defined in National Adaptation Framework as “the ability of a social or ecological system to absorb disturbances while retaining the same basic ways of functioning, and a capacity to adapt to stress and change”.</p>
<b>Scenario</b>	“Scenarios describe possible future developments. They can be used in an exploratory manner or for a scientific assessment in order to understand the functioning of an investigated system.” (Metz and Davidson, 2007).
<b>Sensitivity</b>	“Is the degree to which a system is affected, either adversely or beneficially, by climate related stimuli. The effect may be direct (e.g., a change in crop yield in response to a change in the mean, range, or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea level rise).” (IPCC, 2007).
<b>Win win Options</b>	Win-win options are those that serve a dual purpose, enhancing resilience to climate change impacts while also providing an alternative societal benefit.
<b>Vulnerability</b>	“The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity.” (IPCC, 2007).

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## Appendix B – Additional national climate resources and information

**Ireland's Climate Information Platform (ICIP)**, available as Climate Ireland ([www.climateireland.ie](http://www.climateireland.ie)), provides key stakeholders working on climate change adaptation with a one-stop web-based resource of climate and adaptation information. It is specifically designed to facilitate climate adaptation planning in Ireland. ICIP aims to create awareness and understanding of climate change, the impacts of these changes and adaptation. ICIP will form a key support to the implementation of the National Adaptation Framework.

There are also other sector-specific climate change information systems. For example, CLIMADAPT is a web-based decision support system based on ecological site classification developed specifically for Irish forestry. The system is based on soil and climatic information that can be used to assess species suitability and yield of different species for individual sites under current and future climate change scenarios.

**Projections:** projections of climate change in Ireland for 2050 and 2100 utilise outputs from Global Climate Models. These are downscaled using both dynamic and statistical approaches. Where projections are described in the report, consult the source material referenced to learn more about how climate projections are made.

**Climate Action Regional Offices (CAROs)** have been set up under the National Adaptation Framework for the Dublin metropolitan, East & Midlands, Atlantic Seaboard North and Atlantic Seaboard South regions. The role of the CAROs will involve assisting local authorities with preparing their own Climate Change Action Plans, developing education and awareness initiatives, contributing to the national dialogue on climate action on a local and regional basis. As part of consultation on plans and programmes and SEA being prepared, the relevant CARO office should be consulted with, to ensure any relevant recommendations are considered early in the process.

### EPA SEA-related Resources

**SEA process guidance and resources** including an SEA Spatial Information Sources Inventory, topic specific guidance notes, process checklists etc. are available at: <http://www.epa.ie/monitoringassessment/assessment/sea/>

**The EPA Geo Portal site** provides access to environmental spatial data is available here: <http://gis.epa.ie/>

# An Gníomhaireacht um Chaomhnú Comhshaoil

Is í an Gníomhaireacht um Chaomhnú Comhshaoil (EPA) comhlachta reachtúil a chosnaíonn an comhshaoil do mhuintir na tíre go léir. Rialaímid agus déanaimid maoirsiú ar ghníomhaíochtaí a d'fhéadfadh truailliú a chruthú murach sin. Cinntímid go bhfuil eolas cruinn ann ar threochtaí comhshaoil ionas go nglactar aon chéim is gá. Is iad na príomhnithe a bhfuilimid gníomhach leo ná comhshaoil na hÉireann a chosaint agus cinntiú go bhfuil forbairt inbhuanaithe.

Is comhlacht poiblí neamhspleách í an Gníomhaireacht um Chaomhnú Comhshaoil (EPA) a bunaíodh i mí Iúil 1993 faoin Acht fán nGníomhaireacht um Chaomhnú Comhshaoil 1992. Ó thaobh an Rialtais, is í an Roinn Comhshaoil, Pobal agus Rialtais Áitiúil.

## ÁR bhFREAGRACHTAÍ

### CEADÚNÚ

Bíonn ceadúnais á n-eisiúint againn i gcomhair na nithe seo a leanas chun a chinntiú nach mbíonn astuithe uathu ag cur sláinte an phobail ná an comhshaoil i mbaol:

- áiseanna dramhaíola (m.sh., líonadh talún, loisceoirí, stáisiúin aistrithe dramhaíola);
- gníomhaíochtaí tionsclaíocha ar scála mór (m.sh., déantúsaíocht cógaisíochta, déantúsaíocht stroighne, stáisiúin chumhachta);
- diantalmhaíocht;
- úsáid faoi shríon agus scaoileadh smachtaithe Orgánach Géinathraithe (GMO);
- mór-áiseanna stórais peitreal;
- scardadh dramhuisce.

### FEIDHMIÚ COMHSHAOIL NÁISIÚNTA

- Stiúradh os cionn 2,000 iniúchadh agus cigireacht de áiseanna a fuair ceadúnas ón nGníomhaireacht gach bliain.
- Maoirsiú freagrachtaí cosanta comhshaoil údarás áitiúla thar sé earnáil – aer, fuaim, dramhaíl, dramhuisce agus caighdeán uisce.
- Obair le húdarás áitiúla agus leis na Gardaí chun stop a chur le gníomhaíocht mhídhleathach dramhaíola trí chomhordú a dhéanamh ar líonra forfheidhmithe náisiúnta, díriú isteach ar chiontóirí, stiúradh fiosrúcháin agus maoirsiú leigheas na bhfadhbanna.
- An dlí a chur orthu siúd a bhriseann dlí comhshaoil agus a dhéanann dochar don chomhshaoil mar thoradh ar a gníomhaíochtaí.

### MONATÓIREACHT, ANAILÍS AGUS TUAIRISCIÚ AR AN GCOMHSHAOIL

- Monatóireacht ar chaighdeán aer agus caighdeán aibhneacha, locha, uiscí taoide agus uiscí talaimh; leibhéil agus sruth aibhneacha a thomhas.
- Tuairisciú neamhspleách chun cabhrú le rialtais náisiúnta agus áitiúla cinntiú a dhéanamh.

### RIALÚ ASTUITHE GÁIS CEAPTHA TEASA NA hÉIREANN

- Cainníochtú astuithe gáis ceaptha teasa na hÉireann i gcomhthéacs ár dtiomantas Kyoto.
- Cur i bhfeidhm na Treorach um Thrádáil Astuithe, a bhfuil baint aige le hos cionn 100 cuideachta atá ina mór-ghineadóirí dé-ocsaíd charbóin in Éirinn.

### TAIGHDE AGUS FORBAIRT COMHSHAOIL

- Taighde ar shaincheistanna comhshaoil a chomhordú (cosúil le caighdeán aer agus uisce, athrú aeráide, bithéagsúlacht, teicneolaíochtaí comhshaoil).

### MEASÚNÚ STRAITÉISEACH COMHSHAOIL

- Ag déanamh measúnú ar thionchar phleananna agus chláracha ar chomhshaoil na hÉireann (cosúil le pleananna bainistíochta dramhaíola agus forbartha).

### PLEANÁIL, OIDEACHAS AGUS TREOIR CHOMHSHAOIL

- Treoir a thabhairt don phobal agus do thionscal ar cheistanna comhshaoil éagsúla (m.sh., iarratais ar cheadúnais, seachaint dramhaíola agus rialacháin chomhshaoil).
- Eolas níos fearr ar an gcomhshaoil a scaipeadh (trí cláracha teilifíse comhshaoil agus pacáistí acmhainne do bhunscoileanna agus do mheánscoileanna).

### BAINISTÍOCHT DRAMHAÍOLA FHORGHNÍOMHACH

- Cur chun cinn seachaint agus laghdú dramhaíola trí chomhordú An Chláir Náisiúnta um Chosc Dramhaíola, lena n-áirítear cur i bhfeidhm na dTionscnamh Freagrachta Táirgeoirí.
- Cur i bhfeidhm Rialachán ar nós na treoracha maidir le Trealamh Leictreach agus Leictreonach Caite agus le Srianadh Substaintí Guaiseacha agus substaintí a dhéanann ídiú ar an gcrios ózón.
- Plean Náisiúnta Bainistíochta um Dramhaíl Ghuaiseach a fhorbairt chun dramhaíl ghuaiseach a sheachaint agus a bhainistiú.

### STRUCHTÚR NA GNÍOMHAIREACHTA

Bunaíodh an Gníomhaireacht i 1993 chun comhshaoil na hÉireann a chosaint. Tá an eagraíocht á bhainistiú ag Bord Iáinimseartha, ar a bhfuil Príomhstíurthóir agus ceithre Stiúrthóir.

Tá obair na Gníomhaireachta ar siúl trí ceithre Oifig:

- An Oifig Aeráide, Ceadúnaithe agus Úsáide Acmhainní
- An Oifig um Fhorfheidhmiúchán Comhshaoil
- An Oifig um Measúnacht Comhshaoil
- An Oifig Cumarsáide agus Seirbhísí Corparáide

Tá Coiste Comhairleach ag an nGníomhaireacht le cabhrú léi. Tá dáréag ball air agus tagann siad le chéile cúpla uair in aghaidh na bliana le plé a dhéanamh ar cheistanna ar ábhar inní iad agus le comhairle a thabhairt don Bhard.



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