



Irish Climate Policy Evaluation Project

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Evaluation of Ireland's climate change adaptation and resilience policies

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1. Introduction

The Irish Climate Policy Evaluation (ICPE) project was funded by the EPA (2017-CCRP-DS.12). The aim of the project was to undertake an ex post evaluation of Ireland's policy response to climate change across all sectors since 1996. As an exercise in ex post evaluation, the ICPE project focused on policies and measures already in place at the commencement of the project. Our first ports of call were the NMP, the NAF and data submitted by Ireland under the EU's Monitoring Mechanism Regulation [(EU) No. 525/2013/EU], which requires Member States to report on policies and measures they have adopted to reduce GHG emissions and adapt to climate change. Those policies listed as planned or implemented only in 2017 or 2018 in the NMP were excluded from our analysis. Moreover, policies and measures announced as part of the National Development Plan or the Climate Action Plan fell outside the scope of our analysis.

The project technical description called for an evaluation of "effectiveness, efficiency, coherence and relevance. The evaluation framework utilised should align with standard evaluation criteria and procedures used in ex-post evaluations of EU policies". Accordingly, the ICPE project incorporated the standard criteria of effectiveness, efficiency, coherence and relevance, but, importantly, added two additional criteria: "governance" and "distributional impact". Because of the diverse set of criteria that spans both process and outcome dimensions, the project drew on a diverse set of qualitative and quantitative data and sought to triangulate from multiple sources where possible.

We divided our research into five sectoral work packages. For each of the five work packages, our research commenced with a comprehensive mapping exercise drawing on a wide range of data sources. This was used to produce a sectoral overview that detailed policies in place and undertook an initial evaluation according to the six criteria above. This overview was then presented at a workshop of invited sectoral stakeholders: policymakers from across relevant government departments and public bodies, business, civil society and academia. Input and feedback were sought at these workshops on the research to date as well as on areas suitable for further research.

This document presents the findings of our research on climate change adaptation policies that have been implemented and drafted to date. Section 2 provides an overview of the state of adaptation and resilience policy in Ireland. Section 3 is a summary of the adaptation plans that have been drafted to date under the National Adaptation Framework (NAF) and its predecessor the National Climate Change Adaptation Framework (NCCAF). Section 4 provides an analysis of the plans and discussion of the NCCAF and the NAF. Section 5 discusses the plans developed by the Office of Public Works and the Department of Agriculture, Food and Marine under the NCCAF and NAF. We also discuss lessons and recommendations for climate change adaptation policy.

2. Sectoral Overview

Adaptation to climate change is a recent policy focus of the Irish Government. Under the Climate Action and Low Carbon Development Act 2015, government was required to produce a National Adaptation Framework (NAF), which was released in February 2018. Under the Act, sectoral adaptation plans are required to be produced by relevant government ministers, having regard for the NAF. To assist in this process, the Department of Communications, Climate Action and Energy (DCCAE) provided sectoral adaptation planning guidelines (DCCAE, 2018d). All relevant sectors (Seafood, Agriculture and Forestry; Biodiversity; Built and Archaeological Heritage; Transport Infrastructure; Electricity and Gas Networks; Communications Networks; Flood Risk Management; Water Quality; Water Services Infrastructure; and Health) had developed their adaptation plans by September 2019. Prior to the NAF, the National Climate Change Adaptation Framework (NCCAF), published in 2012, was developed to enable climate change adaptation action to be undertaken, but was non-statutory. Under the NCCAF, the Electricity and Gas Networks, Agriculture, Flood Risk and Transport Sectors developed sectoral adaptation plans.

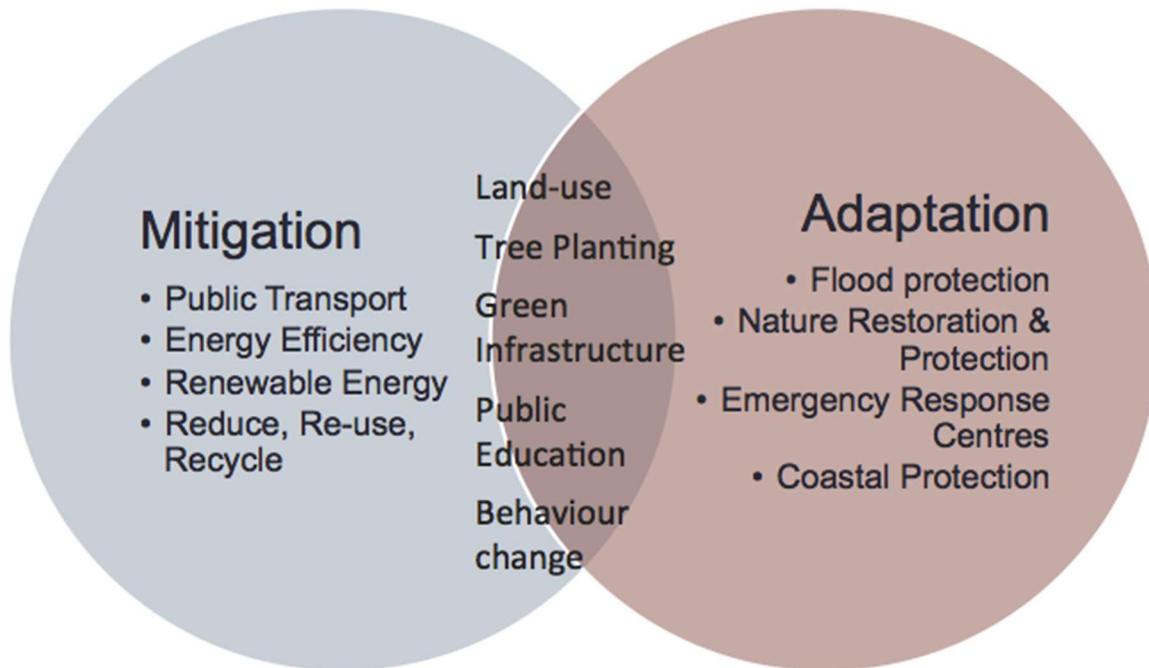
Local authorities across Ireland have also developed adaptation plans following DCCAE's local authority adaptation guidelines (DCCAE, 2018b) and with assistance from Climate Action Regional Offices (CAROs).

Emergency response plans predated legislative requirements for adaptation plans. Under these emergency response plans, flood adaptation works have been undertaken by local authorities and the Office of Public Works (OPW) to respond to the impacts of climate change. Furthermore, biodiversity plans, river basin management plans and local authority development plans have considered climate change adaptation with measures such as sustainable urban drainage, tree planting, and green infrastructure. These measures are included in our analysis of climate change adaptation policies.

2.1 Adaptation to Climate Change and Resilience

Mitigation is focused on preventative measures for addressing climate change (Miller, et al., 2010). In the context of climate change and the vulnerability it creates, prevention through mitigation efforts is an important aspect of policy. However, climate change mitigation does not prepare systems for shocks that may force change. Adaptation policies are increasingly viewed as an approach that should be taken in addressing climate change and achieving resilience to climate change (Smit and Wandel 2006; Heltberg et al., 2009; Pizzo, 2015).

Figure 1: Relationship between Mitigation and Adaptation Actions



Source: Author's creation

Resilience emerged from systems theory and the biological sciences, where it gained prominence through the research of Holling (1973) on the ability of organisms to withstand changes in their ecosystems. Holling developed the first definition of resilience:

Resilience determines the persistence of relationships within a system and is a measure of the ability of these systems to absorb changes of state variables, driving variables, and parameters, and still persist. (Holling, 1973, p.17)

Adaptation also has its roots in the life sciences (Smit and Wandel, 2006; Adger, 2006). In the sciences, adaptation looks specifically at the ability of an organism to adopt new, or to use certain inherent, characteristics to respond to changes in its environment. Species vary in their genetic make-up. Therefore, some species may have an inherent advantage when their environment changes (Holling, 1973). Behavioural characteristics may enable them to adapt and survive when their environment changes (Smit and Wandel, 2006). Consequently, their genes that are adapted for survival are passed onto the next generation, while members with the genes not suited to the new environment die off (Smit and Wandel, 2006). The process of adaptation is visible over time in the natural ecosystem.

In social ecosystems, adaptation maintains the principles of survival and response. The process is not as 'simple' and straightforward as it is with species in natural environments (Holling, 1973; Walker et al., 2004; Smit and Wandel 2006; Miller et al., 2010; Cote and Nightingale, 2012). Adaptation involves the changes humans make to the system such that the system is optimized to meet their needs. Adaptation is expressed through the action of adjustment in

response to external pressures on the social ecosystem (Smit and Wandel, 2006; Adger, 2006). The changes that occur depend on the type of threat, which may be economic, social, political or scientific, and the response enables the system to continue to support humans.

Adaptation is subjective in the context of resilience (Nelson et al., 2007; Adger, 2006). Assumption of the simplicity or complexity of threats creates risk stemming from implementing an inappropriate response (Campbell and Jovchelovitch, 2000). Uncertainty affects the subjectivity of threats, as the outcomes of a threat may not be clear (Nelson, et al., 2007). The ability to predict outcomes is precarious, but climate change will result in adverse outcomes. Inaction is not an option (Nelson et al., 2007; Adger, 2006; Wilkinson, 2011). The threats of climate change include extreme temperatures, extreme weather events, rising sea levels, flooding, and rising temperatures. These impacts will vary according to geographical characteristics of specific locations (Campbell-Lendrum and Corvalan, 2010; Galvão et al., 2009; Corburn, 2009). The outcomes of the various impacts of climate change are broad and diverse, and the implications of not responding are being demonstrated with the rising frequency and intensity of extreme weather events.

It is important to note that while the following section presents weather events in Ireland since 1950, adapting to climate change also concerns addressing so-called ‘slow burn’ changes. In the ICPE project research on agriculture, interviewees suggested that they are already experiencing the impacts of climate change and have been adapting their farm management practices in response.

2.2 Weather Events in Ireland

Ireland has experienced a number of extreme weather events in recent years. In 2017 and 2018, extreme weather events in the form of Storms Ophelia and Emma, and the ‘Beast from the East’, resulted in significant damage to infrastructure (water and energy), while the heatwave and drought in summer 2018 saw the introduction of water restrictions and farmers importing feed for herds.

Table 1 summarises the events that have been recorded by Met Eireann in the last ten years. Appendix I includes events since 1950. Research undertaken by Climate Ireland indicates that the frequency and intensity of extreme weather events will increase going forward (Dwyer, 2012). Responding to these increased risks is the focus of adaptation planning and this is challenged by the constantly shifting baseline for climate risks.

Table 1: Weather Events in Ireland from 2009 to present

Type	Date(s)	Impacts
Pluvial	July 2009	1 in 50-year event; Several areas within the Dublin City Council boundary were affected. One of the worst affected areas was Donnycarney in North Dublin, where the storm (surface) water collection system draining to the Wad River culvert was overwhelmed at the Malahide Road, resulting in flooding at Collins Avenue and Clanmoyle Road. Reports also of spot flooding at Raheny, Clontarf, Drumcondra, Finglas Sandymount, Cabra, Finglas and Glendhu Park in Ashtown.
Flooding	November 2009	Rainfall was high in the month of November, with twice the average amounts measured at all stations.
Coldest Winter	2009/2010	Coldest period with temperatures falling below -10°C in some areas. Coldest since 1962/63.
Extreme Cold (Cold Snaps)	November/December 2010	It was also the coldest of any month at Dublin Airport, Casement Aerodrome and Mullingar, each with over 50 years of record. The lowest December air temperature ever measured in the country, -17.5°C, was recorded at the climatological station of Straide, Co. Mayo, on the morning of the 25th, while Casement Aerodrome's minimum value of -15.7°C on the same day was the lowest value of any month ever recorded in the Dublin area.
Pluvial/Fluvial/Coastal	October 2011	95 social housing units damaged, €1.2M in housing insurance claims alone.
Storm Darwin	February 2014	Considerable damage to housing and other buildings; 8,000 ha of forests damaged. 1 in 20-year event Of 50-65 km/h, gust 100-110 km/h in Dublin Level: Yellow
Storm Ophelia	October 2017	100 large trees blown over in Dublin City; in the rest of the country there was significant damage to buildings. First storm to come from a southerly direction. Stormy with violent, damaging gusts of 120 to 150 km/h. Level: Red
Storm Emma and Beast from the East	February – March 2018	Closure of all schools in Dublin city, many businesses affected, water and power restrictions or outages. Met Eireann issued its first red warning for snow on record.

Source: Met Eireann (n.d)

2.3 Guidelines for Adaptation by Sectors and Local Authorities

In order to support the development of adaptation plans by sectors and local authorities, DCCAE has developed guidelines with expert advice provided by Climate Ireland, the Environmental Protection Agency (EPA) and academia.

Development of Sectoral Adaptation Guidelines was undertaken by DCCAE with support from the Centre for Marine and Renewable Energy Ireland (MaREI) at University College Cork (DCCAE, 2018d). These guidelines are intended to provide the sectors with a coherent and consistent approach to adaptation planning by the key sectors identified in the NAF.

Adaptation planning is structured as a 6 step planning cycle:

1. Preparing the Ground
2. Climate Impact Screening
3. Prioritisation
4. Priority Impact Assessment
5. Develop your Plan
6. Implement, Evaluate and Review

Under the NAF, local authorities are viewed as central to implementation of adaptation actions. For example, they are essential in preparing flood emergency response plans. To build the capacity of local authorities to respond to climate change, Local Authority Adaptation Guidelines were produced by DCCAE and Climate Ireland (DCCAE, 2018b). These guidelines set out five steps for local authorities to follow as they develop their adaptation plans:

1. Preparing the Ground
2. Assessing the Adaptation Baseline
3. Identifying Future Climate Impacts, Vulnerabilities and Risks
4. Identifying, Assessing and Prioritising Adaptation Actions
5. Drafting, Implementing and Monitoring the Strategy

3. Plans in Place

Adaptation is a new policy focus in Ireland and, as such, our analysis is limited to plans that have been developed to date under the NCCAF and NAF, and were available during the time period the research was undertaken. This section summarises the available sectoral plans and local authority plans. The NAF identified the sectors and departments responsible for developing adaptation plans, which are summarised in Table 2 below, along with their progress. The table reflects the plans completed during the timeframe of this project. It should also be noted that this section does not include a summary of the draft plans produced under the NAF by the Office of Public Works or the Department of Agriculture, Food and the Marine, as these are discussed in sections 5.1 and 5.2 below respectively.

3.1 Agriculture and Forestry

The Department of Agriculture, Food and Marine developed the document *Adaptation Planning: Developing Resilience to Climate Change in the Irish Agriculture and Forest Sector* under the NCCAF produced in 2012 (DAFM, 2017). Consequently, it is not a statutory plan, but is the first step in addressing adaptation to climate change in the agriculture and forestry sectors.

The development of the plan involved five steps:

1. Building an adaptation team
2. Climate impact and vulnerability screening

3. Detailed analysis of priority climate impacts and vulnerabilities
4. Identifying, assessing and prioritising options
5. Monitor, review and evaluate

The document acknowledges the vulnerability of the agriculture sector in Ireland to changes in precipitation (intensity and frequency) and temperature (heat and cold), as well as weather events that result in flooding. It also highlights risks to animal health and crops in terms of diseases infecting crops. Furthermore, it recognises that the response to these changes and risks requires cross-agency action to respond to current and future impacts, specifically with regard to water, emergency planning, biodiversity, heritage, transport, energy, communications, and health.

The actions in the document take account of the need for collaboration with different departments and agencies. For example, early warning systems to predict disease outbreaks would involve partnership with Met Eireann. 29 actions set out are spread across 6 categories: national actions, interagency, knowledge transfer and communication, research, land management, and livestock management.

Table 2: Status of Sectoral Plans

Sectoral Level	Lead Department	Status
Seafood Agriculture Forestry Biodiversity	Department of Agriculture, Food and the Marine	Published non-statutory in 2017, Published statutory, 2019
	Department of Culture, Heritage and the Gaeltacht	Published statutory, 2019
		Published statutory, 2019
Built and Archaeological Heritage Transport Infrastructure	Department of Transport, Tourism and Sport	Published statutory, 2019
Electricity and Gas Networks Communications Networks	Department of Communications, Climate Action and Environment	Published non-statutory February 2018 Published statutory, 2019 (Not evaluated in this study)
		Public consultation completed
Flood Risk Management	Office of Public Works	Non-statutory published November 2015 Public consultation completed
Water Quality Water Services Infrastructure Health	Department of Housing, Planning and Local Government	Published statutory, 2019
	Department of Health (DOH)	Published statutory, 2019

Source: (DCCAIE, 2018c)

3.2 National Adaptation Framework

The National Adaptation Framework (NAF) was developed in accordance with the provisions of the 2015 Climate Action and Low Carbon Development Act, and is intended to compliment the National Mitigation Plan and align with the National Planning Framework (NPF/ Project Ireland 2040) and the Capital Investment Plan 2018-2027. The NAF sets out the national approach to adapting to current and future risks posed by climate change. Reducing the vulnerability of the environment, society and the economy are central to the framework, as is realising the opportunities inherent in adaptation for innovation and green growth. As such, the NAF sets out the ‘national strategy for the application of adaptation measures in different sectors and by local authorities’ (DCCAIE, 2018c).

Acknowledging the specific context and place-based needs of different regions, local authorities and sectors, the NAF is intended to be a resource to guide the development of sectoral and local adaptation plans. The NAF provides information on the observed and projected impacts of climate change globally and locally, and recommends steps for developing adaptation plans to be used by stakeholders across sectors and local authorities. Furthermore, the NAF provides the following guiding principles for adaptation: the importance of ownership and commitment at senior level; the need for vulnerability based assessment; openness and knowledge transfer; the importance of fostering cooperation; a precautionary approach, accounting for uncertainty; the need to draw on a range of climate scenarios; identification of a wide range of adaptation options; prioritisation of adaptation actions, and robust monitoring of progress.

Governance is critical to implementation. The NAF elaborates structures to ensure oversight, coordination and accountability. The Climate Change Advisory Council is tasked with providing independent advice based on review of actions undertaken with support from its Adaptation Subcommittee. The National Adaptation Steering Committee, comprised of experts, is tasked with providing sectors with advice and guidance as well as a coordinated, comprehensive and coherent approach to implementation. The County and City Management Association (CCMA) is tasked with supporting local authorities.

3.3 Biodiversity

The National Parks and Wildlife Service published *Ireland’s Biodiversity Sectoral Climate Change Adaptation Plan* for public consultation in February 2019 (NPWS, 2019). The plan was developed in accordance with the DCCAIE sectoral adaptation guidelines, as summarised in section 2.4. The climate impact assessment undertaken demonstrates that Ireland’s biodiversity is already experiencing the impacts of climate change both directly and indirectly. Particular concerns include the impacts of temperature on phenology (time of lifecycle events) and degradation of habitats and invasive species, both on land and in water. For example, the 2018 heatwave impacted on water availability which in turn had negative impacts on peatlands as experienced in Girley Bog. This was evidenced by the negative impact on the growth of Sphagnum moss, which had been transplanted as part of a trial in 2014 and 2015 to restore the bog and promote the formation of peat.

Ecosystem services and the role they play in building adaptive capacity of people and the environment are central to the Plan. The Plan contains five objectives and 28 actions (NPWS, 2019):

1. Protect and restore biodiversity to increase the resilience of natural and human systems to climate change;
2. Improve understanding of the impacts of climate change on biodiversity;
3. Improve landscape connectivity to facilitate mobility in a changing climate;
4. Engage society to protect biodiversity to enhance resilience; and
5. Ensure sufficient financing is available to implement the Biodiversity Climate Change Adaptation.

The plan recognises the cross-cutting nature of biodiversity and aims to ensure that all sectoral and local adaptation plans use nature based solutions to adapt to climate change and achieve resilience. This means protecting and conserving biodiversity and ecosystem services by prioritising the use of green infrastructure in the development and implementation of adaptation solutions. Furthermore, the plan aligns with the National Biodiversity Action Plan 2017-2021.

3.4 Built and Archaeological Heritage

The Department for Communications, Climate Action and Environment (DCCAE) published the draft *Climate Change Adaptation Sectoral Plan for Built and Archaeological Heritage* in May 2019 for public consultation, which closed in July 2019 (DCCAE, 2019b). The Plan was developed following the sectoral adaptation guidelines, as summarised in section 2.4. It is evident from this process that there is a high density of heritage sites across Ireland that will be directly and indirectly impacted by climate change. For example, heritage sites along coastal areas are at risk of sea level rise and salt water intrusion. They also face the risk of damage from storms. There is also an opportunity for discovery of new heritage sites via crop marks. The priority impacts to be addressed by the Plan are inland and coastal flooding, storm damage, coastal erosion, soil movement, changing burial preservation conditions, pests and mould, fires, and maladaptation stemming from energy renovation or flood defences.

While the Plan is intended to protect cultural heritage, historic fabric, buried archaeology, cultural landscapes and traditional ways of life, it recognises that there is more to offer in terms of building social and culture values associated with Ireland's heritage. There are references to how the Plan will align with plans developed in other sectors and by local authorities. The Plan consists of five goals under which there are 16 objectives and 48 actions. The five goals are:

1. Improve understanding of the heritage resource and its vulnerability to climate change impacts;
2. Develop and mainstream sustainable policies and plans for climate change adaptation of built and archaeological heritage;
3. Maintain Ireland's heritage for future generations;
4. Communicate and transfer knowledge;

5. Exploit the opportunities for built and archaeological heritage to demonstrate value and secure resources.

3.5 The Transport Sector

The Department of Transport, Tourism and Sport developed the plan *Developing Resilience to Climate Change in the Irish Transport Sector* under the NCCAF (DTTAS, 2017). Consequently, this plan is not statutory, but is the first step in addressing adaptation to climate change in the transport sector. Ireland has 5,306 kms of national road. Of this, 2,739 kms are primary roads and 2,676 kms are secondary roads. Local and regional roads comprise 93,000 kms, including bridges. Maintenance of national roads is the responsibility of Transport Infrastructure Ireland. Local authorities are responsible for maintenance of regional and local roads.

Figure 2: Plans Relevant to Transport Adaptation

Table 1.1: Thematically Connected Planning		
Plan	Responsible Body	Relevance to Transport
Emergency Planning	Health Service Executive (HSE), An Garda Síochána and Local Authorities	Transport infrastructure and services are particularly vulnerable to impacts of severe weather conditions.
Flood Defence	Office of Public Works (OPW)	Transport infrastructure and services are particularly vulnerable to impacts of fluvial, pluvial and coastal flooding.
Marine	Department of Agriculture, Food and the Marine (DAFM)	Adaptation measures for maritime transport services and infrastructure; sensitive to marine biodiversity and ecosystems. Cross-sectoral concerns for ports regarding import/export of agricultural produce.
Air Quality	Department of Communications, Climate Action and the Environment (DCCA/E)	Recognising the impacts of adaptation measures on air quality concerns the Transport sector.
Health	Department of Health	Climate change impacts to public health for employees and passengers on transport networks.

Source: DTTAS 2017

The Plan recognises the critical role of transport in the economy and society. As the first climate change adaptation plan for transport, it provides a high-level approach and focuses on understanding the impacts of climate change on the transport sector at the national, regional and local level. Following the approach provided by *Climate Ireland* for adaptation, the Plan followed the five steps outlined above. Transport infrastructure at present is vulnerable to

flooding, sea level rise, coastal erosion and extreme weather events. Extreme temperatures, both heat and cold, are projected to increase and create risks for the transport sector in the future.

Acknowledging the interconnected nature of transport to other sectoral adaptation plans, the Plan contains an assessment of available plans and their relevance to transport (Figure 2). The Plan aims to maximise the co-benefits of adaptation and mitigation as well as the role of long term of spatial planning. As such, it highlights the potential of existing measures to enable the adaptive capacity of the sector, in particular planning law, flood management guidelines, emergency planning, and transport infrastructure services (bus, rail, airport and ports). The Plan outlines three categories of adaptation options: policy/government options; infrastructural options; and green options.

To enable adaptation of the transport sector, the Plan highlights four categories of measures under which there are 26 immediate and short- to medium-term actions: policy integration measures; research and collaboration measures; investment and development measures; and risk assessment measures.

3.6 Electricity and Gas Networks

DCCAE published the *Climate Change Adaptation Plan for the Electricity and Gas Networks Sector* in February 2018 (DCCAE, 2018a). The plan underwent public consultation between August and October 2017, and as such was developed before the NAF and under the NCCAF. Future iterations of the plan are to be developed under the NAF. The Plan recognises the important role of the electricity and gas networks in the economic and social systems of Ireland, as well as the energy sector's contribution to emissions. The development of the plan followed EU adaptation guidelines and national recommendations and was developed via a five step process (DCCAE, 2018a):

1. Building the adaptation team – scope of work;
2. Assessing current vulnerabilities/ the adaptation baseline;
3. More detailed analysis of priority climate impacts and vulnerabilities;
4. Identify and assessing adaptation options;
5. Monitoring and review.

Central to the plan is ensuring that 'our evolving energy systems remains sufficiently robust to deal with the likely consequences of climate change' (DCCAE, 2018a). Achieving this will involve collaboration with stakeholders in the energy sector including EirGrid (transmission services operator), ESB Networks and Generation (distribution services operator), Gas Networks Ireland, the Commission for Regulation of Utilities, and the Sustainable Energy Authority of Ireland (SEAI). The involvement of this array of actors is due to the nature of the electricity and gas networks, which are comprised of transmission lines (6,600 kms), transmission stations (<100), distribution lines (167,000 kms), transformers (250,000), gas pipelines (13,500 kms), and compressor stations. Furthermore, collaboration is required with

stakeholders outside the energy sector, including planning bodies and local authorities, to build out new infrastructure that would increase the system's resilience to climate change.

The Plan identifies the key climate impacts to the energy sector as: flooding; extreme weather events; temperature rise; sea level rise; and changes in wind energy content (DCCAE, 2018a). Electricity transmission and distribution networks and gas networks will be affected differently by these impacts. The gas network is more resilient to the impacts of climate change than the electricity network because it is underground. However, erosion and flooding pose challenges.

The Plan recognises the challenge of reducing emissions from energy by transitioning to renewables, while guaranteeing security of supply with renewable technologies that place unique demands on the system. However, it recognises the opportunities of smart grid technologies and greater interconnection with Europe in the process of transitioning and adapting the energy system to climate change. Furthermore, the Plan acknowledges that existing mechanisms can contribute to building resilience, including: planning legislation; emergency planning; energy network company measures; standards for grid systems; ESB's Crisis Management Policy and Action Plan; and Gas Networks Ireland's Business Continuity Plan.

Finally, the Plan provides adaptation actions to reduce vulnerability and increase resilience under three categories: technological, environmental, and policy actions. In total, there are 21 actions which include undertaking an audit of all 'energy infrastructure to identify vulnerabilities and implement optimum adaptation measures' (DCCAE, 2018a, p.48).

3.7 Flood Risk Management

The OPW is responsible for flood risk management. Under the NCCAF the OPW developed the *Flood Risk Management Climate Change Adaptation Plan 2015-2019* (OPW, 2015). The Plan notes that flood risk is 'dependent on the probability and magnitude of the flood hazard and the vulnerability of society, infrastructure and our environment to damage or loss in the event of a flood' (OPW, 2015, p.ii). Flooding in Ireland has been recorded in the National Historic Flood Event Database and is available via the website www.floodmaps.ie.

The Plan aims to adapt to several types of flooding, including coastal flooding, fluvial flooding, pluvial flooding, groundwater flooding, network flooding, and flooding from reservoir or dam breaches. Sea level rise, increased rainfall, and extreme weather events resulting from climate change are anticipated to increase the risks of each type of flood occurring. The Plan is based on work through the National Catchment-based Flood Risk Assessment and Management (CFRAM) Programme which includes the development of Flood Risk Management Plans (FRMPs) that provide detailed approaches and measures to be taken in specific areas. The CFRAM programme aligns with the EU Flood Directive.

The OPW notes that the Plan does not provide specific recommendations for other sectors to respond to flooding, but is intended to provide information for consideration by other sectors

in their adaptation processes. It is a high level Plan and aims to set out a policy framework and recommendations for further research and assessment.

The Plan highlights policies and legislation that enable (or otherwise) the OPW to undertake measures to mitigate and adapt to flood risk. These include:

1. Land commission embankments: Historically, trusts were set up to maintain flood defences on lands acquired by the state through the Land Commission which was dissolved in 1999. The trust is now managed by DAFM. However, responsibility for maintenance, restoration and repair of embankments does not lie with DAFM.
2. Drainage districts: Established under the Arterial Drainage Act, these schemes are maintained by local authorities who report to the OPW.
3. Arterial drainage schemes: These schemes were intended to provide drainage of agricultural lands to enhance production. They are no longer allowed to be developed. Maintenance of these drains is the responsibility of the OPW in order to minimise ecological damage.
4. Hydrometric monitoring: The monitoring of surface water is the responsibility of the OPW and the EPA. Monitoring stations provide real-time information on water levels and assist in flood risk management.
5. Flood protection (flood relief schemes): An amendment of the Arterial Drainage Act in 1995 gives powers to the OPW to implement flood relief schemes that protect local communities. Relief measures include storing flood water upstream, embankments, increasing capacity of river channels and diversion.
6. Flood risk prevention: Under the National Flood Policy Review of 2004, guidelines were developed by the OPW to assist planners in assess flood risk of developments.
7. Flood risk preparedness, response and resilience: Resulting from the National Flood Policy Review, work was undertaken to increase awareness and preparedness of the public with regards to what to do before, during and after a flood event.
8. CFRAM: Delivering the recommendations of the National Flood Policy Review, the CFRAM Programme was developed by the OPW to undertake long term planning for flood risk.
9. Urban storm-water management: Recognising that urban development can increase flood risk, local authorities are required to maintain the road and urban storm water drainage infrastructure. Irish Water is responsible for combined sewerage systems and maintaining their capacity.
10. Management of flood risk from infrastructural assets: Owners and operators of water-bearing infrastructure are responsible under SI No. 122 of 2010 for managing flood risk stemming from their infrastructure.

Adaptation actions proposed by the Plan take into account these policies and propose future actions, and identify relevant stakeholders with whom the OPW will work. For example, Adaptation Action A.4 (Research) will involve collaboration with the EPA and local authorities to ‘Address information needs to improve adaptation to potential flood risk futures through

research on communication and community awareness and action’ (OPW, 2015, p.57). In total, there are 30 actions across the following six categories:

1. Research
2. Assessment
3. Planning, design and implementation
4. Capacity building
5. Monitoring and review
6. Adaptation planning and governance

3.8 Water Quality and Water Services Infrastructure

The Department of Housing, Planning and Local Government published the *Draft Climate Change Sectoral Adaptation Plan: Water Quality and Water Services Infrastructure* in May 2019 for public consultation (DHPLG, 2019). The Plan was developed in accordance with the sectoral adaptation guidelines, as summarised in section 2.4. The Plan defines water quality as ‘the biological, chemical and physical status of raw water’ and water services infrastructures as ‘above and below ground infrastructure assets relevant to water and wastewater service provision’ (DHPLG, 2019). Recognising that water quality and therefore the ability to provide water services is and will continue to be impacted by climate change, the draft Plan sets out the priority concerns for the sector in relation to climate change adaptation. For water quality, the key concerns are increased precipitation, decreased precipitation and high temperatures which pose risks to public health, service provision and environmental risks. For water services, the key concerns are high temperatures, high precipitation, low precipitation, and increased storminess, which pose risks to again to public health, service provision and environmental quality.

Figure 3. Water services infrastructure: Adaptation Drivers to address reduced water availability

Key current drivers for adaptive measures *	Cross-sectoral linkages	Related UN SDGs
<ul style="list-style-type: none"> • EU directives (e.g. Water Framework Directive, Floods Directive) (e) [ICM; WRP, MR] • National Water Resources Plan (p) [ICM; WRP] • River Basin Management Plan (e) [ICM, WRP] • Irish Water Business Plan (e) [WRP] • Catchment Flood Risk Assessment and Management (e) [ICM] • DHPLG’s Rural Water Programme (e) [WRP] • Irish Water’s Water Services Strategic Plan (e) [WRP] • Abstraction licensing (p) [WRP] • Greater Dublin Area Water Restriction Management Scale (ODP) 	<ul style="list-style-type: none"> • Agriculture (DAFM) • Forestry (DAFM) • Biodiversity (DAHG) • Energy (DCENR) • Communications (DCCAE) • Local Authority Adaptation Strategies 	

* Note: (p) planned drivers, (e) existing drivers. Abbreviations in square brackets relate to adaptive measures as described above.

Source: DHPLG (2019)

The Plan provides detailed analysis on the risks and their potential impacts, and proposes key adaptive measures that can reduce those risks. For example, increased temperatures will lead to increased demand for water by households, which in turn could result in supply shortages and increased pressure on water treatment and pumping. Adaptive responses to this include integrated catchment management and water resource planning. This would include addressing leakages in the existing system, metering, and engagement. The Plan highlights the existing drivers for adaptation measures along with cross-sectoral linkages and their relationship to the Sustainable Development Goals (SDGs) (Figure 3). Overall, there are 13 adaptation measures in the Plan that address the impacts.

3.9 Health

The Department of Health (DOH) published the draft plan, *Climate Change Adaptation Plan for the Health Sector*, in July 2019 (DOH, 2019). At just eight pages in length, the Plan is brief. It highlights six climate scenarios that create risks for health. Two of the scenarios, UV radiation from sun exposure and air pollution, are noted to be long-term effects (DOH, 2019). Increased exposure to UV radiation is anticipated to result in higher rates of skin cancer due to most Irish people having fair skin (DOH, 2019). Air pollution is anticipated to contribute to early onset of allergy season and premature mortality (DOH, 2019). The remaining four climate scenarios are acute: windstorms, extreme heat and heatwaves, high precipitation and flooding, and cold snaps (DOH, 2019). The primary risks associated with these scenarios are death and physical injury. Flooding has additional risks such as water borne vector diseases, chemical contamination of water, and damage to critical infrastructure which may disrupt health services delivery (DOH, 2019). The plan recognises that collaboration is needed as the impacts of climate change on health are dependent on the actions of other sectors. As such, the need for the DOH to work with these stakeholders is reflected in the three categories of actions identified (DOH, 2019):

- Population health and wellbeing: Ireland’s health care system will need to prevent avoidable illness where possible and, where this is not possible, be prepared for different volumes and patterns of demand.
- Service continuity during acute events: effective emergency planning and preparedness will be essential to ensure operational continuity and service delivery during severe weather events.
- Infrastructure resilience to severe weather: the healthcare system infrastructure including buildings, communications, emergency service vehicles and models of care, together with the supply chain including fuel, food, and medical supplies, will need to be made more resilient to more frequent severe weather events and other impacts of climate change.

While the plan is short, its succinctness highlights the key challenges ahead for the health sector in Ireland and the need for cross sector collaboration to address them.

3.10 Local Authority Adaptation Strategies

In addition to the national sectoral plans, 29 local authority adaptation strategies were developed with assistance from the CAROs (Table 3). Under the NAF, local authorities are viewed as central to implementation of adaptation actions. For example, they are essential in preparing flood emergency response plans. To build the capacity of local authorities to respond to climate change, Local Authority Adaptation Guidelines were produced by DCCAE and Climate Ireland (DCCAE 2018b). These guidelines set out five steps for local authorities to follow as they developed their adaptation plans:

1. Preparing the Ground
2. Assessing the Adaptation Baseline
3. Identifying Future Climate Impacts, Vulnerabilities and Risks
4. Identifying, Assessing and Prioritising Adaptation Actions
5. Drafting, Implementing and Monitoring the Strategy

Table 3: Local Authorities and CAROs

CARO Region	County
Dublin Metropolitan Region	Dublin City Council
	Dun Laoghaire-Rathdown County Council
	Fingal County Council
	South Dublin County Council
Eastern and Midlands	Kildare County Council
	Cavan County Council
	Carlow County Council
	Kilkenny County Council
	Laois County Council
	Leitrim County Council
	Longford County Council
	Louth County Council
	Meath County Council
	Monaghan County Council
	Offaly County Council
	Roscommon County Council
	Tipperary County Council
	Waterford County Council
	Westmeath County Council
	Wexford County Council
Wicklow County Council	
Atlantic Seaboard North	Mayo County Council
	Donegal County Council
	Galway County Council
	Sligo County Council
Atlantic Seaboard South	Cork County Council
	Clare County Council
	Kerry County Council
	Limerick County Council

Dublin Local Authority plans were developed by Codema – Dublin’s Energy Agency. The process was started before the guidelines for local authorities were produced by DCCAE. The plans were developed with consideration of how the Dublin Local Authorities can demonstrate leadership in climate action through their operations and service delivery. As such, a different methodology from the DCCAE guidelines for local authorities was used, namely the Local Governments for Sustainability (ICLEI) Five Milestone Methodology. The Five Milestone process consists of the following steps: initiate, research, plan, implement and monitor and iterate. In addition, workshops and interviews with over 100 staff across the four local authorities were undertaken to develop the actions contained within the plans, which focus on the remit of the Dublin local authorities (Dekker, 2018).

4. Analysis of Plans

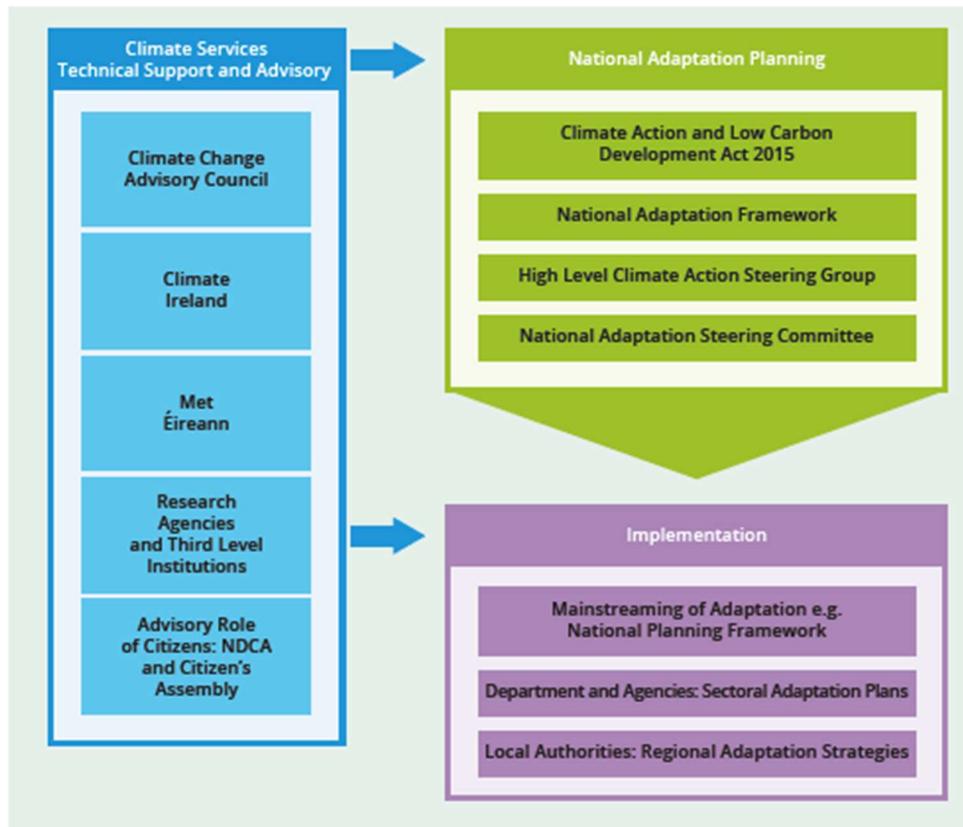
The EPA Technical Description for this research project stipulated an evaluation of ‘effectiveness, efficiency, coherence and relevance. The evaluation framework utilised should align with standard evaluation criteria and procedures used in ex-post evaluations of EU policies’. The project builds on these guidelines by using an evaluation framework that incorporate the effectiveness, efficiency, coherence and relevance criteria, but also adds two additional criteria: governance and “distributional impact.

A challenge with undertaking an evaluation of the plans currently in place is their relative newness. All 10 sectoral adaptation plans required under the Climate Action and Low Carbon Development Act have been completed. Prior to statutory requirements four were published: Flood Risk Management, Agriculture and Forestry, Electricity and Gas Networks, and Transportation Infrastructure by their respective departments.

Based on analysis of the content of the plans, it is evident that consideration was given to the coherence and relevance of the plans to each other, and to other legislation. For example, the document *Adaptation Planning: Developing Resilience to Climate Change in the Irish Agriculture and Forest Sector* acknowledges the overlap between mitigation in the Agriculture, Forestry, and Other Land-Use sector and adaptation. Furthermore, the plans recognise that EU policies will influence adaptation in the sector, specifically rural development and the Nitrates Directive, while the draft *Climate Change Adaptation Sectoral Plan for Built and Archaeological Heritage* references the Dublin local authority climate change action plans and their measures to protect heritage.

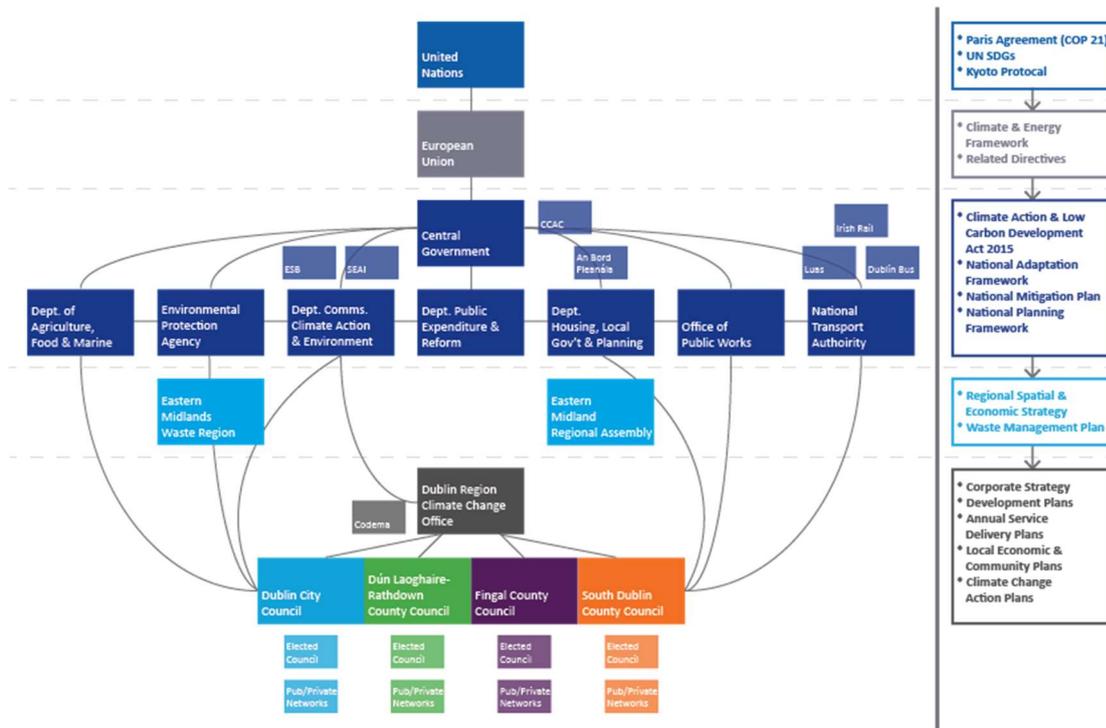
Additionally, governance (Figures 4 and 5) was a key criterion in the development of the plans demonstrated by creation of the National Adaptation Steering Committee and the CAROs. Section 5 will discuss the effectiveness of the governance structures in supporting sectors and local authorities in developing their plans and strategies respectively.

Figure 4: National Adaptation Governance Structure



Source: DCCAE (2018c)

Figure 5: Local Authorities



Source: Dekker (2018)

4.1 Progressing Adaptation: NCCAF to NAF

The primary difference between the NCCAF and the NAF is that the latter is statutory. As the NCCAF was developed in 2012 and established the call for the development of the climate information platform, *Climate Ireland*, it is to be expected that there are differences between the NCCAF and NAF, and subsequently the plans developed under each. Appendix II summarises key elements of the NCCAF and NAF. There are important differences, including the number of plans produced under each and the sectoral categories. Notably, both identified 12 sectors to be addressed, but the NCAAF provided for development of 8 sectoral adaptation plans, whereas the NAF provided for development of 9 sectoral adaptation plans. Under the NCCAF only 4 plans of the 8 plans were produced, while under the NAF all sectors have complied, and plans are at various stages of development. Only four of the sectors are the same under the NCCAF and NAF. It is not clear whether this is due to research undertaken during the NCCAF process, or if it is related to changes in government departments. The existence of published plans under both the NCAAF and the NAF would have facilitated comparison and assessment, including identification of other factors that influenced the capacity of government departments to develop plans under NCCAF.

Although it is beyond the scope of this research project, it is possible that Ireland's economic recovery can explain differences between the NCCAF and NAP processes. The public sector was unable to hire new staff between 2008 and 2015, except in exceptional circumstances. The resources needed to develop baseline data and undertake research were potentially constrained both in terms of finances and human resources. This could be demonstrated by third level institutions being tasked with undertaking the research, under the NCCAF in partnership with the OPW, Teagasc, EPA and Met Eireann. However, hiring resumed in the public sector by the time the NAF process was commenced. Nonetheless, , the absence of adaptation targets at the EU level and other factors, most prominently Brexit, have been prioritised in recent years and may therefore have constrained financing and human resources for climate change adaptation policy development. Future research could investigate the impacts of the economic downturn on the capacity of government to respond to climate change.

Another key difference between the NCCAF and NAF is the governance structure. The then Department of Environment, Community and Local Government was responsible for overseeing the implementation of the NCCAF and assuring compliance with the EU Adaptation Strategy. The NAF is the responsibility of the Department of Communications, Climate Action and Environment (DCCAE). However, under the Low Carbon Development Act 2015, there is a somewhat stronger governance structure than existed previously, which supports greater accountability for action (or inaction) to achieve national, EU and international targets. Furthermore, while the NCCAF called for adaptation guidelines to be developed, it was only under the NAF that official Sectoral Adaptation Planning Guidelines and Local Authority Adaptation Guidelines were provided (DCCAE, 2018b, 2018d).

Since the development of NCCAF, a number of key events have contributed to the changes in the NAF that may have acted as drivers for the changes observed. These include the release of the IPCC's Fifth Assessment Report in 2013-2014 and the landmark Paris Agreement agreed

at COP21 in 2015. In Ireland, as shown above, there has been an increase in the number of flood events, with the winter of 2015/16 being the most extreme to date (Met Eireann, n.d; OPW, 2019).

Although the adaptation plans are legislated for under the 2015 Act, the speed with which the plans have been produced perhaps reflects wider global climate change science and policy developments. Most plans were released for public consultation only in 2019. It is possible that this occurred partially in response to the publication of the IPCC's landmark report on *Global Warming of 1.5°C* (IPCC, 2018), as well as widespread experiences of climate change events that have gained greater attention locally and globally. This is discussed in the case studies of the adaptation work undertaken by the OPW and DAFM, which are the case studies in the next section.

5. Progressing Adaptation Policy: Case Studies

Acknowledging climate change adaptation is a relatively new policy domain, analysis of progress and impacts is limited. Our focused analysis within this work package of the ICPE project examines two case studies of the adaptation plans developed by the Office of Public Works (OPW) and the Department of Agriculture, Food and Marine (DAFM) under the NCCAF and NAF. Consequently, they present an opportunity to assess the respective effectiveness of the NCCAF and NAF frameworks, as well as the added value of statutory requirements for adaptation.

The sets of plans are notably different in their focus, but both follow the guidelines laid set out under the NCCAF and the NAF.

5.1 Case Study 1: Office of Public Works

The Office of Public Works is tasked with addressing flood risk in Ireland. The OPW produced the *Flood Risk Management Climate Change Adaptation Plan 2015-2019* (OPW, 2015) under the NCCAF and produced the *Climate Change Sectoral Adaptation Plan Flood Risk Management (2019-2024) draft plan* (OPW, 2019) under the NAF. The latter completed public consultation in August 2019. The draft plan developed under the NAF is an update of the plan developed under the NCCAF, informed by the latest research. It takes into account new research on the impacts of climate change and responses to flooding in Ireland. The plan also follows the guidelines provided by DCCAE.

Examination of both plans shows that flood adaptation is not novel in Ireland. There is a history of responding to flooding for different purposes:

Historically flood risk management focused on land drainage for the benefit of agricultural improvement. With increasing urbanisation the Arterial Drainage Act, 1945 was amended in 1995 to permit the Office of Public Works (OPW) to implement localised flood relief schemes to provide flood protection for cities, towns, and villages. (OPW, 2019: p. 13)

Responding to global calls for changes in approaches to flood management, a review of national flood policy was undertaken in 2004. This resulted in several recommendations that resulted in the development and implementation of key programmes that have informed Ireland's approach to flood management prior to the NAF. The primary programme is the Catchment-based Flood Risk Assessment and Management (CFRAM), which emerged from a recognition of the need to focus on flood risk management rather than relying on flood protection measures alone, using a catchment-based approach for assessing risk which is supported by the development of flood maps and flood risk management plans (FRMPs). This represents a move from reactive to proactive flood response policy. Furthermore, the CFRAM programme aligned with the EU Floods Directive of 2007, which calls for member states to undertake preliminary flood risk assessments (PFRA) to identify areas for further assessment (AFAs). CFRAM was completed in 2018, and highlights the level of flood risk facing Ireland. The survey assessed 300 communities and found that 80% of the properties in these communities are at risk of flooding.

Following from the National Flood Review, the OPW's approach to flood risk management has focused on, in order of priority:

- Prevention: Key to prevention is imbedding flood risk management in all government policies, particularly planning policy, to prevent development in flood prone areas. In 2009 the OPW and the Department of Housing, Planning and Local Government (DHPLG) developed guidelines for planners to assess planning and development applications for flood risk.
- Protection: CFRAM identified flood relief schemes across the country. The hierarchy of protection goes from green infrastructure to grey infrastructure. Identifying the appropriate protection response includes an assessment of the feasibility schemes for each area that account for the unique characteristics of an area.
- Preparedness: As flooding is not always preventable or possible to protect from, preparedness is critical. This involves preparing the public by building awareness prior to, during and after flood events by providing information on what to do. Preparedness may also include flood warning systems.

To support prevention, protection and preparedness, the OPW has provided information via two websites: floodinfo.ie and flooding.ie. The website floodinfo.ie provides information on both fluvial and coastal flood risk, based on three scenarios: low probability, medium probability and high probability. This information is presented in two formats: interactive for the whole country, and localised maps of key areas that can be viewed as PDFs. Users can also view photos of past flood events on these maps to understand the extent of past flooding. Users can also view flood plan maps. Information is provided on the measures that will be taken in areas to reduce flood risk. The measures that are currently used by the OPW include:

- Sustainable planning and development management
- Sustainable urban drainage systems (SUDS)
- Adaptation planning

- Land use management and natural flood risk management
- Maintenance of channels not part of a scheme
- Flood forecasting and warning
- Emergency response planning
- Promotion of individual and community resilience
- Individual property protection
- Flood-related data collection
- Voluntary home relocation

The decision to use each of the measures, individually or in combination, is dependent on the nature of the area and the flood risks specific to the location. These variables determine the feasibility of proposed flood relief schemes. Further research in the area of flood adaptation is ongoing. For example, research to support the promotion of individual and community resilience is being undertaken by DHPLG to align with the review of the Framework of Major Emergency Management.

The second website, flooding.ie, is focused on protection. Information provided on the website serves to inform people how to protect themselves and their property before, during and after a flood event. For example, farmers and businesses owners are provided with practical information to respond and recover from a flood event that will minimise adverse impacts on their assets and operations.

5.1.1 Key challenges

While these resources provide valuable information on flooding and actions being taken to address the risk, flood adaptation faces challenges. A project stakeholder workshop held in June 2019 as well as interviews with key stakeholders identified challenges to flood adaptation that need to be addressed. The key challenges can be broadly summarised into three categories: legislation, finance and communication.

While legislation exists to govern flood response, a variety of factors influence the uptake of flood responses measures. At the EU level, the Floods Directive 2007 sets out a high level response to flooding that required member states to undertake Preliminary Flood Risk Assessments (PFRA). Ireland transposed the Floods Directive through the European Communities (Assessment and Management of Flood Risks) Regulations 2010 (S.I. No. 122/2010), which was amended by S.I. No 495/2015. However, legislation and other policy initiatives pre-dating the Floods Directive and implementing legislation have shaped flood response in Ireland. These include the Arterial Drainage Act 1945, which was amended in 1995 to allow the OPW to undertake local flood relief schemes to protect cities, towns and villages, and the National Flood Policy Review in 2004.

Other legislation and policies shape the capacity of the OPW and local authorities to implement flood relief schemes, such as the Planning and Development Act 2010 which includes requirements for public consultation. Key stakeholders interviewed as part of this research suggested that, due to the public consultation for flood relief schemes being open to comment

from individuals across the country, it is possible that those directly impacted by flood risk may inadvertently be harmed by those not impacted. This creates challenges for implementing necessary flood relief schemes that have been assessed as suited to a particular location. The opportunity to appeal decisions through third party appeals under the Planning Act was cited by interviewees as a tool that has been used to prevent the development of appropriate schemes. For example, in the case of the relief scheme in Clontarf, Dublin it was users of the road that objected to the wall, not the residents of the area according to interviewees. While this example used amenity as a reason to oppose a scheme, some objections have used strategic environmental assessments as a means to object to measures by individuals or groups not directly affected.

Another challenge is the understanding of roles and how that determines the capacity of the OPW and local authorities to respond. Riparian rights are a challenge in both rural and urban contexts. In rural areas, where a water course crosses a property, it is understood that the owner of the land is responsible for the maintenance and health of the water course. The challenge lies in communicating the downstream and upstream impacts of not managing the water course. In urban areas, it may be that individual property owners do not know that they are responsible for the maintenance of water courses. In some instances, this has created challenges for local authorities, where a house has been built adjacent to a water course and, over time, natural processes have eroded the land, making the building unsafe. In these circumstances, local authorities can only advise building owners to move.

Our research has not been able to assess the coherence of all legislation and policies that have direct and indirect effects on the development and implementation of flood relief schemes. However, we recommend that future research be conducted to assess coherence of policy. In particular, consideration should be given to how to effectively balance the rights of objectors with the rights of those who may be negatively impacted by third party objections. This is particularly critical against a backdrop of increasing flood risk caused by climate change, where it is likely that difficult decisions will need to be made with regard to land-use and land-use change.

The financing of flood prevention, protection and preparedness measures needs to be considered in the context of future as well as current climate risks. Our discussions with stakeholders highlighted the dangers of relying solely on the present cost of action in the absence of consideration of future risk. This runs the risk of spending money on infrastructure that will need to be enhanced in future and consequently will incur avoidable additional costs. Selecting a measure based on current risk and cost alone may result in a measure that is not future-proofed. Thorough consideration needs to be given to the usefulness, value and functionality of measures in the context in which they are to be used. For example, early warning systems are valuable in alerting people to flood risk, such that they are able to prepare and evacuate as necessary. However, the costs of a sensor network may far out-weigh the value of the system, depending on where it is deployed. A sensor network in an unpopulated area may not be necessary. Identifying the right technology is essential. It needs to be reliable and should enhance existing means of predicting flood events. There may be opportunities for

sensor networks to monitor not just flood risks but also water quality and other environmental indicators. Consideration of the multiple benefits of flood measures is important to ensure that actions are cost effective not only today but in 50 years, and provide multiple benefits. Achieving this involves communicating the risks of flooding and the opportunities inherent in reducing risk.

Engagement with key stakeholders as part of this research highlighted the challenges of effective communication. In the context of climate change and flood risk, it was suggested by stakeholders that while there is an eagerness for action, there is a lack of understanding of the scale of the problem and the changes needed. Even when individuals and communities are provided with relevant information by the OPW on risks and effective remedies, there are individuals and groups that object to measures and actions. Public consultation has been a means by which to engage with the public, but is time- and resource-intensive. In an eight-week window, it is expected that a consultation process will reach all people who are impacted by a project, engage with them in its design, and explain the process for selecting measures. This process is repeated across various government departments at central and local level. It was suggested by stakeholders that design of flood projects needs to be more integrative and collaborative. Flooding will affect critical infrastructure from the electricity network to the roads network. For this reason, all relevant departments need to collaborate in developing responses. Doing so will have multiple benefits, from producing plans that reduce risk and prevent flooding, to ensuring the emergency response plans are comprehensive and enable first responders to access people in flooded buildings. Additionally, integration and collaboration may reduce costs by consolidating resources and coordinating efforts. Furthermore, integration and collaboration will require cross-departmental and cross-government communication and ownership, which will add value to communication with the public in terms of the risks and responses.

5.2 Case Study 2: Department of Agriculture, Food and the Marine

Under the NCCAF, the Department of Agriculture, Food and the Marine (DAFM) was responsible for developing adaptation plans for the agriculture, forestry and marine sectors. However, the adaptation plan, *Adaptation Planning – Developing Resilience to Climate Change in the Irish Agriculture and Forest Sector* did not include the marine sector because this was to be developed separately. This plan, developed under the NCCAF, focused on adaptation measures addressing risks to livestock, crop production, and forestry. Actions included in the Plan fell into six categories: national actions, interagency, knowledge transfer and communication, research, land management, and livestock management.

Under the NAF, DAFM published for consultation the *Draft Agriculture, Forest and Seafood Sectoral Climate Change Adaptation Plan* in June 2019 (DAFM, 2019). This plan is a continuation of the work done under the NCCAF but includes the addition of the seafood sector. As in the first case study above, the Plan follows the guidelines produced under the NAF (DCCAE, 2018d). However, the draft adaptation plan retains the use of case studies to illustrate vulnerabilities and responses to climate change.

Notably, and in contrast to the flood risk management plans developed by the OPW, both plans produced by DAFM followed a similar methodology. This is likely due to the timing of the plans. The first was released in 2017 after the 2015 Climate Act was enacted and the sectoral guidelines were at an advanced stage. The methodology for the 2017 plan was:

- Build the adaptation team
- Climate impact and vulnerability screening
- More detailed analysis of priority climate impacts and vulnerabilities
- Identifying, assessing and prioritising options
- Monitor, review and evaluate

This methodology is marginally different from the sectoral adaptation guidelines published by DCCAE in 2018 (DCCAE, 2018d). The plan developed under the NAF does not outline the exact methodology used but it is evident in the structure of the plan that the sectoral adaptation guidelines were followed, which is similar to the other sectoral plans. In contrast to the first plan, there is a clearly stated goal and supporting objectives.

The plan developed under the NAF states that the overall adaptation goal is to:

Build resilience to the effects of climate change and weather related events in agriculture, forestry and seafood sector, reduce any negative impacts where possible, take advantage of any opportunities and to contribute to achievement of DAFM Statement of Strategy Goals (DAFM, 2019, p.25).

DAFM has highlighted four overarching objectives to support this goal (DAFM, 2019):

- Ensure a joined up approach to adaptation planning in the Department of Agriculture, Food and the Marine.
- Raise awareness of the impacts of climate change in the agriculture, forest and seafood sector.
- Reduce vulnerability of the agriculture, forest and seafood sector to main climate impacts and seek to increase resilience.
- Embed adaptation planning in agriculture, forest and seafood sectoral policies.

The overarching adaptation objectives are supported by 17 high-level actions that focus on the need for collaboration, coordination and integration. The case studies contained in the plan provide examples of actions that have been taken, while demonstrating the need for cross-sector cooperation.

The use of case studies in both plans illustrates impacts of climate change on the agriculture and forestry sectors. In the first plan the costs of climate change events are the focus of the case studies. The five case studies in this plan are short and focused on winter floods, fodder crisis, winter freezing, winter storms, and health and safety. In the draft plan developed under the NAF process, the 13 case studies discuss the knock-on effects of climate change events,

considering the risks to the long term viability of the various sectors. The case studies also serve to illustrate challenges ahead.

5.2.1 Key Challenges

Relative to the case studies set out in the plan developed under the NCCAF, those contained in the draft plan developed under the NAF process are expanded, stronger, and more detailed in terms of linking the impacts of climate change to the sector. With this increased depth, the case studies highlight challenges ahead that may hinder adaptation efforts, particularly gaps in existing policies, programmes and communication. Furthermore, our project workshop with key stakeholders identified system-level challenges to adaptation that need to be addressed. This will be discussed in greater detail in section 6. This section will discuss the key challenges within the context of the remit of DAFM, which can be summarised into the following categories: slow-onset climate change impacts, interdependence of sector, and communication.

It is evident from the draft adaptation plan developed under the NAF process that agriculture, forestry and seafood are not just vulnerable to sudden onset climate change impacts such as extreme weather events and flooding. They are also highly susceptible to changes in weather patterns, particularly precipitation intensity and frequency, as well as shifts in seasonal timing of precipitation. These changes are happening now. Farmers in particular have been actively adapting farm management practices to these changes. The weather events of 2018, highlighted in case study 2 of the sectoral adaptation plan, illustrate interconnectedness of grass production with dairy and beef. Farmers' incomes in the absence of climate change are already vulnerable to disruptions in supply chains and fluctuations in the market demand for goods. Climate change not only compounds their economic risks but creates additional risks, such as health risks, both physical and mental.

In interviews undertaken with stakeholders in the climate change mitigation in agriculture work package of our ICPE project, these risks were made apparent in the example of dairy farming. An interviewee stated that they have experienced changes in precipitation on different fields where they graze cows in the last few years. For the farmer interviewed, there was an increased need to move the herd from field to field to allow pasture to grow. Additionally, herds have been kept indoors for longer, putting into question the credibility of Irish dairy being primarily grass-fed. Furthermore, the intensity of the work in moving herds is physically taxing and places farmers at greater risk of injury, which may result in long-term disability and poor mental health.

As discussed in our climate change mitigation in agriculture sectoral work package, climate change policy has primarily focused on farm-level emissions, to the exclusion of those that stem from distribution and processing. The draft adaptation plan for this sector recognises that lack of preparedness will lead to adverse outcomes for food supply and security. This is an acknowledgement of the need for distributors and processors to adapt, which will require gaining the cooperation and understanding of the need to act and options to build resilience. Furthermore, adaptation and mitigation are interrelated. Measures to achieve one can have benefits for the other. However, policies have yet to recognise and communicate which actions achieve both, and then encourage and support farmers in their uptake. Lastly, as with mitigation

measures, adaptation measures need to take a systemic, long-term view. For example, the distribution of goods is dependent on a resilient transport sector, and the processing of goods is dependent on a resilient energy system.

In the draft adaptation plan developed under the NAF process, the case studies illustrate the risks facing the seafood sector. However, it is evident that the commitment to a sectoral approach by the Irish government falls down even more in this sector. When considering the work undertaken by the OPW with regard to coastal protection, it becomes evident that the division of responsibility for climate adaptation is a hindrance rather than a benefit. The division implies that there is no relationship between the geophysical elements of the coast, and the biodiversity that lives along the coast that provides economic and social benefits to coastal communities. The reality is that they are inextricably linked. There is no way to delineate one from the other.

The separation of responsibility results in duplication (if not triplication, as water quality is the responsibility of DHPLG) of work where in practice collaboration and coordination is needed. The case studies in the plan on harmful algal blooms, fish stock distributions, ocean acidification, ocean plankton, and seafood infrastructure effectively highlight the need for collaboration, given that they are all related. For example, by changing the pH of the water algal blooms create risks for plankton which serve as a food source for fish and other marine life. Decreases in plankton may result in declining fish stocks, which reduce the incomes of those who depend on the coast for survival, which in turn reduces tourism to coastal areas. As such, water quality has implications beyond the immediate impact of reduced bathing in summer.

Effective communication is essential to ensure collaboration between departments, as well as between government, farmers and civil society. There is a lack of communication between government departments, as well as possibly difficulties in identifying relevant points of contact. Communication between government and farmers and civil society is also lacking. One challenge with communication in this context is explaining why certain actions are being taken or not. The OPW identified this as a challenge to undertaking flood works. Often, objections would arise to the use of flood walls in areas where they are needed. While the OPW would have assessed all options before implementing, objections may arise from those not directly affected. While the OPW is responsible for developing, implementing and communicating about flood adaptation measures, this is not the case in agriculture. In agriculture, individual farmers are responsible for implementing actions recommended by DAFM or Teagasc to protect their land and home. It was suggested in interviews that farmers have not been actively engaged on actions to protect their land from climate change. They have been asked to undertake certain actions but not informed of why they should do so. For example, hedgerow conservation can bring benefits for flood adaptation, mitigation, and pollinators. In this case, knowledge from various government departments is needed to provide farmers with comprehensive information. This highlights the need for collaboration in adaptation.

Cross-departmental communication is key to effective collaboration. This is not exclusive to adaptation in agriculture. Adaptation and mitigation actions need to be implemented collaboratively to achieve coherence and cohesion, which are lacking in the majority of the sectoral adaptation plans produced to date that have followed DCCAE's guidelines. DAFM's adaptation plan is effective in highlighting the cross-cutting nature of climate action with its use of case studies. Critically, the case studies are effective communication tools that ground the complex terminology found in climate scenarios and projects into real terms that can be understood by affected stakeholders and wider society. Furthermore, the case studies draw attention, though not explicitly, to a key reason for responding to climate change, namely its impacts on human health.

6. Recommendations

The 'newness' of adaptation policy in Ireland, in comparison to mitigation policy, in theory would suggest that there would be no lessons to be learned or recommendations emerging from this study. As the DAFM sectoral adaptation plan notes:

Impacts of climate change are not constrained by sectoral or spatial boundaries. Therefore, there is an appreciation for increasing the need for cross-sectoral integration across climate policies. However, at this point in time there is little experience in terms of cross-sectoral adaptation policy. It is anticipated that such policy will be complex and have resource implications that will need addressing. Further work is needed to better understand how cross-sectoral integration could be achieved. (DAFM, 2019, p 24)

However, analysis of the NCCAF and NAF through case studies has demonstrated that there are lessons and opportunities with regards to the process and governance for adaptation planning, tools for collaboration and integration, and communication.

6.1 Process and Governance for Adaptation Planning

To facilitate the development of sectoral adaptation plans, the NCCAF called for the development of guidelines. This came into fruition under the NAF. Our analysis of the plans that have been produced under the sectoral adaptation guidelines and those under the local authority adaptation guidelines indicates that the plan development process needs to be adapted to support the collaborative action that is called for in the *Climate Action Plan to Tackle Climate Breakdown* (DCCAE, 2019a). The plan development process needs to evolve to ensure that the plans are developed not solely because they are legal requirements. Analysis of the existing plans suggests that legislation may not be the right driver. The plans have been produced to fit the specified guidelines rather than necessarily being tailored to fit the unique attributes of each sector. The adherence to specified guidelines can also be seen in the local authority adaptation plans. In some of these plans, the fact that some plans appear to duplicate or copy existing plans suggests again that the development of prescriptive guidelines may have resulted in plans that may not adequately address a local authority's unique characteristics.

A key challenge highlighted in our project workshops was the lack of coordination and cross-departmental collaboration. The sectoral adaptation guidelines have been beneficial for each sector in developing an understanding of their climate risks. However, our review of each plan shows that requiring sectors to develop actions to respond to climate risk in isolation does not foster the collaboration and cooperation necessary. It would be beneficial for DCCAE or the Climate Change Unit in the Department of the Taoiseach to be designated as the entity to facilitate collaboration across sectors to develop one national adaptation plan, or one climate action plan that addresses both adaptation and mitigation. The 2019 Climate Action Plan (DCCAE, 2019a) has a single chapter on adaptation, which is treated as separate of mitigation. However, adaptation and mitigation actions overlap and can have multiple benefits, as our analysis of the agriculture sector and in the local authority action plans has shown.

6.2 Tools for Collaboration, Integration and Communication

There is potential for co-benefits and trade-offs from actions identified in the various sectoral adaptation plans. In particular, as the agriculture and forest sector covers the majority of the land area in Ireland it has the potential to play a central role in the potential development of green infrastructure initiatives and protecting biodiversity to support resilience in other sectors. For example, well managed riparian forests can act as a buffer between water courses and agriculture. Maintaining grazing in upland peatlands also has an important dual purpose role to play in both protecting against wildfires and acting as a sink during periods of high water flow surges. (DAFM, 2019, p.20)

An adaptation plan consisting of actions that require collaboration across departments and with other stakeholders will need tools to support collaborative development. During our stakeholder workshop for this work package, it was clear that well-designed workshops are one tool that enable policy makers to come together and discuss issues and potential solutions. The format of such workshops and the ongoing work outside of the workshops are important. This will ensure that the outputs of workshops are used constructively.

Such workshops need to be designed to facilitate discussions that identify problems and support active ongoing problem-solving. Policy challenges discussed may not be directly in the field of expertise of all participating stakeholders, but they may nonetheless be affected by them indirectly. By creating this environment, stakeholders will be connected with each other and can build relationships that may be of use to them in their ongoing work. Responsibility for facilitating these workshops could potentially be allocated to the CAROs and DCCAE. The workshops are a tool for creating an intra-governmental network for climate action. Moreover, the sectoral adaptation plans highlight the key role of local authorities in implementing actions. Furthermore, this network is also essential for communication internally and externally to civil society.

Communication was raised as a key issue in our project stakeholder workshop for this work package, and arises in the context of the sectoral adaptation plans. Effective communication

of climate risks requires involvement of various central government departments and local authorities, as well as good data to monitor progress. Mapping is a tool that has not been actively utilised. Geological Survey Ireland (GSI), located within DCCA, is tasked with providing open data and maps with information on geological characteristics, and interpreting how these interact with proposed infrastructure projects and climate risks. The information held by GSI is critical to responding to climate change in a manner that acknowledges Ireland's varying landscape. Mapping may also be used to consolidate information regarding ongoing actions and initiatives. This may assist in efforts to achieve collaboration as well as to communicating why actions are being undertaken and how decisions were made. An example to follow can be found in Canada with the Prairie Institute for Climate Change, which has produced an atlas of climate change in Canada. This atlas includes climate risks as well as actions being implemented across the country to respond. Dissemination is an important dimension of this work.

At present, *Climate Ireland* hosts information on climate change in Ireland. The Climate Ireland website could host a map of the climate actions being undertaken across the country and by whom. Furthermore, while the Climate Ireland website has been developed in an academic context with input from policy makers, it retains an academic tone. If it is to evolve to be a tool for public communication, it will need to be simplified. This is perhaps an opportunity for collaboration between the CAROs and the National Dialogue for Climate Action to develop a platform that effectively communicates what is being done in Ireland by government departments and local authorities to address climate change.

While adaptation policy is in its infancy in Ireland, the approach taken to date highlights the need for greater integration and coordination of mitigation and adaptation responses to climate change across sectors and levels of government. Government can streamline responses and introduce efficiencies by providing opportunities for key policy stakeholders to engage in collaborative processes to develop and implement climate actions. Furthermore, resulting actions have the potential to acknowledge the unique landscape characteristics of Ireland and the specificities of various economic sectors, and by so doing to improve the health and livelihoods of citizens. Well-planned workshops that facilitate dialogue between stakeholders, along with a strong understanding of the actions sectors and local authorities are already taking and what supports they need, will help to facilitate development of stronger climate adaptation policies.

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Appendix I: Weather Events in Ireland from 1950 to present (continued on next page)

Type	Date(s)	Impacts
Flooding	December 1954	Flooding of 1,500 houses that accommodated 2000 families. Dublin mainly affected.
Hurricane Debbie	September 1961	An unusual hurricane that developed in the east Atlantic. There was damage to property and 11 deaths attributed to the storm.
Severe Cold Spell	January 1963	There were between 40-50 days of air frost, and days where air temperature fell below -10°C.
Pluvial/ Severe Thunder Storm	June 1963	Flooding in Dundrum, Blackrock, Sandymount, and Ballsbridge, where 97.8 mm of rain fell.
Flooding	November 1973	Severe flooding in south and west in counties Kerry, Cork and Limerick.
Severe Storm	January 1974	Extreme damage was caused to coastal areas, as storm coincided with full moon spring tides. There were five deaths reported.
Storm	January 1976	Approximately 90,000 homes were without electricity. Most severe in the mid-west of country.
Dry Period	Oct 1974- August 1976	Rainfall for this period was well below normal and the summers of 1975 and 1976 were notably dry and sunny. (There is no excepted definition of drought.)
Fastnet yacht race	August 1979	Storm off the coast of Ireland.
Heavy Rainfall	November 1980	Reported that 157.1 mm of rain fell in the first two days of November.
Heavy Snowfall	January 1982	Prolonged snowfall with gale-force winds. Some areas accumulated 25 cm of snow.
Widespread Thunderstorms	July 1985	Widespread thunderstorms that resulted in 100s of animals being killed by lightning and large hailstones.
Hurricane Charley/ Flooding	August 1986	Hurricane Charley – Worst flooding in Dublin in 100 Years.
Heavy Snowfall	January 1987	Snowfall accumulation of up to 19 cm.
Heavy Rainfall	October 1987	Heavy rainfall event resulting in flooding.
Storm Force Winds	February 1988	Strong winds of up to 83 knots. Over 40,000 homes without electricity in southern counties.
Heavy Rainfall	October 1989	Heavy rainfall in west and northwest, excess of a 1 in 100 year event.
Storms and heavy rain	February 1990	Wettest and windiest February on record due to series of storms over Atlantic.
Windstorm	January 1991	Strong southerly/ south-westerly winds.
Flooding	June 1993	Excess of 100mm of rain fell in a 24-hour period over parts of Dublin and Kildare.
Tornado	March 1995	Tornado in County Meath accompanied by hail, and thunderstorms. Damage to houses and schools.
Warmest Summer on Record	Summer 1995	Mean air temperature 2°C above normal. Temperature rose to 30°C in Dublin, Kilkenny experienced 27 days with temperatures over 25°C.
Flooding	August 1997	Four day rainfall resulted in flooding in the south.
Windstorm	December 1997	Windstorm comparable to Hurricane Debbie.
Flooding	December 1998	Flooding in Blackwater.

Hurricane force winds	December 1998	Hurricane winds in the north and northwest.
Fluvial	November 2000	250 Properties flooded in Dublin, 90.8 mm of rain fell. Significant disruption and damage, especially in the area of the Lower Tolka catchment.
Coastal	February 2002	Rain led to high groundwater levels which was coupled with the highest tide ever recorded. This caused sea defences to be overtopped. 1250 Properties flooded in Dublin, €60M worth of damage.
Fluvial	November 2002	Repeat of 2000 greater severity, 80 mm of rain fell in Dublin.
Flooding	September 2003	Rainfall event.
Warmest Summer	Summer 2006	Warmest summer on record since 1995.
Pluvial	August 2008	North City; 42.9mm in 2 hours = 1 in 100-year event.
Pluvial	September 2008	Heavy rainfall.
Pluvial	July 2009	1 in 50-year event; Several areas within the Dublin City Council boundary were affected. One of the worst affected areas was Donnycarney in North Dublin, where the storm (surface) water collection system draining to the Wad River culvert was overwhelmed at the Malahide Road, resulting in flooding at Collins Avenue and Clanmoyle Road. Reports also of spot flooding at Raheny, Clontarf, Drumcondra, Finglas Sandymount, Cabra, Finglas and Glendhu Park in Ashtown.
Flooding	November 2009	Rainfall was high in the month of November, with twice the average amounts measured at all stations.
Coldest Winter	2009/2010	Coldest period with temperatures falling below -10°C in some areas. Coldest since 1962/63.
Extreme Cold (Cold Snaps)	November/December 2010	It was also the coldest of any month at Dublin Airport, Casement Aerodrome and Mullingar, each with over 50 years of record. The lowest December air temperature ever measured in the country, -17.5°C, was recorded at the climatological station of Straide, Co. Mayo, on the morning of the 25th, while Casement Aerodrome's minimum value of -15.7°C on the same day was the lowest value of any month ever recorded in the Dublin area.
Pluvial/Fluvial/Coastal	October 2011	95 social housing units damaged, €1.2M in housing insurance claims alone.
Storm Darwin	February 2014	Considerable damage to housing and other buildings; 8,000 ha of forests damaged 1 in 20-year event Of 50-65 km/h, gust 100-110 km/h in Dublin Level: Yellow
Storm Ophelia	October 2017	100 large trees blown over in Dublin City; in the rest of the country there was significant damage to buildings. First storm to come from a southerly direction. Stormy with violent, damaging gusts of 120 to 150 km/h. Level: Red
Storm Emma and Beast from the East	February – March 2018	Closure of all schools in city, many businesses affected, water and power restrictions or outages. Met Eireann issued its first red warning for snow on record.

Source: Met Eireann (n.d.)

Appendix II: NCCAF and NAF – Structure (continued on next page)

Elements	NCCAF	NAF
Basis	Non Statutory	Statutory
Building Blocks/ Guiding Principles	<ol style="list-style-type: none"> 1. A robust knowledge base 2. An assessment of adaptive capacity 3. A vulnerability assessment 4. Identification of adaptation requirements 5. Action plan 6. A review mechanism 	<ol style="list-style-type: none"> 1. Ownership 2. Vulnerability based assessment 3. Openness and knowledge transfer 4. Foster cooperation 5. Account for uncertainty 6. Climate scenarios 7. Identify a wide range of adaptation options 8. Prioritise adaptation actions 9. Monitoring progress
Sectors	<ol style="list-style-type: none"> 1. Water 2. Emergency planning 3. Marine 4. Agriculture 5. Forestry 6. Biodiversity 7. Heritage 8. Transport 9. Energy 10. Communications 11. Flood Defence 12. Health 	<ol style="list-style-type: none"> 1. Seafood 2. Agriculture 3. Forestry 4. Biodiversity 5. Built and Archaeological Heritage 6. Transport Infrastructure 7. Electricity and Gas Networks 8. Communications network 9. Flood Risk Management 10. Water quality 11. Water Services Infrastructure 12. Health
Year to be completed	2014	2019
Plans produced	4 (Agriculture, Flood Defence, Transport, and Energy)	10 (1-3 merged into one)
Framework	<ul style="list-style-type: none"> • Providing the policy context for a strategic national adaptation response to climate change: • Promoting dialogue and understanding of adaptation issues: • Identifying and promoting adaptation solutions and • Committing to actions to support the adaptation process. 	<ul style="list-style-type: none"> • Integrate climate adaptation within all relevant national policy and legislation (e.g. National Planning Framework, estimates and budgetary process, National Investment Plan) and Department and Agency decision making. • Increasing awareness of the necessity for climate adaptation and building adaptive capacity where required. • Encouraging the implementation of climate adaptation measures. • Developing and exploiting the knowledge base.

		<ul style="list-style-type: none"> Addressing prioritised urgent and future climate risks. Monitoring the progress and effectiveness of adaptation at national level.
Assessment of Climate Change Risks	Calls for extensive research to be undertaken by academia (ICARUS-Maynooth, NUI Galway, UCD, UCC), Teagasc, COFORD, OPW, EPA and Met Eireann to fill gaps and identify adaptation measures	Informed by researched called for in NCCAF.
Governance/ Responsibility	<p>‘Strong policy and planning co-ordination among Government Departments and local authorities will be crucial in the delivery of this Adaptation Framework, and the forthcoming EU Adaptation Strategy where issues of national competence arise’</p> <p>and</p> <p>‘Department of the Environment, Community and Local Government will lead and co-ordinate national adaptation policy and the implementation of this Framework, working as appropriate through the Cabinet Committee system, to ensure overall policy coherence and effective communication across Departments and Agencies, particularly where there are cross-cutting issues within sectoral adaptation plans.’</p>	<p>In addition to sectoral and local authority adaptation plans, the roles of various stakeholders are indicated</p> <ol style="list-style-type: none"> Climate Change Advisory Council – independent expert advice Met Eireann – helping Irish society to be ready for and responsive to weather-related challenges Private Sector – to engage with respective departments on climate action Civil Society – to have a voice in determining the future of Ireland’s climate resilience International Development – Ireland plays its part at a global level in respect of discharging its obligations on matters relating to how we contribute to climate resilience
Local Authorities	Pro-active approach, integrate climate change into their development plans.	Pivotal role in planning for, and responding to, emergency situations. Work to date by sectors have identified local authorities as a key stakeholder responsible.