



COMHAIRLE CONTAE AN CHLÁIR  
CLARE COUNTY COUNCIL

# CLIMATE CHANGE ADAPTATION STRATEGY

2019-2024



# FOREWORD

We welcome the publication of Clare County Council's Climate Change Adaptation Strategy 2019-2024. Climate change is one of the biggest risks facing the communities, physical infrastructure, biodiversity and social fabric which makes county Clare such a unique place to live.

The challenges being presented by climate change are many and varied and range from longer hotter summers, increased rainfall, flooding, rising sea levels and intensified storms in winter.

In county Clare we are experiencing the effects of such climate changes on a more frequent basis.

In line with the National Adaptation Framework this strategy creates a roadmap of goals and objectives to be delivered across six thematic areas which Clare County Council will undertake to adapt to the effects of climate change and safeguard our way of life.

By taking this proactive action to adjust and prepare for a changing climate we will build resilience in our economy, environment and communities.

Clare County Council fully supports the implementation of the 2015 Paris Agreement on Climate Change. The Paris Agreement is a protocol that was ratified by Ireland on 4th November 2016 and it is aimed at primarily; limiting global warming to less than 2.0°C above pre-industrial levels, building resilience and increasing the ability to mitigate the impacts of climate change.

The Local Authority is committed to working with the Climate Action Regional Office (CARO), which will provide guidance and support on how Climate Change Adaptation and Mitigation measures can be implemented in County Clare.

This will be a major undertaking and should not be underestimated. We will face difficult decisions along the way. However we must also find the opportunities in the challenge of adapting to climate change. We must capitalise on these opportunities and turn them to our advantage to continue to develop our county in a sustainable manner for future generations.

Le meas,



*Cathal Crowe*  
Cllr. Cathal Crowe  
**Mayor of Clare**



*Pat Dowling*  
Mr. Pat Dowling  
**Clare Chief Executive**

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# EXECUTIVE SUMMARY

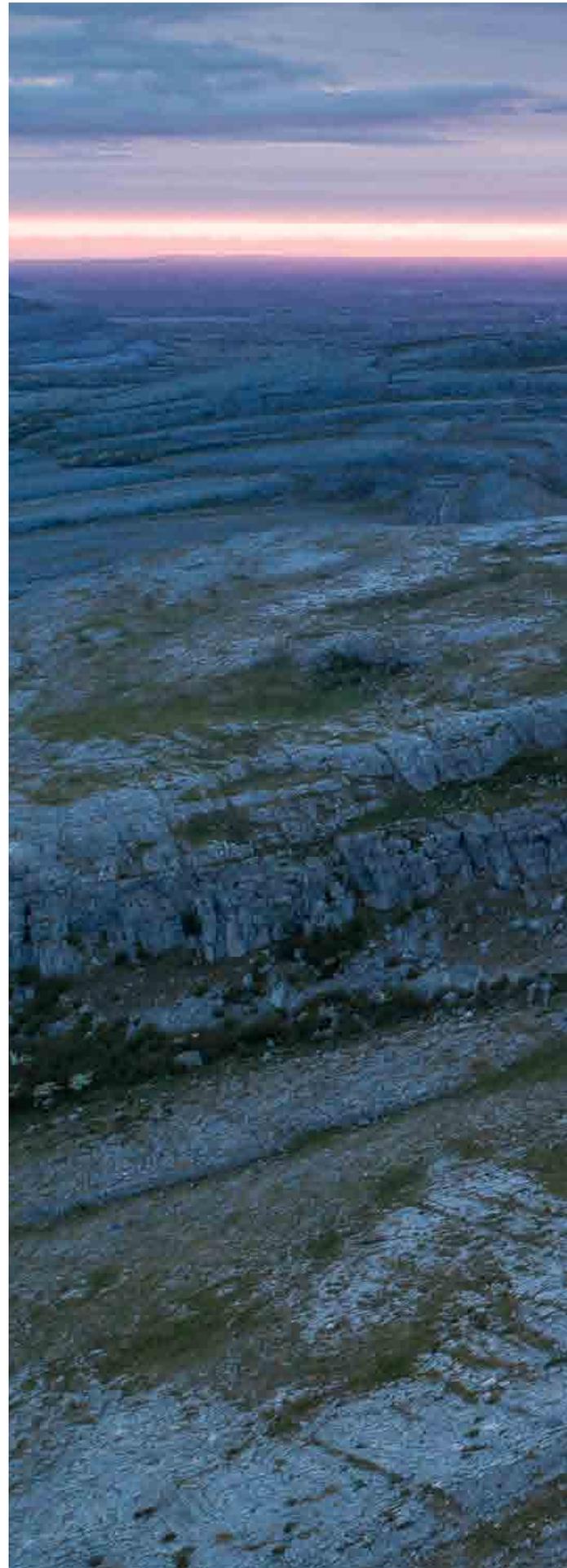
This document outlines the proposed Adaptation Strategy that Clare County Council will implement to adapt to the effects of climate change and to safeguard the biophysical infrastructure and well being of the people and communities of County Clare.

The strategy has been developed in accordance with the **2018 Local Authority Adaptation Strategy Development Guidelines** which set out a road map for local authorities and ensure a consistent approach across the sector.

Our strategy sets out the high level vision on how we will transition to a low carbon climate resilient future by adapting a wide range of actions across the different Directorates to adapt to the challenges of climate change. The strategy will be dynamic and flexible to respond quickly to the threats and opportunities that will face the local authority in the coming years.

The strategy is based on extensive review, research and stakeholder engagement. The public consultation process which is part of this process will also inform the objectives and actions set out in the strategy.

This strategy will not be a standalone document but its goals and objectives will be incorporated into all future plans and policies of Clare County Council to ensure climate adaptation is at the forefront of our service delivery.





# 1. INTRODUCTION





**Clare County Council's climate change adaptation strategy forms part of Ireland's national strategy for climate adaptation as set out in the National Adaptation Framework (NAF) which was mandated under the provisions of the Climate Action and Low Carbon Development Act 2015.**

The strategy in this document is primarily focused on adaptation to climate change and aims to identify Clare County Council's vulnerabilities and the major risks facing the county. It will develop a pathway in how to adapt and plan to strengthen our physical infrastructure, bio-diversity and also develop resilience in our communities to deal with the effects of climate change.

While some variations in climate can at times be considered normal, emerging research and observational records from across the world now show rates of change that are far greater than those experienced historically and are the direct result of mankind's intervention. Ireland's climate is changing in line with global trends and these changes are bringing significant and wide ranging challenges to the local authority sector and the communities we serve.

It is important in the context of this strategy before going further to understand some of the main terminology used in discussing climate change.

#### **So what do we mean by Climate ?**

The Intergovernmental Panel on Climate Change (IPCC) 2001 glossary defines climate as follows:

“Climate in a narrow sense is usually defined as the “average weather,” or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period ranging from months to thousands or millions of years. The classical period is 30 years, as defined by the World Meteorological Organization (WMO). These quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state, including a statistical description, of the climate system.”

Climate change in essence means a significant change in the measurements of weather patterns lasting for an extended period i.e. greater than 30 years.

Climate Adaptation then can be best described as planning proactively to take action and make adjustments to minimise or avoid the existing and anticipated impacts from climate change.

The Intergovernmental Panel on Climate Change (IPCC), in 2014, defined climate adaptation as:

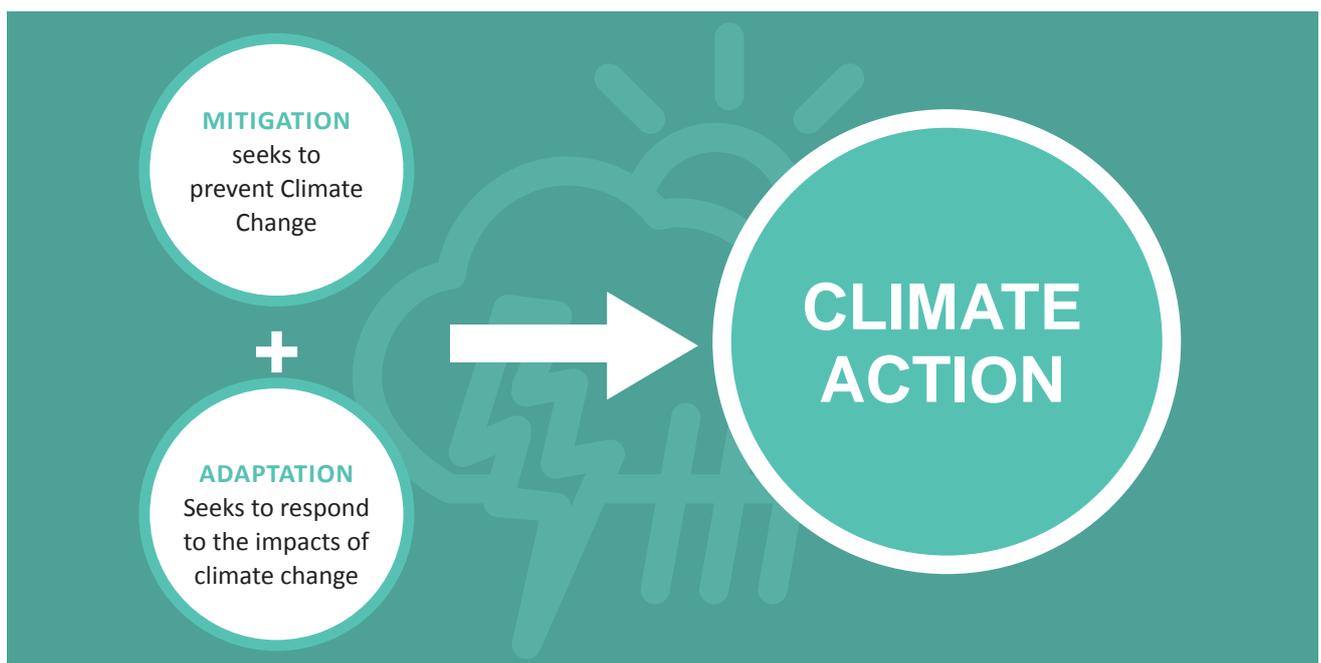
“The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects.”

Currently however we are mainly reacting and not fully adapting to these climate events. Clare County Council reacts to these events as they unfold such as snow in winter, floods, storm damage or prolonged hot and dry spells in the summer. The Council deploys resources to deal with each crisis as it happens. This is not a sustainable approach and we must adapt to the changes in our climate.

Another expression frequently used in discussing climate is **mitigation**. It is important at this point to stress that climate change is here now and although we can certainly try to mitigate its effects by reducing our production of green house gases we cannot solely wait for such mitigation measures to take effect. Unfortunately the time period required to see the benefits of mitigation are too long and in the meantime we must adapt but equally not pass up on any opportunity to mitigate or indeed innovate solutions to address climate change.

**Adaptation** refers to efforts to manage the risks and impacts associated with existing or anticipated impacts of climate change.

**Mitigation** refers to the efforts to reduce the emission of greenhouse gases and reduces the severity of future climate change impacts.



## 1.1. Ireland's Changing Climate.

### What is the evidence that illustrates that Ireland's climate is in fact changing?

The Environmental Protection Agency under the climate change research programme 2007-2013 published a report on a **“Summary of the State of Knowledge on Climate Change Impacts for Ireland”**.

The report relied upon a number of data sources such as Met Éireann, the National University of Ireland Maynooth and material from the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4). It should be noted that Met Éireann has over 100 years of records measuring many different climate parameters.

The report states that

“Changes in Ireland's climate during the last century are in line with global and regional trends associated with human-induced climate change. These changes are projected to continue and increase over the coming decades and up to the end of this century. Adaptation actions will be required in order to avoid the adverse impacts of these changes.”

Among many of the findings are the following salient points when analysed over the preceding century;

- The temperature has increased by 0.7°C since 1890 equating to an average of 0.06°C per decade but this trend increased in the period 1980-2008 to 0.14°C per decade.
- We have had a decrease in frost nights with an approximate median decrease of 30-40%.

- Sea levels since the advent of satellite measurements have risen by 3.5cm per decade.
- In phenology, the study of cyclical and seasonal nature of plants and animals, it was noted that there is a longer growing season with an earlier spring which can impact on biodiversity.
- We have had an increase in rainfall in particular in the north and west of the country.
- There appears to be a decrease in the frequency of storms but an increase in their intensity.

This change to our climate has been attributed largely to the increased levels of atmospheric carbon dioxide (CO<sub>2</sub>) produced by the use of fossil fuels, resulting in numerous climatic shifts and impacts around the globe.

Several gases, such as carbon dioxide and methane (CH<sub>4</sub>), exist naturally in the atmosphere and contribute to the warming of the Earth's surface by trapping heat from the sun in what is known as the greenhouse effect. When the proportion of such greenhouse gases in the atmosphere is stable, the effect is beneficial, making surface temperatures warmer and alleviating temperature swings. However, human activity is increasing the concentration of greenhouse gases in the atmosphere, which is already causing average temperatures to rise.

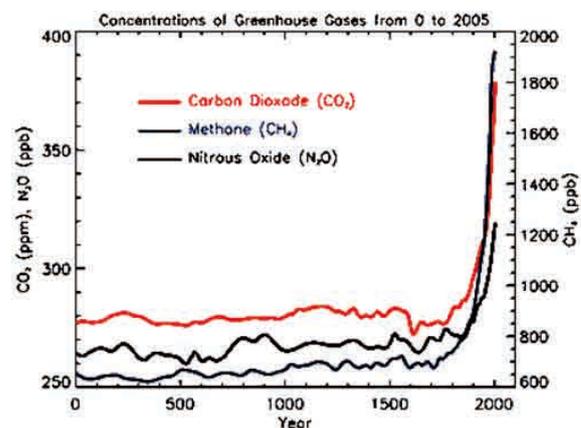
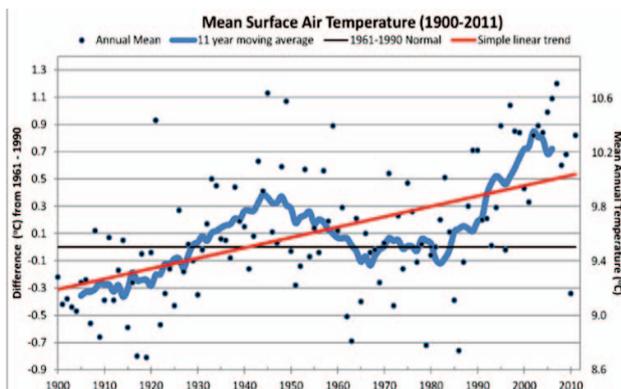


Figure 1: Atmospheric Greenhouse Gas Level (Source: IPCC, 2007)

There is broad scientific consensus that human activities, most notably the burning of fossil fuels for energy, have led to the rapid build-up in atmospheric greenhouse gases. The Intergovernmental Panel on Climate Change (IPCC) stated in 2007 that CO<sub>2</sub> levels in the atmosphere rose from a pre-industrial level of 280 parts per million (ppm) to 379ppm in 2005. This coincided with an increase in the average global temperature of 0.74°C between 1906 and 2005. In 2013, the U.S. National Oceanic and Atmospheric Administration announced that CO<sub>2</sub> levels had reached 400ppm. That same year, the IPCC concluded that

**“human influence has been detected in warming of the atmosphere and the ocean, in changes in the global water cycle, in reductions in snow and ice, in global mean sea level rise, and in changes in some climate extremes... it is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century”.**

In 2012, the World Meteorological Organization [4] released its analysis that shows that the decade spanning 2001-2010 was the warmest ever recorded in all continents of the globe.



**Figure 2:** Annual mean surface air temperature (1900–2011).

## 1.2 EU National Policy.

The United Nations Framework Convention on Climate Change (UNFCCC) is an international environmental treaty adopted in May 1992. The framework's objective is

**“to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system”.**

The framework outlined how specific international treaties may negotiate further action towards its key objective. The Paris Agreement 2015 is a protocol set within the context of the UNFCCC and was ratified by Ireland on 4th November 2016 and it is aimed at:

- limiting global warming to less than 2.0°C above pre-industrial level and pursue efforts to limit the temperature increase to 1.50°C
- Building resilience and increasing the ability to mitigate the impacts of climate change.
- The agreement states the need for Parties to formulate and implement National Adaptation Plans.

The European Union published a strategy on adapting to climate change in April 2013. The main focus of this strategy was to build a more climate resilient Europe.

Following the European Union lead the Irish government published the **National Policy Position on Climate Action and Low Carbon Development** in April 2014. It established the fundamental national objective of achieving a transition to a competitive, low carbon, climate-resilient and environmentally sustainable economy by 2050.

As envisaged by the National Policy Position, the evolution of climate policy in Ireland will be a dynamic, iterative process, based on the adoption by Government of a series of national mitigation plans and national adaptation frameworks over the period to 2050 with the ultimate objective of achieving the National Transition Objective by 2050.

The Statutory authority for these mitigation and adaptation plans was subsequently provided for in the **Climate Action and Low Carbon Development Act 2015** (“The Climate Act”).



Ireland’s national strategy for climate adaptation is laid out in the National Adaptation Framework (NAF) which was prepared under Section 5 of the “Climate Action and Low Carbon Development Act 2015”. The “Climate Act” also states that the Minister for the Environment, Community and Local Government is to submit by December 2017 to the Government for approval a ‘National Climate Change Adaptation Framework’. This Framework, which will be reviewed every five years, is to specify the application of adaptation measures in different sectors and by local authorities in order to reduce vulnerability to the negative effects of climate change.

The National Adaptation Framework was approved by Government in December 2017, and was published and laid before the Oireachtas on 19 January 2018.

The NAF also requires that each local authority make and adopt local adaptation strategies. The minister has identified local authorities as a key stakeholder in responding to the challenges of climate change. Local Authorities represent the level of government closest to communities and business and are the first responders to many climate related emergencies making them an invaluable resource.

While there is strong emphasis on local authorities through the NAF to develop and implement adaptation measures and actions, mitigation measures and actions that seek to combat, reduce or eliminate the emissions of greenhouse gases are also hugely important. Local authorities have a significant role to play in actively implementing mitigation actions through measures including the design and construction of flood defences, retrofitting of building stock, energy efficient projects, promoting sustainable energy communities and encouraging sustainable transport and land use.

The Department of Communication Climate Action and Environment (DCCAE) published the “Local Authority Adaptation Strategy Development Guidelines” in December 2018. These guidelines lay out the road map for local authorities on how to develop their adaptation strategies.

The local authority sector are not alone in developing these adaptation plans/strategies. The NAF identifies 12 key sectors under the remit of seven Government Ministers where sectoral adaptation plans are also to be prepared. The sectoral plans will specify the adaptation policy measures each Minister proposes to adopt. This will ensure that it is a joined up approach and there are no omissions between national and local goals and objectives.



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**The sectors and lead Government Departments required to prepare sectoral adaptation plans under the Framework are as follows:**

**1. Seafood**

Department of Agriculture, Food and the Marine

**2. Agriculture**

Department of Agriculture, Food and the Marine

**3. Forestry**

Department of Agriculture, Food and the Marine

**4. Biodiversity**

Department of Culture, Heritage and the Gaeltacht

**5. Built and Archaeological Heritage**

Department of Culture, Heritage and the Gaeltacht

**6. Transport infrastructure**

Department of Transport, Tourism and Sport

**7. Electricity and Gas Networks**

Department of Communications, Climate Action and Environment

**8. Communications Networks**

Department of Communications, Climate Action and Environment

**9. Flood Risk Management**

Office of Public Works

**10. Water Quality**

Department of Housing, Planning and Local Government

**11. Water Services Infrastructure**

Department of Housing, Planning and Local Government

**12. Health**

Department of Health

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The statutory deadline for the submission of completed sectoral adaptation plans to Government for approval is 30 September 2019.

The **National Development Plan (NDP)** also includes objectives in relation to the aim of transitioning to a low carbon and climate resilient society, including €940 million for flood risk management projects. The NDP also established a Climate Action Fund with an allocation of at least €500 million to 2027. The Climate Action Fund will support initiatives from the public and private sector that will help Ireland reach its climate and energy targets. The Fund has the objective of funding initiatives that contribute to the achievement of Ireland’s climate and energy targets in a cost effective manner. It also offers the potential for innovative interventions which, in the absence of support from the Fund, would not otherwise be developed. The Clare Adaptation strategy will be used to mainstream adaptation over time into the plans and policies of Clare County Council. This will be done during the statutory review of all local authority plans and policies. It is important to note that the Adaptation strategy is not part of a hierarchy of plans but instead seeks to inform and “climate proof” existing and future plans and policies. It provides a high level guide on how climate change can be integrated into all the relevant operations of the local authority over time.

### **1.3 Adaptation Methodology.**

There are many inter related disciplines, issues and challenges in developing an adaptation strategy to deal with climate change. No one person has either the knowledge or the skill set to formulate a strategy single-handedly. It was important therefore to follow the National Adaptation Framework guidance document to ensure a consistent approach across the country. In Clare County Council the Adaptation Team members were drawn from across the various Directorates to ensure the proper balance of skills and objectivity was achieved. Each team member brought their wealth of knowledge from their varied experiences working throughout the county which enabled a more holistic approach to be taken. Not only did the team focus on the obvious risks and challenges facing the physical infrastructure in the county but also looked at the less obvious areas of community and biodiversity.

This balance in the team allowed us to develop the strategy by accurately identifying the;

- Baseline assessment including previous climate events
- Climate risk identification and Prioritisation
- Objectives, Actions and goals
- Implementation, Monitoring and Reporting

The team were also aware of the broader national sectoral plans and although the majority of the plans are not yet published the team have included an objective to incorporate the actions identified in those plans as they apply to Clare County Council during review stages of the Clare Adaption Strategy or other council plans and policies.

## 1.4 Screening overview for Appropriate Assessment:

It should be noted that under the European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004 (S.I. 435 of 2004 as amended by S.I. 200 of 2011), all plans which are likely to have a significant effect on the environment must undergo screening to determine whether a Strategic Environmental Assessment (SEA) is required. "Screening" is the process for making a determination as to whether a particular plan, would be likely to have significant environmental effects, and would thus warrant SEA. This strategy has been screened for SEA and it is determined that full SEA is not required for this draft of the strategy. The screening report accompanies this strategy.

Screening of this strategy has also been undertaken in accordance with the requirements of Article 6(3) of the EU Habitats Directive (directive 92/43/EEC) to determine if the Climate Change Adaptation Strategy is likely to significantly affect Natura 2000 sites (i.e. Special Areas of Conservation (SAC) and Special Protection Areas (SPA)) within or surrounding the plan area. It is determined that a stage 2 Natura Impact Report is not required. The screening report accompanies this plan.





## **2. REGIONAL CONTEXT**

## 2.1 Regional Context.

For the purposes of the roll out of the Climate Change Adaptation Strategies the country has been divided into four regions. Clare is situated in the Atlantic Seaboard South Region. The rationale for grouping counties in this way is that each of the four regions face similar challenges with respect to climate change. Within the Atlantic Seaboard South Region are the Local Authority areas of Cork County, Cork City, Kerry and Limerick City and County.



CLIMATE ACTION REGION	LOCAL AUTHORITY FUNCTION AREA	LEAD AUTHORITY
<b>Midlands and Eastern</b>	Carlow, Cavan, Kildare, Kilkenny, Laois, Leitrim, Longford, Louth, Meath, Monaghan, Offaly, Roscommon, Tipperary, Waterford, Westmeath, Wexford, Wicklow	Kildare County Council
<b>Atlantic Seaboard North</b>	Donegal, Sligo, Mayo, Galway City & County	Mayo County Council
<b>Atlantic Seaboard South</b>	Clare, Limerick, Kerry, Cork City & County.	Cork County Council
<b>Dublin Metropolitan</b>	South Dublin, Fingal, Dun-Laoghaire-Rathdown, Dublin City	Dublin City Council

**Table 2.1** Climate Action Regions

Each region is supported by a Climate Action Regional Office (CARO). The function of this office is to assist and coordinate the preparation of county level adaptation strategies. One local authority has the role of lead authority and facilitates the CARO. In the case of the Atlantic Seaboard South region Cork County Council is the designated CARO.



**Figure 2:** Showing the Climate Action Regional Offices (CARO) and associated local authorities

## 2.2 Profile of County Clare.

County Clare consists of an area of approximately 3450km<sup>2</sup> and is bounded by the counties of Galway to the north, Tipperary to the east and Limerick to the south. Its natural boundaries comprise Galway Bay to the north, the River Shannon and Lough Derg to the east and the Shannon Estuary /Atlantic Ocean to the south and west. It is the 7th largest county in the country.

The county has a diverse topography, varying from bare limestone pavement to estuarial mudflats and from high Atlantic cliffs to inland lakes and waterways. Much of the county has an underlying limestone strata which is highly permeable.

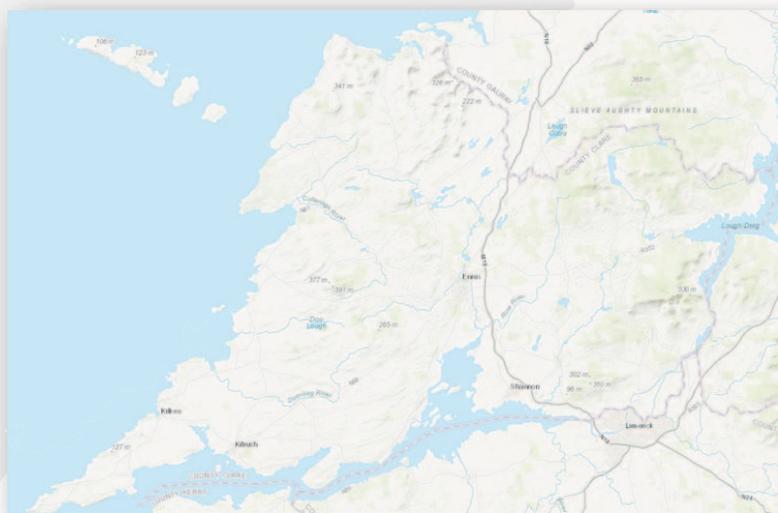
As per the Census of population 2016 County Clare had a population of 118,817, and this represented a 1.3% increase on the population of the county from the Census of 2011. There are two main population centres mainly Ennis, which is the county town, situated on the river Fergus with a population of approximately 25,000 people and Shannon town, population 10,000, which is situated adjacent to the International airport, Industrial zone and Shannon estuary.

The **Clare County Development Plan 2017-2023** identifies 175 designated settlements including towns and villages which are divided across 4 municipal districts for administrative purposes.

The county's coastline is approximately 360km in length and faces into the Atlantic ocean on its western coast. An important asset of the tourism sector are our blue flag beaches and 8 of these beaches are situated on the Wild Atlantic Way.

The county is drained along its southern border by the river Shannon and lough Derg. The other main river is the Fergus which originates from the mid-northern end of the county and flows through the town of Ennis before discharging into the Shannon estuary via a tidal barrage at Clarecastle.

Some of the county's main towns and centres of population such as Ennis, Shannon, Kilrush and Kilkee are on or close to the coastline.



The ESB operate one of the country's largest hydro-power schemes on the River Shannon at Ardnacrusha in south east Clare as well as the coal fired power station at Moneypoint on the Shannon estuary. Moneypoint power station has one of the deepest water berths in the country.

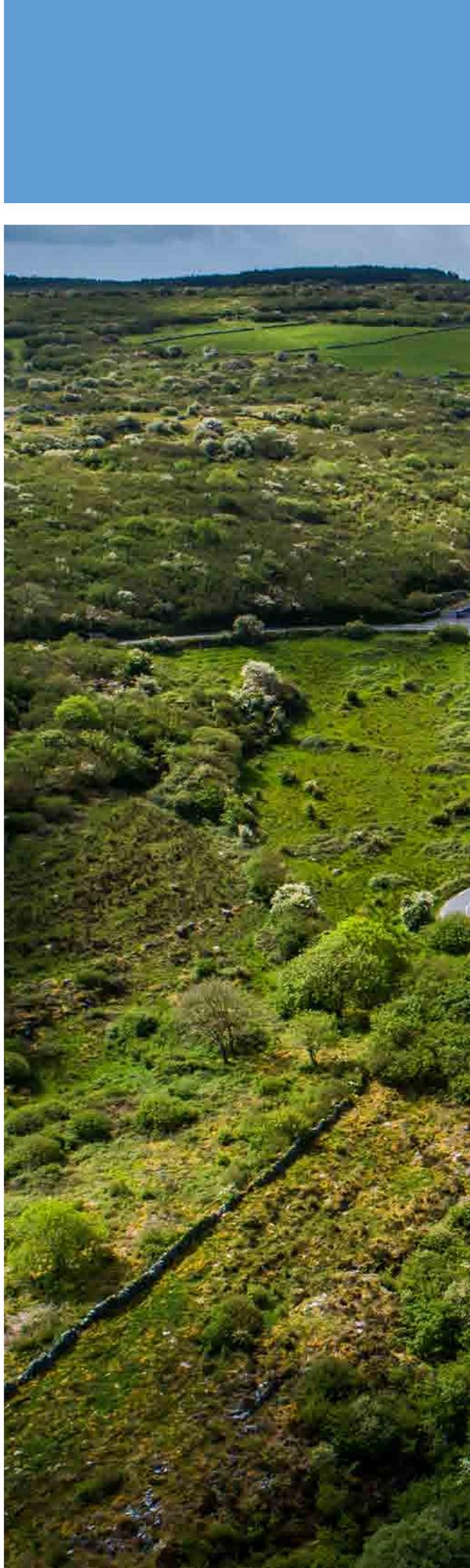
The main industrial region in the county is situated in the Shannon industrial zone adjacent to the international airport. This is a low lying area of the county and is protected from the Shannon estuary by embankments. The embankments have been damaged previously by severe winter storms. Tourism and agriculture are the other main industries in the rest of the county.

The Council housing stock, with an age profile dating from the 1930's to 2018, stood at 2600 units in early 2019. In addition the Council owns in excess of 50 municipal buildings whose functions encompass the full range of local government activity and vary from Area Offices, Libraries, Theatres, Amenity Sites and Leisure Centres.

The National Road network (motorway/dual carriageway), which is managed by Transport Infrastructure Ireland (TII) has a total length of 51km in the county. This consists of the M18/N18 route which bisects the county in a roughly north south direction. The national secondary road infrastructure which is funded by TII but managed and maintained by Clare County Council consists of 181km of National Secondary routes. The remaining road network consists of 631km of Regional and 3,402 km of Local roads. In addition there are approximately 1500 bridges throughout the road network the majority of which are stone arch in construction and date from the 1800-1900s.

Iarnród Éireann operate a rail service to both Limerick and Galway with stations in Ennis and Sixmilebridge. The railway line to Limerick is prone to flooding in winter months and there is a frequent interruption to the service because of this.

Given the size and geographical features of the county as well as the infrastructure assets and responsibilities of Clare County Council, the negative impacts of climate change pose a significant risk to citizens, the economy, the environment and the delivery of local government services. It is therefore imperative to introduce adaptation and mitigation measures in a planned and co-ordinated approach across the county.





### 3. ADAPTATION BASELINE ASSESSMENT

### 3.1 Observed Climate Change.

Changes in Ireland’s climate are in line with global trends including increasing temperatures, changes in precipitation patterns, and changes in the variability and intensity of storms. This has resulted in flooding events, sea level rise, extremes of temperature and coastal storm sea surges.

In order to adequately plan for the future we must first look to the past to understand what effects this changing climate has had on County Clare.

The main historical and future significant severe weather events which have and will affect County Clare are summarised under the follow headings.

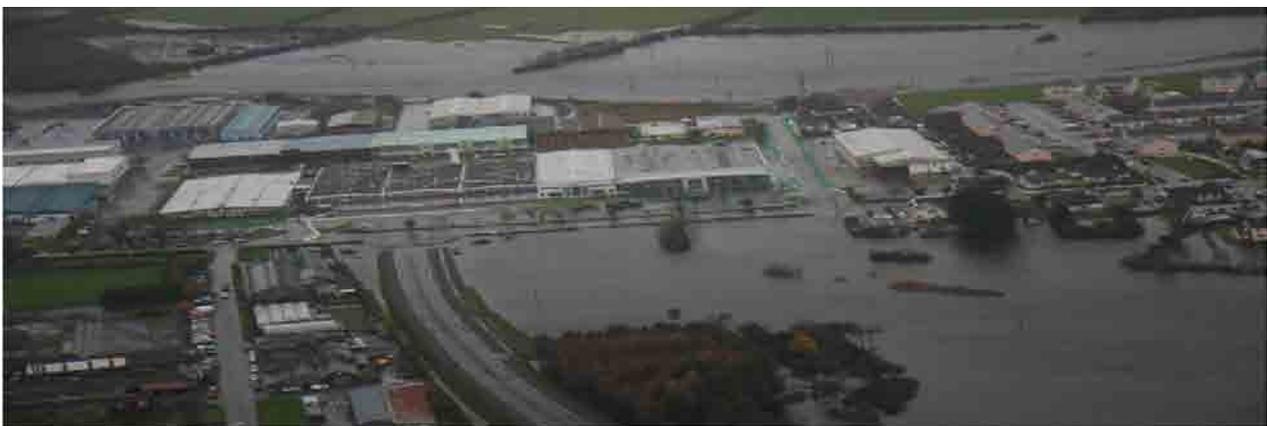
- Fluvial (rivers)/ Pluvial (rainfall) Flooding;
- Coastal Flooding / Sea temperature / Sea Level rise
- Storms
- Protracted hot and cold weather Events.

The process of Adaptation involves firstly understanding and assessing the baseline of some of the main weather events experienced to date in the county. This will in turn help outline our response to future climate events in accordance with our risk assessment and flexible adaptation pathway.

In developing the strategy we have looked at the main weather events over a circa 30 year period which is a sufficiently long period to capture climate changes.

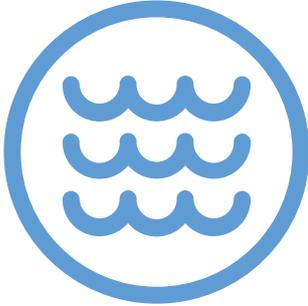
<b>Major Weather Events Clare</b>	1986	08/86 Storm - Hurricane Charley
	1995 - 1999	Summer 1995 Warmest Summer on Record Dec 1997 Windstorm
	2005 - 2009	Summer 2006 Warmest Summer Since 1995 Summer 2008 Heavy Rain & Flooding Nov 2009 Flooding
	2010 - 2014	Winter 2009-10 Severe Cold Spell 11/10 - 12/10 Severe Cold Spell 12/13 Coastal Flooding Winter 13/14 Winter Storms 02/14 Storm Darwin
	2015 - 2019	12/15 Flooding 09/15 Flooding 12/16 - 01/17 Flooding 10/17 Storm Ophelia 07/18 Prolonged Drought 03/18 Storm Emma

These events can be divided into the various severe weather categories and the effect these events had in County Clare. We have further developed these events into small case studies to illustrate their impact on the infrastructure and communities in Clare.



Ennis Flooding 2009

## 3.2 Case Study 1: Flood events.



### November 2009 Flood Incidents.

During the 2 week period from Wednesday 18th November to Wednesday 2nd December 2009, County Clare experienced severe flood incidents throughout the county. Rainfall for the month of November was approximately five times the previous average. The nature of the flooding incidents in number, size and duration presented a potential threat to life and property which was never before experienced in the county. Clare Local Authorities led a coordinated inter agency response to the flooding incidents to prevent loss of life and reduce the impact of the incidents on householders, businesses and the general public.

The flooding incidents are broadly split between three areas;

- 1) Ennis town and environs
- 2) North Clare
- 3) East Clare

While the prolonged wet spell culminating in an intense rainfall event was common to each of the areas the cause of the flood events were different and complex.

However in each area the net effect in all locations was similar;

- Houses flooded and in some cases the occupants had to be evacuated
- Business properties and stock damaged
- Agriculture livestock cut off from fodder supplies
- Roads became impassable, temporarily blocked and ultimately suffered severe damage from flood waters
- Bridges were subject to previously unknown water pressures and required constant supervision to monitor their structural integrity.

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#### Total no. of houses affected by the November 2009 floods were:

Ennis	112
Ennis Environs	12
North Clare	14
South-East Clare	31

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#### Ennis and Environs

In Ennis town the combination of prolonged intense rainfall over a period of several days occurred on the run in to a tidal peak. The tidal peak was exacerbated by south westerly winds at critical times and this resulted in the highest ever recorded water levels on the River Fergus in the town centre. Other areas in Ennis and the surrounding area flooded purely because of the enormous rainfall amounts which had built up in catchments, river systems etc. over several days and weeks prior to the flood events e.g. St. Flannan's College, Lough Girroga, Oakwood Drive, Elm Park, Watery Road, Ballybeg, parts of Clonroadmore, Fíor Uisce, etc.

On the evening of Thursday, 19th November 2009, a breach occurred at the river wall on Abbey Street which resulted in flooding in part of the town centre, this area was evacuated until the breach was secured by Army personnel.

During the course of the incident critical infrastructure was identified and protected as follows;

- Ennis Town Centre – protection provided at vulnerable locations along the river banks
- ESB sub-station at Gort Road Industrial Estate
- Telecommunications tower adjacent to Ennis Garda Station
- Ennis Garda Station

#### North Clare

The unique karst geology of North Clare consists of complex underground rock formations which contain many naturally occurring voids and underground drainage systems. The flood events in November occurred when these underground systems became overloaded due to the previously unexpected water quantities. These flooding incidents were a result of this underground system overflowing at ground level and preventing floodwaters dissipating.

The duration of flooding in North Clare was longer than other parts of the county and the response provided was further complicated by the geographical area involved and the extensive damage to the local road network.

#### East Clare

The eastern borders of County Clare are defined by the River Shannon. Some areas along the banks of the river experienced flooding due to the increased river levels during November e.g. Mountshannon, Scarriff etc. The flow along the River Shannon is split between the natural river course and the manmade Headrace Canal at Parteen Weir located north of O'Briensbridge in Co. Clare. The rate of flow along the natural river course and the Headrace Canal is controlled by the ESB.

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#### This variation of flow is determined by the need to

- provide a continuance of flow from the catchment upstream,
- provide a continuance of efficient energy production from the hydroelectric dam downstream of the Headrace Canal at Ardnacrusha,
- maintain the structural integrity of the weir itself and minimise inundation of floodwaters onto communities downstream e.g. Springfield (Clonlara), Shannon Banks, O'Briensbridge etc. in Co. Clare and Castleconnell and Montpelier in Co. Limerick.

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#### The response to the incident in East Clare involved;

- The monitoring of the River Shannon level
- Strengthening the flood defence systems at Shannon Banks
- Evacuation of 5 houses at Springfield, Clonlara
- Precautionary evacuation of some areas of Shannon Banks
- Pumping operations at Shannon Banks
- Extensive sandbagging in the area
- Road Closures

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#### Winter 2015-16:

In December 2015 to January 2016 protracted rainfall events and storms led to flooding in a number of areas. In Springfield, Clonlara, Co. Clare a total of 14 houses were directly affected by these flood events – either by way of being flooded or under threat of flooding or by being isolated due to flood inundation of lands surrounding them. To deal with this flooding a co-ordinated response was provided by Clare County Council, Clare County Fire & Rescue Service, Clare Civil Defence, and the Defence Forces.

Other impacts of this severe weather were protracted road closures throughout Co. Clare and 3 bridges were seriously compromised resulting in one being demolished by flood waters.

Severe flooding occurred in parts of Ennis and its environs, Springfield in the South East of Clare, and a number of other areas throughout the county. The then recently completed flood defences in Ennis worked well and the vast majority of the town centre escaped any flooding damage. In addition to having countywide inter-agency co-ordination meetings based at Áras an Contae, as the response continued, a number of local interagency co-ordination meetings took place in South East Clare dealing with the local response to the flooding in the Clonlara area. The Municipal District Engineer coordinated the response from the Local Authority including Civil Defence & Fire Service; Defence Forces and assisting the Department of Social Protection personnel in engaging directly with affected residents.

#### **Details of the extent and severity of the flooding in County Clare**

In the period from December 3rd 2015 to early January 2016 County Clare experienced severe flooding. This primarily occurred due to extensive rainfall on the county over the period. In this regard, the following points are relevant:

A total of 233 mm of rainfall was recorded at Shannon Airport through the month of December 2015. This was the second highest monthly rainfall in 30 years. The actual highest recorded monthly rainfall over the past 30 years was in November, 2009 at 263 mm. The rainfall during the previous month (October 2009) was 87 mm – implying a total over the two months of 350 mm.

The rainfall through November, 2015 was 191 mm – implying a total rainfall for the last two months of 2015 of 424 mm – significantly greater than the total for November, 2009 and the month prior to it.

The mean rainfall for December over the past 30 years has been just over 104 mm.

Over the first 13 days of December a total of 125 mm of rainfall was recorded i.e. a total of 53% of the month's rainfall fell during the first 13 days of the month – during a month when the second highest monthly rainfall in 30 years was recorded and following on from the month of November when a well above average rainfall also occurred.

Therefore, going into December, water tables were very high and by December 13th following two extreme rainfall events over two consecutive week-ends, land saturation was at 100%, all drainage systems (both natural and constructed) were full and many had surcharged and overflowed causing very serious and widespread flooding throughout the public road network, to private properties in several locations and widespread inundation of land in most parts of the county.

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#### **The foregoing sums up the situation going into the week beginning December 14th and the most notable features of which were;**

- Flood levels at Springfield, Clonlara exceeded the 2009 record, most probably due to a combination of flows from the Shannon and Mulcaire rivers.
- Small river catchments throughout the county had surcharged – most notably in the Ennis Area where the contribution of the swollen Claureen River to the rising river Fergus resulted in highest levels through the town since November, 2009 and the surcharged Edenvale stream caused inundation within and around St. Flannan's College and its environs.
- Extensive flooding of roads throughout the county – many of these roads had to be closed to traffic including a number of strategic routes.

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What evolved over the first 13 days of December was in itself a significant and extreme weather event. However the rainfall events continued and therefore, the original 10 day event extended to become a 5 week long extreme event with little or no break in a pattern which delivered a series of elaborate rainstorms almost on a weekly basis including Storms Desmond, Eva, Frank and Gertrude throughout the remainder of December into January 2016.

### Miltown Malbay Flood - September 11th 2015

In September we experienced an intense localised rain fall event in Miltown Malbay, Co. Clare. This event caused flooding to the main street of Miltown Malbay and affected a number of properties. The flood was caused by an intense period of localised rainfall which inundated an existing culverted stream under the main street causing it to back up and flood the surrounding streets which damaged properties.

The morning after the flood event subsidence was evident to the rear of the abutment at Clonbony bridge on the outskirts of Miltown Malby. The bridge is on the busy N67 coastal route. As a precaution the road was closed until flood waters subsided and a detailed inspection could be undertaken. The inspection revealed severe scour damage under both bridge abutments and cracks in the abutment walls. Sections of the parapet walls had also been knocked as flood waters had engulfed the bridge and flowed over the top of it. The N67 was closed for a number of months while emergency repairs were carried out. The diversion route was a major inconvenience for the local residents.



*Clonbony Bridge N67 Miltown Malby: Emergency closure, river diversion, propping and repair due to flood scour damage.*

### Coastal Flooding

During the period from 13 December 2013 to 10th February 2014 there were storms in or around Ireland roughly once every three days. In addition to the very strong winds there were periods of extremely heavy rain (most of them rather short-lived) and a lot of thunderstorm activity. These storms coincided with high tides and created severe conditions in a number of coastal areas. This was the most sustained period of storms for fifteen years since Christmas 1998.

The sustained conditions caused coastal flooding and severe damage at 32 locations along the County Clare coastline. In particular flooding occurred at Lahinch, New Quay and on the Loop Head Peninsula. Emergency Repairs were required to embankments along the Shannon Estuary to prevent a breach.



*Coastal Flooding at Kilcredaun Loop Head Peninsula 2014 isolated 10 properties from the mainland.*

### Shannon Embankments

Shannon Town and Shannon Airport are protected from the Shannon Estuary by a series of embankments. The area protected by the Shannon embankments consists of Shannon Town, Shannon Free Zone industrial estate and Shannon Airport. Significant areas lie below sea level.

High astronomical tides, low atmospheric conditions, windblown waves, (particularly a south westerly wind) and a combination of these conditions have previously caused overtopping and damage to the embankments. Repeated overtopping of the embankments causes erosion and weakening of the structure which may lead to significant coastal flooding.

## 3.3 Case Study 2: Storms



### **Storm Emma, “The Beast from the East”**

*March 2018, Blizzard conditions, snow and sub zero temperatures.*

The impacts of Storm Emma and ‘The Beast from the East’ were widespread across the country. Met Éireann issued a “Status Red” weather warning for the entire country. The effect of the red weather warning meant that all employers both public and private closed all non-essential businesses for the duration of the storm. The storm was forecasted in advance and in general people had adequate time to prepare for the severe weather. The storm was most intense for the Midlands and East of the country. Although most people heeded the warnings not to travel, there was severe disruption to the transport network.

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#### **The impacts of the Storm to Co. Clare were:**

- Some remote locations were cut off for a number of days due to the heavy snow and drifting making roads impassable.
- Schools and businesses shut down.
- Public transport nationwide came to a standstill due to widespread cancellations to services, Shannon Airport was closed.
- All public facilities and amenities were closed i.e. public offices, libraries, sports and leisure centres and community centres.

Clare County Council used the facilities and processes of the Major Emergency Management system to ensure essential services continue. Fire Service and Civil Defence assisted key workers in the HSE, public health and wider community to get to work in extremely difficult conditions.

### **Storm Ophelia**

*October 2017 – Severe wind event.*

Storm Ophelia was the easternmost Major Hurricane (Category 3 or higher) on record in the Atlantic Basin. On the 12th October 2017, Met Éireann issued an initial advisory on a storm reaching Ireland that had the potential to be a high-impact event. On the 14th October, it issued a ‘Status Red’ warning for parts of Ireland. Issuing such a warning more than 48 hours in advance was “unprecedented”, as warnings are normally issued within 24 hours of the event. On the 15th October, the National Emergency Co-ordination Group and Met Éireann convened to advise the public in relation to the post-tropical storm Ophelia reaching the Republic of Ireland.

At 20:15hrs on the 15th, ‘Status Red’ warnings were extended to all areas of the Republic of Ireland, and officials confirmed that all public education services would be cancelled for the following day. The National Emergency Co-ordination Group requested that all schools and colleges be closed, HSE appointments, Bus Éireann services, postal services and court sittings were cancelled. There were widespread road closures and flight cancellations. The public were advised to avoid all unnecessary travel. Nationally three people died as a result of interactions with falling trees caused by Storm Ophelia.

The storm caused major power outages, lifted roofs, felled countless trees and caused coastal flooding in Ireland. The impact on of the storm on trees were exacerbated as trees were generally in full leaf at that time of year.

Nationally fallen electricity poles and electric cables left 300,000 households and 385,000 premises in total without power. This in turn affected other infrastructure and services, such as water treatment and wastewater systems. ESB Networks and Irish water worked together for over a week after Storm Ophelia to restore electricity and water supply, prioritising vulnerable customers and co-ordinating with the Principal Response Agencies to provide humanitarian assistance to those left without water and power. Clare County Council used the mechanisms and facilities for Major Emergency Management to co-ordinate the response activities of the County Council and emergency services. The response to the storm included numerous public safety information messages over social media platforms. As the storm passed County Clare in the afternoon of the 17th October, the recovery operation involving clearing roads of fallen trees and debris was co-ordinated by Clare County Council. Updates to the general public on the status of road blockages was relayed via social media and through local radio throughout the afternoon and evening.

### Storm Darwin

*February 2014 – Severe wind event*

Storm Darwin hit Co. Clare in the late morning of 12th February 2014. The storm was of short duration but high impact. The 159 km/h (86 knots) gust at Shannon Airport was the highest February value recorded since 1945 and the highest overall since 1961. Mace Head, Co. Galway recorded hurricane force winds (mean 10-minute wind speed above 63 knots or 117 km/h), the fifth highest wind speed recorded in Ireland. By 3.00pm the storm had cleared Co. Clare and wind speeds started to decrease.



*Storm Darwin: Fallen tree Knockerra Village February 2014.*

The storm consisted of extreme west to northwest gusty winds, remarkably, there was no reported loss of life due to the storm even though there was considerable damage to housing and other buildings. The forestry industry estimated that approximately 8000 ha (+/- 560ha) were damaged (Department of Agriculture, Food and the Marine, 2014).

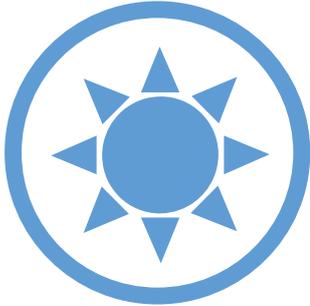
The storm caused most damage in the South and Mid-west of the country. County Clare was one of the worst affected counties. There was unprecedented damage to the ESB distribution network and nationally 260,000 premises were without power. Many telecommunications facilities were also damaged by the storm.

Storm Darwin was the last and most severe of a series of winter storms which affected Ireland from December 2013, to February 2014. Storm force winds occurred on 12 different days during this period: 5th/14th/18th/24th/26th/27th Dec 2013 and 3rd/25th/26th January and 1st/8th/12th February 2014.



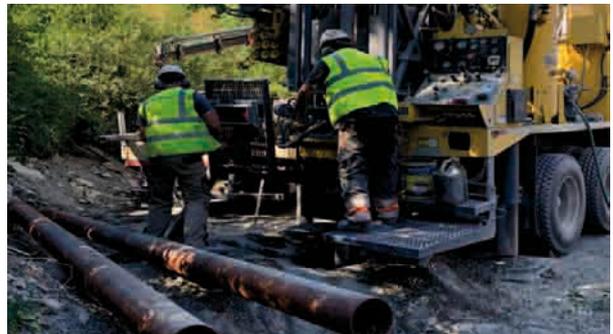
*Emergency coastal defences under construction Cloughaninchy February 2014 protecting 14 houses.*

## 3.4 Case Study 3: Prolonged Dry Spell – Drought Summer 2018.



The summer of 2018 was officially classed as a drought by Met Éireann. The prolonged dry warm spell caused significant issues with water supply and in the agricultural sector. The demand on the major water supply schemes increased significantly while schemes serviced by groundwater supplies had to be augmented by tankers as ground water levels across the region plummeted. Additional deeper wells were drilled to try and supplement supply.

Roads throughout the county suffered from the prolonged heat and “melting roads” became a phenomenon whereby the bitumen softened and became liquid causing short term maintenance issues and longer term resurfacing problems. Again significant resources were diverted from normal operations to deal with these issues.



*Well Drilling Violet Hill Broadford Summer 2018*

## 3.5 Financial Cost of Weather Events.

It is apparent from the descriptions above of severe weather events measured over a relatively short period of time in County Clare that the financial costs are significant in dealing with them and their aftermath. It also has an untold cost to the communities who endure them.

In 2018 the cost for Clare County Council in dealing with Storm Emma was €186,818 and for dealing with the prolonged drought which followed under the Service Level Agreement with Irish Water was €403,171. At the other end of the scale the infrastructure damage cost incurred as a result of the winter coastal storms of January/February 2014 was of the order of €35m in County Clare. The Council ultimately received €16.8m in central government funding to address the damage caused. This reactive response is not a sustainable model for the future.

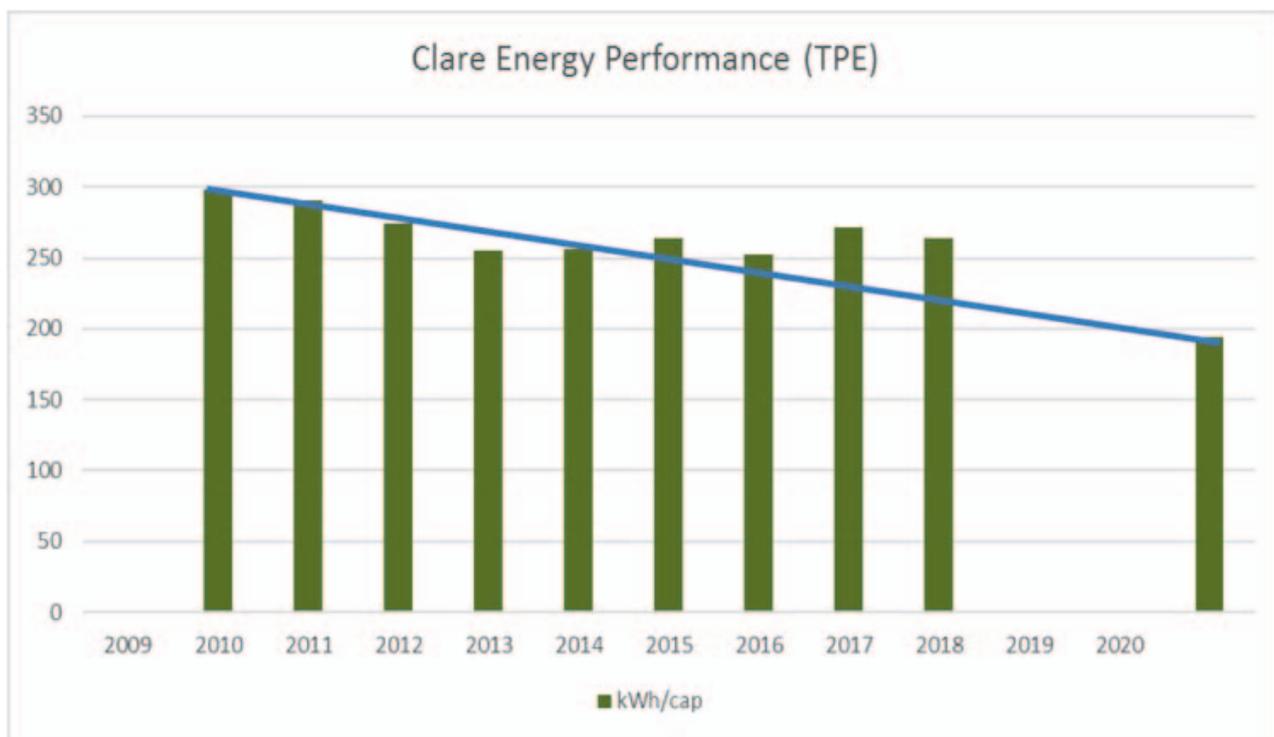
### 3.6 Adaptation Baseline Energy Assessment.

#### Baseline Energy use/greenhouse gas emissions data

One of the main factors driving climate change is the increased level of CO<sub>2</sub> emissions caused by energy related power consumption. Ireland has a national target to improve energy efficiency by 20% by 2020. The public sector has a critical leadership role to play, with a more ambitious 33% energy efficiency target in the same period. Clare County Council's energy baseline period against which the Public Sector Energy Efficiency reduction requirements are measured as per Ireland's National Energy Efficiency Action Plan (NEEAP) has been identified as the average yearly consumption between 2006-2008. This is tracked annually through the SEAI (Sustainable Energy Authority of Ireland) Monitoring and Reporting cycle.

In its latest performance report entitled "Annual Report 2018 on Public Sector Energy Efficiency Performance", the Sustainable Energy Authority of Ireland (SEAI) have credited Clare County Council with a 17.8% energy savings against its 2006-2008 energy usage baseline. Although this is more efficient than the original baseline we are not yet on the path to meet the 2020 target.

The energy performance for Clare County Council is illustrated in the chart below. The performance is given in Total Primary Energy Requirement (TPER) kWh per capita of population served. The Central Statistics office (CSO) provides the population data from the Census of Population. The Sustainable Energy Authority of Ireland (SEAI) provides the TPER data from the mandatory reporting website.



## Gap to Target.

The gap to the target energy performance is illustrated in the charts below. From the charts it can be seen that;

- The target energy consumption in 2020 is 15.671 GWh.
- An energy performance improvement of 18% is required for the period 2017 to 2020.
- An energy reduction of 3.56 GWh is required to achieve the performance improvement required.

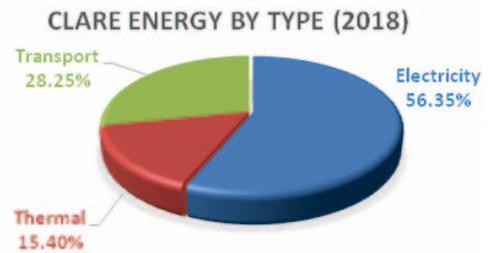
## CO2 emissions performance in total kg of CO2 energy related emissions

The chart opposite illustrates the energy related CO2 emissions for Clare County Council. From the chart, it can be seen that a reduction of 1,333 tonnes of CO2 is required to meet the reduction target by 2020. We are currently above the glide path.

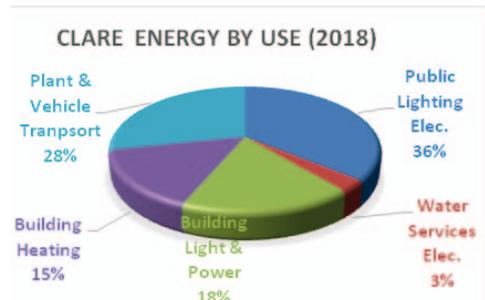


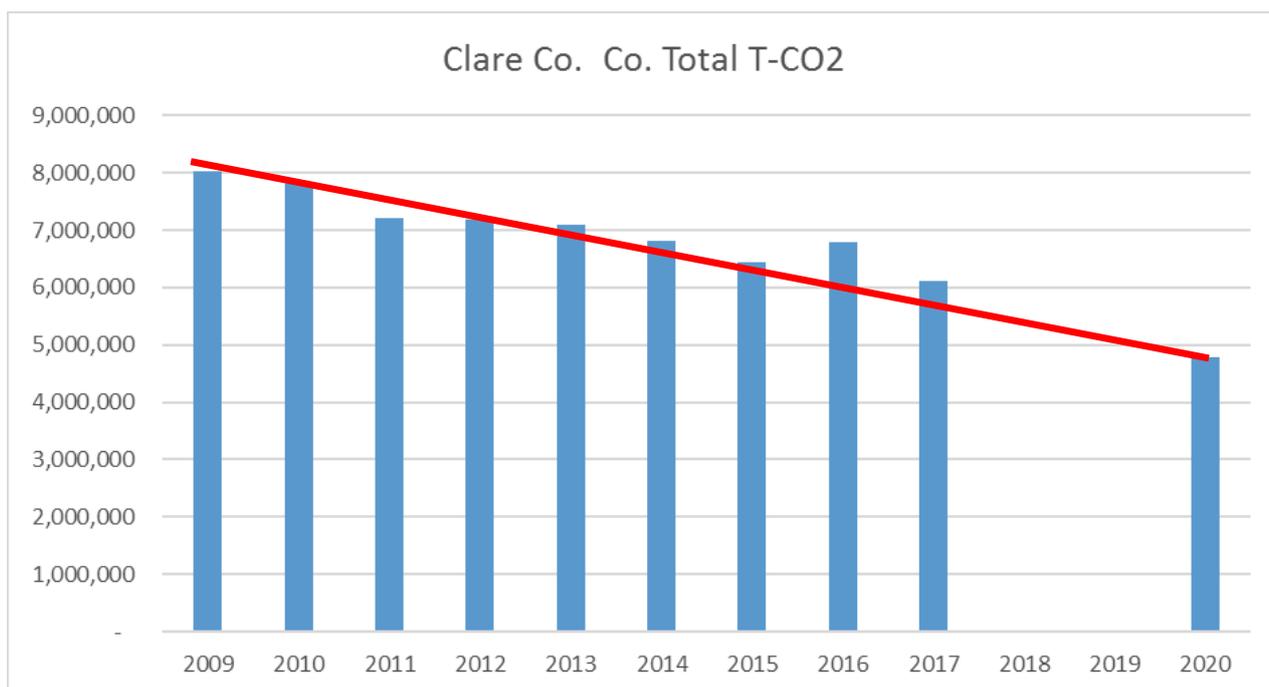
## Energy Consumption by Type and Use

Energy use at Clare County Council is analysed by type of energy used and the purpose of the energy use in the following charts.



The chart opposite illustrates that **public lighting represents 36% of all energy** use and as such will warrant further scrutiny to achieve the required energy savings.





**Clare County Council has been active in targeting energy efficiency opportunities and increasing the renewable energy share of energy consumption. Some of the projects that have been undertaken include:-**

- Upgrades to water and waste-water infrastructure (pumps, sensors, controls) prior to Irish Water being established.
- Building fabric and heating system upgrades in buildings, offices, libraries, museum
- Retrofits to local authority houses (over 900 to date) to achieve C3 minimum BER
- Installation of biomass boilers & solar thermal heating panels in County Hall, Ennis
- Upgrade to LED lighting in offices, libraries and museum
- Installation of Combined Heat & Power plant in Leisure centre with LED lighting upgrade
- Public lighting upgrades of 2,200 lights to LED lamps
- Participation in Regional upgrade to public lights with the Roads Management Office, to replace 13,000 public lights to LED
- Installation of 5 Electric Vehicle (EV) charging points on local authority sites
- Building Management System (BMS) at County Hall, Ennis
- Remote energy monitoring programme for County Hall and Ennis Leisure Centre
- Participation in Better Energy Communities and Renewable energy grant schemes administered by SEAI

### 3.7 Climate Action Fund

The Climate Action Fund is one of four funds established under the National Development Plan 2018-2027 as part of Project Ireland 2040. The fund will support initiatives that contribute to the achievement of Ireland’s climate and energy targets in a cost effective manner. It offers the potential for innovative interventions which, in the absence of support from the Fund, would not otherwise be developed.

The Fund will also seek to facilitate projects that contribute to other Government policy priorities including:-

1. Supporting innovation and capacity building towards the development of climate change solutions capable of being scaled and delivering benefits beyond a once-off impact.
2. Generating wider socio-economic benefits such as job creation, air quality improvements, reduction in fuel poverty, bio-diversity and community resilience and development.



The Department of Communications, Climate Action and Environment has responsibility for implementing the fund, which will have an allocation of at least €500 million over the period to 2027.

The Road Management Office (RMO), which is a shared service offering support to Local Authorities, was tasked with developing a business case for the upgrading of the public lighting network nationally. Clare County Council are scheduled to be in the second phase of this roll out.

Organisation / Lead Applicant	Project Name	Maximum Support Approved
ESB eCars	ESB Electric Vehicle High Power Charging Infrastructure Development Project	€10,000,000
Gas Networks Ireland	GRAZE Gas – Green Renewable Agricultural Zero Emissions Gas	€8,474,540
Irish Rail	Hybrid Drive for Inter City Railcar (ICR 22500) fleet	€15,000,000
Dublin City Council	Dublin District Heating System	€20,000,000
South Dublin County Council	The South Dublin County Council Tallaght District Heating Scheme	€4,447,952
Road Management Office	Local Authority Public Lighting Energy Efficiency Project	€17,470,000
3 Counties Energy Agency CLG	Driving HGV Efficiently into Brexit	€1,373,400
<b>Total</b>		<b>€76,765,692</b>

On completion of the Assessment Stage of the First Call for Applications for support under the Climate Action Fund, the following seven projects have been approved as eligible for support by the Minister for Communications, Climate Action and Environment, Richard Bruton T.D.

These projects will now proceed to the Validation Stage of the process. Projects that do not satisfactorily complete this stage will not progress to be supported by the Climate Action Fund.

*Baine Coimisiún, Ceimiseáil ar son na hAeráide & Comhshuíle*  
 Department of Communications, Climate Action & Environment

There are 14,100 street lights approximately in the county, of which 2,200 now have LED lanterns. The number of public lights in the charge of the Council has been increasing annually, primarily due to the taking in charge of estates.

The estimated cost of replacing the public lights with LED lanterns in Clare is €8.0m. In November 2018, the RMO was successful in securing €17.5 million in support from the Climate Action Fund to roll out this project on a regional basis. The upgrading of the public lighting to LED lanterns in County Clare would result in a reduction in electricity use to approximately 30%. The successful roll out of this project will help significantly to achieve the 2020 energy reduction target of 33%.





## 4. CLIMATE RISK IDENTIFICATION AND PRIORITISATION

## 4.1 Projected Climate Variables

The following relevant climate parameters from Chapter 1 have been summarised with regards to their predicted changes for the Atlantic Seaboard South Region and in particular County Clare in the coming years. The associated climate changes and their biophysical effects are also identified.

Parameter	Observed	Projected	Example of Biophysical Impacts
 <b>Temperature</b>	<ul style="list-style-type: none"> <li>Average temperatures have increased by 0.8°C since 1900, an average of 0.07°C per decade.</li> <li>The number of warm days (over 20°C) has increased while the number of cold days (below 0°C) has decreased.</li> </ul>	<ul style="list-style-type: none"> <li>Projections indicate an increase in average temperatures across all seasons (0.9-1.7°C).</li> <li>The number of warm days is expected to increase and heat waves are expected to occur more frequently.</li> </ul>	<ul style="list-style-type: none"> <li>Incidences of cold stress are likely to decrease while incidences of heat stress will increase.</li> <li>The duration of the growing season will increase, occurring earlier and extending farther.</li> </ul>
 <b>Precipitation</b>	<ul style="list-style-type: none"> <li>Increase in average annual national rainfall of approximately 60mm or 5% in the period 1981-2010, compared to the 30-year period 1961-1990.</li> <li>The largest increases are observed over the west of the country.</li> </ul>	<ul style="list-style-type: none"> <li>Significant reductions are expected in average levels of annual, spring and summer rainfall.</li> <li>Projections indicate a substantial increase in the frequency of heavy precipitation events in Winter and Autumn (approx. 20%).</li> </ul>	<ul style="list-style-type: none"> <li>The increased occurrence of dry spells will result in increased pressure on water supply.</li> <li>An increase in the frequency of extreme precipitation events will result in increased fluvial and pluvial flood risk.</li> </ul>
 <b>Wind Speed and Storms</b>	<ul style="list-style-type: none"> <li>No long-term change in average wind speed or direction can be determined with confidence.</li> <li>The number and intensity of storms in the North Atlantic has increased by approx. three storms per decade since 1950.</li> </ul>	<ul style="list-style-type: none"> <li>Projections indicate an overall decrease in wind speed and an increase in extreme wind speeds, particularly during winter.</li> <li>The number of very intense storms is projected to increase over the North Atlantic region. Projections suggest that the winter track of these storms may extend further south and over Ireland more often.</li> </ul>	<ul style="list-style-type: none"> <li>Increases in extreme wind speeds may impact on wind turbines and the continuity of power supply.</li> <li>Infrastructure will be at risk due to the increased occurrence of intense storms (e.g. winter 2013/2014).</li> </ul>
 <b>Sea Level and Sea Surface Temperature</b>	<ul style="list-style-type: none"> <li>Historically, sea level has not been measured with the necessary accuracy to determine sea level changes around Ireland. However, measurements from Newlyn, in southwest England, show a sea level rise of 1.7cm per decade since 1916. These measurements are considered to be representative of the situation to the South of Ireland.</li> <li>Sea surface temperatures have increased by 0.85°C since 1950, with 2007 the warmest year in Irish coastal records.</li> </ul>	<ul style="list-style-type: none"> <li>Sea levels will continue to rise for all coastal areas, by up to 0.8 m by 2100. The south of Ireland will likely feel the impacts of these rises first.</li> <li>Sea surface temperatures are projected to continue warming for the coming decade. For the Irish Sea, projections indicate a warming of 1.9°C by the end of the century.</li> </ul>	<ul style="list-style-type: none"> <li>Significant increase in areas at risk of coastal inundation and erosion.</li> <li>Increased risk to coastal aquifers and water supply.</li> <li>Change in distribution fish species;</li> <li>Implications for fisheries and aquaculture industries.</li> </ul>

**Table 4.1** Summary of projected climate impacts for Ireland (Source: National Adaptation Framework, 2018)

## 4.2 Climate Hazard Impacts and Consequences

Using Table 4.1 the Climate Hazard Impacts and Consequences illustrated in the following 6 tables were identified at the Adaptation Team workshop held in Ennis and Mallow in February 2019. The workshop was facilitated by the Climate Adaptation Regional Office (CARO).



*Climate Adaptation Workshop Ennis.*

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The climate hazards identified are typical of all local authorities in the Atlantic Seaboard South Region. The climate hazards illustrated were in turn grouped under the 6 main themes of;

- **Theme 1:** Local Adaptation Governance and Business Operations.
- **Theme 2 :** Infrastructure and Built Environment.
- **Theme 3 :** Landuse and Development.
- **Theme 4 :** Drainage and Flood Management.
- **Theme 5 :** Natural Resources and Cultural Infrastructure.
- **Theme 6 :** Community Health and Wellbeing.

The identification of these climate hazards and their consequences were further expanded upon to form the basis of the Adaptation Actions proposed as part of this strategy (Chapter 5).

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SERVICES/FUNCTIONS	CLIMATE HAZARD IMPACTS	CONSEQUENCES
<b>THEME 1: Local Adaptation Governance and Business Operations</b>		
<b>Business efficiency, effectiveness and emergency response</b>	<ul style="list-style-type: none"> <li>• Building Closures – storm, snow, extreme rainfall.</li> <li>• Building damage, impacts on servers – storm events.</li> <li>• Electricity supply affected – storm events</li> <li>• Risks to staff welfare, public safety, local business and tourism assets - storm, snow, rainfall events.</li> </ul>	<ul style="list-style-type: none"> <li>• Service disruption to customers: motor tax, housing applications, scheduled meetings, arts/cultural events etc.</li> <li>• Inability to meet statutory deadlines eg. planning applications – financial/ reputational consequences.</li> <li>• Resources stretched to deal with various impacts from extreme weather events above and beyond the performance of daily duties.</li> <li>• Increased pressure on emergency response and recovery operations.</li> <li>• Consequence to local/regional economies</li> <li>• Financial implications to local authority in clean-up operations, staff overtime, unable to perform normal duties.</li> <li>• Economic impacts – longer term consequence to local economy and local authority in terms of rate collection.</li> </ul>
<b>Business operations</b>	<ul style="list-style-type: none"> <li>• Capitalising on opportunities arising from addressing the impacts of climate hazards.</li> </ul>	<ul style="list-style-type: none"> <li>• Potential Positive outcome in accessing Climate Action fund.</li> </ul>

SERVICES/FUNCTIONS	CLIMATE HAZARD IMPACTS	CONSEQUENCES
<b>THEME 2: Infrastructure &amp; Built Environment</b>		
<b>Roads/footpaths, bridges, project construction and maintenance</b>	<ul style="list-style-type: none"> <li>• Changes in rates of deterioration - faster rate of deterioration in areas subject to flooding, sustained high temperatures, combination events.</li> <li>• Infrastructure collapse, significant damage – sustained duration and frequency of extreme events.</li> <li>• Blocked roads – storm, snow, rainfall events</li> <li>• Impact on construction projects – all extreme weather events.</li> </ul>	<ul style="list-style-type: none"> <li>• Nuisance</li> <li>• Risk to public safety</li> <li>• Financial implications for unscheduled maintenance, repair, upgrade, new construction, staff overtime costs.</li> <li>• Reduced economic efficiency of road network for commuting traffic and emergency transport routes disrupted.</li> <li>• Time delays and cost implications in delivery of infrastructure.</li> </ul>
<b>Surface Water Drainage</b>	<ul style="list-style-type: none"> <li>• Exceedance of drainage capacity – localised and larger scale flooding - sea level rise, storm surge, rainfall, combination events.</li> <li>• Reduction in drainage capacity – sea level rise, storm surge.</li> <li>• Inflow/infiltration into wastewater networks – extreme rainfall event</li> <li>• Reduced pressure on surface water drainage systems - drought conditions</li> </ul>	<ul style="list-style-type: none"> <li>• Blocked roads, flooding/damage to roads properties/business – impact on insurance costs.</li> <li>• Operating challenges of infrastructure – knock on effects for wider community.</li> <li>• Stretch on staff resources.</li> <li>• Financial implications for increased maintenance, repair</li> </ul>
<b>Building Stock – LA Buildings and 2600 No. social housing units</b>	<ul style="list-style-type: none"> <li>• Damage and deterioration of housing stock - storm, rainfall, snow &amp; heat sustained events</li> <li>• Increased need for heat/cooling – extreme cold events/extreme heat events</li> <li>• Closure of Local Authority buildings – storm, snow, rainfall events.</li> </ul>	<ul style="list-style-type: none"> <li>• Cost of maintenance, safety implications to public, possible rehousing of tenants</li> <li>• Cost of energy/fuel (negative or positive)</li> <li>• Service disruption</li> <li>• Pressure on housing staff to rectify maintenances reports issues.</li> </ul>
<b>Flood defences &amp; Coastal Infrastructure</b>	<ul style="list-style-type: none"> <li>• Exceedance of existing flood defences – storm surge, rainfall events</li> <li>• Increased coastal erosion and inundation – storm surge, rainfall events</li> </ul>	<ul style="list-style-type: none"> <li>• Loss of capital infrastructure – cost of replacement.</li> <li>• Damage/loss of properties/lands take – displacement or isolation of communities</li> <li>• Disruption to commuting traffic, and utilities – economic impact.</li> </ul>

SERVICES/FUNCTIONS	CLIMATE HAZARD IMPACTS	CONSEQUENCES
<b>THEME 2: Infrastructure &amp; Built Environment Continued</b>		
<b>Flood defences &amp; Coastal Infrastructure continued</b>	<ul style="list-style-type: none"> <li>• Increased frequency or permanent inundation of coastal infrastructure &amp; utilities i.e. water, sewerage, communications, electricity, transportation routes – storm surge, rainfall events</li> <li>• Destruction, damage, disturbance to council managed marinas and piers/ slips.</li> <li>• Increased erosion and/or overtopping of seawalls and other coastal defences.</li> </ul>	<ul style="list-style-type: none"> <li>• Increased cost to local authority repair, replacement.</li> </ul>
<b>Community Infrastructure</b>	<ul style="list-style-type: none"> <li>• Deterioration of community infrastructure eg, playgrounds, public parks, swimming pools, public spaces - sustained weather extreme events.</li> <li>• Impacts on recreation amenities and tourism activities – storm, rainfall, snow events, heat waves.</li> <li>• Impacts on coastal recreational infrastructure and public areas – sea level rise, storm surge.</li> <li>• Reduced water for swimming pools, irrigation of open spaces, parks etc - drought conditions.</li> <li>• Beach closures eg. Due to e-coli levels after storms.</li> <li>• Risk to public safety in times of high temperatures for unsecured lakes, rivers, etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Cost of maintenance/upgrade.</li> <li>• Loss of revenue locally/regionally – tourism.</li> <li>• Closure of community infrastructure – short term.</li> <li>• Injury, illness or potential loss of life.</li> </ul>
<b>Cultural/Heritage</b>	<ul style="list-style-type: none"> <li>• Damage to cultural and heritage assets and cultural landscapes – storm and rainfall events.</li> </ul>	<ul style="list-style-type: none"> <li>• Negative impact on tourism – economic consequence locally/regionally.</li> <li>• Loss of assets of intrinsic historical importance.</li> </ul>

SERVICES/FUNCTIONS	CLIMATE HAZARD IMPACTS	CONSEQUENCES
<b>THEME 3: Landuse and Development</b>		
Spatial Planning and landuse	<ul style="list-style-type: none"> <li>• Inappropriate location of urban expansion areas</li> <li>• Increased uncertainty in long term landuse planning and infrastructure design i.e. location of future developments, suitability of infrastructure designs to cope with impacts of weather events.</li> <li>• Loss of private property and community assets – extreme rainfall events, sea level rise, storm surge</li> <li>• Early retirement of capital infrastructure - all extreme weather events</li> </ul>	<ul style="list-style-type: none"> <li>• Increased insurance costs</li> <li>• Increased pressure on emergency response resources</li> <li>• Long term economic cost to area and to general public</li> <li>• Impact on quality of life</li> </ul>

SERVICES/FUNCTIONS	CLIMATE HAZARD IMPACTS	CONSEQUENCES
<b>THEME 4: Drainage and Flood Management</b>		
Stormwater	<ul style="list-style-type: none"> <li>• Inundation of stormwater infrastructure – storm surge, rainfall events.</li> <li>• Increased peak flows – rainfall events</li> <li>• Changes in groundwater levels – drought conditions</li> <li>• Changes in floodplains – rainfall events</li> <li>• Reduced/unreliable power supply for pumping and treatment – storm events</li> <li>• Changes in mean and peak stream and river flows – rainfall and drought events. Uncertain water availability – drought conditions.</li> </ul>	<ul style="list-style-type: none"> <li>• Disruption to communities</li> <li>• Negative Environmental consequences - draw on staff resources to investigate/rectify.</li> <li>• Local surface water flooding events.</li> </ul>
Water Quality	<ul style="list-style-type: none"> <li>• Increased flooding mobilising runoff from land, incl contaminants into surface waters</li> <li>• Changes in species distribution and phenology of river systems</li> <li>• Low flows resulting in deterioration of water quality – low rainfall/ drought events</li> <li>• Saline intrusion of waters - sea level rise and Storm Surge.</li> </ul>	<ul style="list-style-type: none"> <li>• Increased discharges from drainage systems to groundwaters</li> <li>• Increased pollution of surface water systems</li> <li>• Changes to surface water habitats</li> <li>• Spread of pathogens and other contaminants</li> </ul>

SERVICES/FUNCTIONS	CLIMATE HAZARD IMPACTS	CONSEQUENCES
<b>THEME 5: Natural Resources and Cultural Infrastructure</b>		
<b>Bio-diversity</b>	<ul style="list-style-type: none"> <li>• Shift in distribution of plant and animal species – all extreme weather events.</li> <li>• Loss of bio-diversity - all sustained extreme weather events.</li> <li>• Increased risk of disturbance to population and species leading to extinction – heatwave events</li> <li>• Reduced ecosystem resilience to stress – all extreme weather events</li> <li>• Increased ecosystem and species heat stress – heatwave events.</li> <li>• Increased pressure on dune systems – storm and heatwave events.</li> <li>• Increased gorse and sand dune fires – heatwave and drought events.</li> </ul>	<ul style="list-style-type: none"> <li>• Inability to meet objectives to protect and conserve important habitats.</li> <li>• Negative consequence on health and wellbeing of communities.</li> <li>• Stretched emergency services in dealing with gorse fires, fires on sand dune areas.</li> <li>• Economic impact – reduced tourism.</li> </ul>
<b>Weed/pest Management – MD Offices</b>	<ul style="list-style-type: none"> <li>• Changes in rate of coverage and spatial distribution of invasive species – change in average mean temp</li> </ul>	<ul style="list-style-type: none"> <li>• Cost and staff resources required to manage and deal with invasive species.</li> </ul>
<b>Coastal Management</b>	<ul style="list-style-type: none"> <li>• Increased coastal erosion and inundation – sea level rise, storm surge</li> <li>• Undermining and loss of critical infrastructure such as roads, bridges, drainage systems - sea level rise, storm surge, rainfall events</li> <li>• Loss of private property/community assets - sea level rise, storm surge.</li> <li>• Loss of beach width – sea level rise, storm surge.</li> <li>• Changes to wetlands, shoreline erosion and saltwater intrusion– sea level rise, storm surge.</li> <li>• Water quality – storm surge, extreme rainfall.</li> </ul>	<ul style="list-style-type: none"> <li>• Land take, loss of property, infrastructural assets.</li> <li>• Economic impact – loss of tourism.</li> <li>• Environmental impact – loss of biodiversity, inability to meet requirements of WFD.</li> <li>• Isolated communities</li> </ul>

SERVICES/FUNCTIONS	CLIMATE HAZARD IMPACTS	CONSEQUENCES
<b>THEME 6: Community Health and Wellbeing</b>		
<b>Community Development</b>	<ul style="list-style-type: none"> <li>• Increase isolation and disconnect of communities, inaccessibility – rainfall, snow, flood events, heat events (i.e. gorse and sand dune fires)</li> <li>• Damage to properties, streetscapes and community assets – storm and rainfall events</li> <li>• Contaminants to waterways and drinking water supplies – rainfall (flooding), sea level rise and storm surge</li> <li>• Pressure on drinking water supplies – Heatwave and extreme cold events.</li> <li>• Land and property take at coastal areas – storm surge, coastal flooding</li> </ul>	<ul style="list-style-type: none"> <li>• Abandonment of vulnerable rural areas</li> <li>• Impact on local economies, reduced interest in settlement</li> <li>• Cost of repair, replacement of street surfaces, public areas</li> <li>• Disadvantaged communities.</li> </ul>

### 4.3 Impacts and Opportunities.

The impacts and consequences identified across the 6 main Themes will in turn present a vast array of demands on the local authority. The local authority itself will be severely tested on an ongoing basis to respond to the many challenges to maintain its core service delivery. This will put a strain on both financial and human resources across the organization.

Elements of critical infrastructure, habitats and national heritage will be further stressed as the impacts of severe weather such as storms, flooding and heat/cold stress take their toll on such assets.

It will also potentially affect economic development when trying to attract investment. If services and the landscape are perceived to be vulnerable to climate change future and existing investment may relocate to other counties.

A major issue already facing parts of County Clare is the decline of rural communities and this will be exacerbated if towns and villages are further isolated due to stresses on services and biodiversity in their hinterlands.

However there will also be opportunities which we can take advantage of if we quickly adapt to this challenge.

The Climate Action Fund is already in place and can provide a readily accessible source of funding for big scale projects such as the conversion of the street lighting stock to LED illumination.

A warmer summer climate will present a more attractive tourism product which will have the added benefit of creating jobs in rural areas and prevent further community decline.

By being cognizant of climate change and its effects we can appropriately designate land use to meet not only the needs of industry but also communities and biodiversity. In this way we can create an attractive social and economic environment where people can live and work in harmony with their surroundings.

## 4.4 Climate Change Risk Prioritisation.

Having identified the predicted climate variables and the hazards and consequences they will produce it is equally important to categorise the risk that they pose. The future climate change risk is calculated by combining the projection confidence (i.e. the level of confidence attributable to projections of change in the climatic variable) with the future impact consequence (i.e. the estimated future level of service disruption caused).

A notional scale is developed for each parameter as shown in matrix format in Figure 4.1 and the future climate risk priority is calculated using the equation:



**Future climate change risk = Projection confidence X Future impact consequences**

		PROJECTION CONFIDENCE				
		LOW 1	LOW/ MED. 2	MEDIUM 3	MED/HIGH 4	HIGH 5
FUTURE CONSEQUENCE	NEGLIGIBLE 1	1	1	1	1	2
	MINOR 2	1	1	2	2	3
	MODERATE 3	2	2	3	3	4
	MAJOR 4	3	3	4	4	5
	CRITICAL 5	4	4	5	5	5

**Figure 4.1** Climate risk matrix.

This method of risk classification is common across many industries and is a useful tool to prioritise large amounts of data so that the major risks are clearly identified. This will also assist in project selection as low risk items will not be initially considered.

**THE FUTURE RISK PRIORITIES ARE GIVEN SCALE VALUES WITH THE FOLLOWING DEFINITIONS;**

<b>5: Critical</b>	Must not be accepted as part of routine (unadapted) operational procedures; urgent attention at the most senior level required; adaptation measures that function to diminish risk must be proposed and acted on immediately.
<b>4: Major</b>	May be accepted as a part of routine operations only where adaptation measures have been identified and are immediately feasible monitoring/early warning of the risk is routine and the nature of risk is well understood; senior management must be informed of the status and evolution of the risk over time.
<b>3: Moderate</b>	May remain part of routine operations, but a schedule for future adaptation should be in place, with a thorough investigation of any lead time and/or required precedent steps prior to adaptation measures becoming feasible having been conducted
<b>2: Minor:</b>	Likely to remain part of routine operations; should be assigned a monitoring and observation protocol; existing controls are sufficient and no further action will be required unless significant change occurs.
<b>1: Negligible:</b>	No further action will be required in the short term unless significant change occurs in the climate variable or receiving environment in question.

The calculation of the future climate risk for each variable allows the ranking and prioritisation of risks as shown in Table 4.2.

Future Climate Change Risk	Projection Confidence	Future Consequence	Future risk priorities
Fluvial flooding	4	5	5
Heat waves	5	4	5
Coastal flooding	4	4	4
Pluvial flooding	2	5	4
Wind storms	3	4	4
Groundwater flooding	1	4	3
Coastal erosion	2	4	3
Freezing conditions	5	1	2

**Table 4.2** *Prioritisation of future climate change risks for County Clare.*

The future risk priorities are in line with what we forecast the likely affects of climate change will be in County Clare i.e. Freezing conditions scores the lowest as the incidences of cold stress are likely to decrease. Therefore dealing with cold stress will likely remain as part of routine operations.

## 4.5 Adaptation Actions.

Climate adaptation actions will reduce the negative effects of climate change or take advantage of emerging opportunities. In the next section, the objectives of Clare County Council for the future management of climate risks are stated, the adaptation pathways process explained, adaptation actions outlined and early stage adaptation described.

## 4.6 Objectives In Relation To The Future Management Of The Climate Change Risks.

Clare County Council's objectives in relation to the future management of the identified climate change risks are the development of a comprehensive understanding of how a changing climate will impact on operations and service provision and the implementation of actions to reduce exposure to climate risks and to capture any new opportunities.

**For each identified climate change risk, the approach taken has been:**

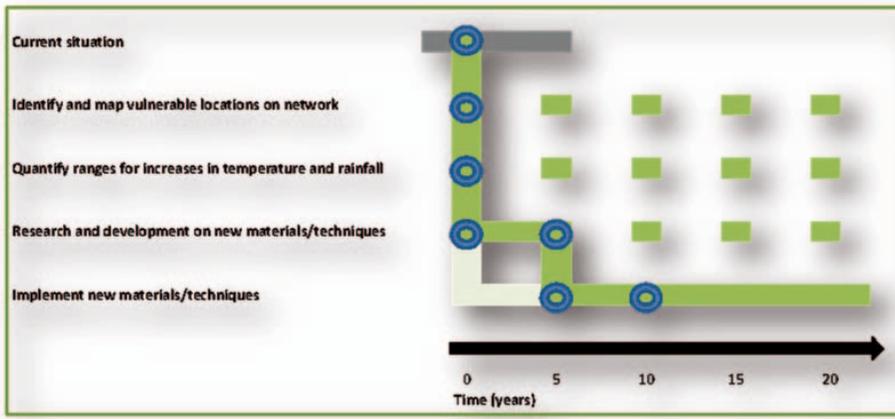
- 1) Adaptation is considered as being about organisational change, managing uncertainty, decreasing vulnerability of citizens and infrastructure and increasing resilience to maintain effective local government services;
- 2) An exploratory and considered approach is taken to adaptation actions to ensure the effectiveness of initiatives.

## 4.7 Adaptation Pathway Maps For Climate Risk Management.

Having established the future risk priorities we need to develop a roadmap on how we will implement them. Adaptation pathway maps are a decision making tool recommended in the 2016 EPA Guideline document and provide both a graphic illustration of the trade-offs between adaptation choices and a framework to describe the range of options available to formulate an adaptation action. An adaptation pathway depicts several possible actions to accomplish the goals within a timeline and helps to sequence actions. In the sequencing of future adaptation actions, uncertainty is important and adaptation pathways assist in analysing, programming and developing optimal combinations of actions to achieve desired goals.

The pathway methodology shown in Figure 4.2 sets out a rigid pathway for a particular roads related issue. Year 1 consists of data gathering relating to the road network, new techniques are developed from year 1 to 5 with the programme implemented thereafter over the following years.



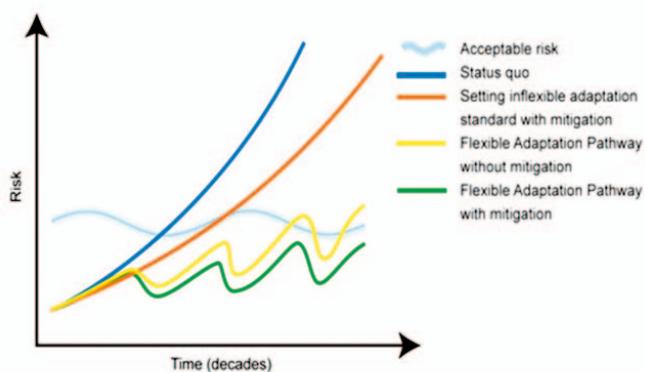


**Figure 4.2** Pathways map of options to increase resilience of wet-mix macadam and surface dressed roads to increased temperature and precipitation.

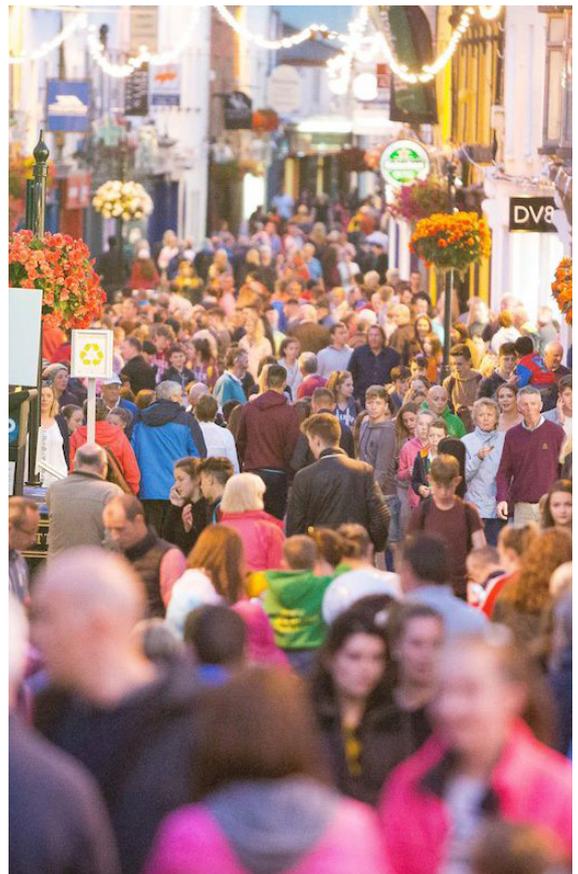
However to deal with climate change a more flexible approach in general will be required (Figure 4.2) but the use of rigid pathway maps will also be appropriate in certain circumstances.

## 4.8 The Most Appropriate Route Through The Pathways Map.

The 2019-2024 Clare County Council Adaptation Strategy is the first such Strategy prepared and a cautious, exploratory and flexible approach is being taken.



**Figure 4.3** Changing risk in response to a flexible adaptation pathway.



**The proposed pathway for the adaptation strategy has the following underpinning key features;**

- It is based on acceptable and unacceptable levels of risk and the understanding that if a flexible adaptation approach is pursued, along with climate change mitigation (Figure 4.3), then risk will be kept below an acceptable level.
- It focuses on recognising and addressing the long-term and uncertain nature of climate change;
- It also utilises pathways consisting of robust adaptation actions;
- By incorporating ‘no regret actions’ (adaptation actions that are cost effective and worthwhile regardless of the extent of future climate change) and ‘low regret actions’ (adaptation measures for which the associated costs are relatively low and for which the benefits, although primarily realised under projected future climate changes, may be relatively high);
- It avoids mal-adaptation which has been defined as **“action taken ostensibly to avoid or reduce vulnerability to climate change that impacts adversely on, or increases the vulnerability of other systems, sectors or social groups”**.
- It is dynamic in that climate change science and knowledge as well as responses are evolving and the Strategy will be updated frequently to reflect the most up to date information.





**5. ADAPTATION  
THEMES, GOALS  
AND ACTIONS.**

## 5.1 Thematic Areas and High-Level Goals.

In order to bring a coherent approach to the Adaptation Strategy it was necessary to distil the many themes, risks and vulnerabilities which were identified in the team workshop to a manageable number of core themes and goals to maintain a sharp and realistic focus

for the strategy. For Clare County Council we identified the following 6 broad themes and a corresponding goal which cover the extensive range of services, policies and responsibilities of the local authority.

THEME	GOAL
<b>THEME 1: Local Adaptation Governance and Business Operations.</b>	Climate Change adaptation considerations are mainstreamed and integrated successfully into all functions and activities of the local authority ensuring operational protocols, procedures and policies implement an appropriate response in addressing the diversity of impacts associated with climate change
<b>THEME 2: Infrastructure and Built Environment.</b>	Increased capacity for climate resilient structural infrastructure is centred around the effective management of climate risk, informed investment decisions and positive contribution towards a low carbon society
<b>THEME 3: Landuse and Development.</b>	Sustainable policies and measures are devised influencing positive behavioural changes, supporting climate adaptation actions and endorsing approaches for successful transition to low carbon and climate resilient society.
<b>THEME 4: Drainage and Flood Management.</b>	Create understanding of risks and consequences of flooding and successful management of a co-ordinated approach to drainage and flooding
<b>THEME 5: Natural Resources and Cultural Infrastructure.</b>	Fostering meaningful approaches to protecting natural and key cultural assets through an appreciation for the adaptive capacity of the natural environment to absorb the impacts of climate change.
<b>THEME 6: Community Health and Wellbeing.</b>	Empowered and cohesive communities with strong understanding of climate risks, increased resilience to impacts of climate change with capacity to champion climate action at local level



In this way we have a more structured focused approach to guide our Climate Adaptation Strategy. The strategy will be an iterative flexible approach guided by continual learning and understanding of the effects of climate change

These strategic goals are themselves underpinned by the following 4 main guiding principles;

1. **Mainstream Adaptation.** The strategy will be ingrained in all policies and decisions made by Clare County Council.
2. **Informed Decision Making.** All decisions will be based on well founded and robust evidence to better support long term planning.
3. **Building Resilience.** The most vulnerable communities will be prioritised to build resilience.
4. **Capitalising on Opportunities.** We must look to take advantage of any opportunity to maximise resource use and influence positive behavioural changes.

## STRATEGIC GOALS

**1. MAINSTREAM ADAPTATION.**

**2. INFORMED DECISION MAKING.**

**3. BUILDING RESILIENCE.**

**4. CAPITALISING ON OPPORTUNITIES**

## 5.2 Climate Change Actions.

Clare County Council will address its climate adaptation responsibilities through the following schedules of objectives and actions.

The actions and objectives were developed from local authority directorates workshop, guidance documents and research conducted on a national level. Each high-level goal can involve a number of local authority services and directorates and will seek to ensure the economic, effective and efficient delivery of services under changing climatic conditions.

## 5.3 Adaptation Objectives and Actions.

G1 LOCAL ADAPTATION GOVERNANCE AND BUSINESS OPERATIONS			
OBJECTIVE 1: To ensure that climate adaptation is mainstreamed into all activities and operations of the Local Authority. To implement an appropriate response in addressing diversity of climate change impacts.			
No	Action	Lead	Timeframe S/M/L
1.	Establish an Adaptation Steering Group with representatives from across key functions of local authority to ensure the successful implementation of the actions of this Climate Change Adaptation Plan and to report on progress.	Management Team	Short 1- 2 years
2.	Main Stream Climate Action Policy as integral considerations in the Corporate Plan objectives providing for all the local authority activities and the delivery of functions and services across the administrative area.	All Directorates	Short 1- 2 years
3.	Undertake and implement a Business Continuity Plan to identify and address specifically, the impacts associated with extreme weather events on all functions/services of the local authority including: <ul style="list-style-type: none"> <li>• Preparing for critical services disruptions,</li> <li>• Mitigating/Minimising the impact of service disruption and,</li> <li>• Improving the capacity / ability to recover.</li> </ul>	All Directorates	Short 1- 2 years
4.	Through our Learning and Development Unit we will work with all Directorates in the first instance to raise awareness and basic understanding of Climate Change and Adaptation among our staff, Councillors and the wider community.  We will work through our existing networks and partners (i.e. Junior Achievement / Regional Training Centres etc) to develop more formalised structures and training: particularly in the areas of response and Health & Safety.	Finance and Support Services	Short 1- 2 years
5.	Liaise, collaborate and work in partnership with the sectors identified in the National Adaptation Framework in the delivery of the sectoral adaptation actions, as approved by Government, where they relate and are relevant to the functions and activities of Clare County Council at local level and in local communities.	All Directorates	1-5 Years

## G2 INFRASTRUCTURE AND BUILT ENVIRONMENT

**OBJECTIVE 1: To ensure and increase the resilience of infrastructural assets and inform investment decisions.**

No	Action	Lead	Timeframe S/M/L
1.	Apply a robust risk assessment and management framework to Local Authority owned buildings and properties to identify and protect against the key vulnerabilities to the impacts of climate change and mitigate against service disruption.	Social Development	Short 1- 2 years
2.	Integrate climate considerations into the design, planning and construction of all roads, footpaths, bridges, public realm and other construction projects. Make provision to incorporate green infrastructure as a mechanism for carbon offset.	Physical Development	Short 1- 2 years Medium 2 - 5 years Long > 5 years
3.	Under a Risk Assessment of physical infrastructure in the area identify the severity of climate change risks on their function and condition. The risk assessment should provide for an understanding and quantification of risks posed. The findings should be integrated into decision making processes, road infrastructure programmes and physical investment strategies.	Physical Development	Medium 2 - 5 years
4.	Incorporate climate change impacts into Major Emergency Risk Assessment. These include an assessment of the risks to Co. Clare associated with severe weather extremes (wind storms, severe cold/ice, electrical storms, heat waves, flooding, landslides and forest fires), and maintenance of critical infrastructure	Physical Development	Medium 2 - 5 years



## G2 INFRASTRUCTURE AND BUILT ENVIRONMENT

**OBJECTIVE 2: To promote County Clare as a Low Carbon County and support the development of low carbon and green technology businesses and industries throughout the County.**

No	Action	Lead	Timeframe S/M/L
1.	Facilitate through land use, policy objectives, the Development Management Process and subject to the necessary environmental investigations and safeguards, the development of energy sources which will achieve low carbon outputs.	Economic Development	Medium 2-5 years Long >5 years
2.	Promote measures to reduce emissions of greenhouse gases through the adoption of sustainable planning strategies, as well as objectives for the integration of land use and transportation planning.	Economic Development	Medium 2-5 years Long > 5 years
3.	Raise awareness and understanding of the impacts of climate change on both the local economy and communities in the County.	Rural Development	Short 1- 2 years Medium 2-5 years Long > 5 years
4.	Support sustainable modes of transport such as walking and cycling through promotional strategies and the provision of infrastructure where required.	Physical Development	Short 1-2 years Medium 2-5 years Long > 5 years
5.	Support on-land and off-shore renewable energy production by a range of appropriate technologies	Economic Development	Medium 2-5 years
6.	(a) As a means of de-carbonising the economic and social sectors, thus reducing greenhouse gases, we will support the increased use of renewable energy in the commercial and agricultural sectors.  (b) Support energy efficiency in industry and communal programmes at town and village level in households.  (c) Support public sector bodies to achieve energy efficiency targets in their use of energy and support them in adopting energy management systems (E.G. ISO 50001)	Economic Development	Medium 2-5 years
7.	Develop and Promote Clare as a sustainable, secure affordable and low carbon economy as a means of attracting inward investment. Increase participation of businesses in energy management programmes.	Economic Development	Medium 2-5 years
8.	Develop a risk assessment to safeguard capital buildings such as housing stock, libraries, community buildings, Fire stations, Museum, Leisure Centres, Visitor attractions, works depots and Civic Amenity sites that Clare County Council owns and maintains from the risks associated with the impacts of climate change.	Economic Development Social Development	Long > 5 years
9.	In accordance with the objectives of the Atlantic Economic Corridor, identify the vacant Council owned buildings and Enterprise space in key towns in the County and work to maximise occupation of existing vacant buildings and brown field sites.	Economic Development	Medium 2-5 years

## G2 INFRASTRUCTURE AND BUILT ENVIRONMENT

### OBJECTIVE 3: To support sustainable travel in County Clare.

No	Action	Lead	Timeframe S/M/L
1.	Prepare an integrated transport strategy that takes account of 'Smarter Travel – A Sustainable Transport Future – A New Transport Policy for Ireland 2009-2020' and promote the development of walking, cycling, public transport and other sustainable forms of transport.	Physical Development	Short 1- 2 years Medium 2 - 5 years Long > 5 years
2.	Support the provision of green infrastructure development, active living and sustainable residential development.	Economic Development	Short 1- 2 years Medium 2 - 5 years Long >5 years
3.	(a) Prepare and implement a Sustainable Urban Mobility Plan for the Ennis and Environs area.  (b) Implement an Active Travel Towns programme in the Ennis area arising from the Ennis 2040 strategy.	Physical Development	Medium 2 - 5 years Long > 5 years

## G2 INFRASTRUCTURE AND BUILT ENVIRONMENT

### OBJECTIVE 4: To support land use policy, future development proposals and transportation strategies that ensure the viability of bus and rail services in County Clare.

No	Action	Lead	Timeframe S/M/L
1.	Support and facilitate the improvement and expansion of rail infrastructure and services and the opening/reinstating of railway stations on the Western Railway Corridor within County Clare and in particular Crusheen.	Economic Development	Medium 2-5 years Long > 5 years
2.	Support and work with relevant partners to sustain year round rail services from Ennis to Limerick.	Physical Development  Economic Development	Short 1-2 years Medium 2-5 years Long > 5 years
3.	Through land use zoning and the Development Management Process, identify and safeguard land required for the development of rail infrastructure including bridges, stations and goods terminals and areas necessary for the development of the rail infrastructure in the County.	Physical Development  Economic Development	Medium 2-5 years
4.	Work with relevant stakeholders to encourage and promote a sustainable, community-based public transport scheme that will enable access to service centers for all members of the community in the County.	Rural Development	Medium 2-5 years

### G3 LAND USE AND DEVELOPMENT

**OBJECTIVE 1: To provide for the integration of planning, land-use and transportation considerations in identifying the optimum location for future development.**

No	Action	Lead	Timeframe S/M/L
1.	Through the Development Plan and Local Area Plan process, ensure that sufficient lands are zoned at appropriate locations in order to meet the envisaged land use requirements of the area during the lifetime of the Development Plan.	Economic Development	Short 1-2 years Medium 2-5 years
2.	Input into the development of the Limerick Shannon Metropolitan Area Transport Strategy (LSMATS) and implement when adopted.	Economic Development Physical Development	<b>Medium 2-5 years</b>

### G3 LAND USE AND DEVELOPMENT

**OBJECTIVE 2: To integrate climate action consideration into landuse planning policy and influence positive behaviour**

No	Action	Lead	Timeframe S/M/L
1.	Integrate and promote climate-smart and NZEB (Near zero energy buildings) design performance outcomes in development standards through the development management process.	Economic Development	Short 1-2 years Medium 2-5years
2.	Promote the integrated planning; design and delivery of green infrastructure (including urban greening) though appropriate provisions in planning policies, development standards, and infrastructural, public realm and community projects.	Social Development Economic Development Rural Development	<b>Short 1-2 years</b> <b>Medium 2-5 years</b> <b>Long &gt; 5 years</b>
3.	Research and incorporate, in the statutory planning process, measures in accordance with Section 10 (n) of the Planning and development Acts 2000 (as amended) for: (n) the promotion of sustainable settlement and transportation strategies in urban and rural areas	Economic Development	<b>Short 1-2 years</b>

## G4 DRAINAGE AND FLOOD MANAGEMENT

### OBJECTIVE 1: To manage the risk of flooding through a variety of responses

No	Action	Lead	Timeframe S/M/L
1.	Develop a surface water management plan for the assessment and management of flood risks with the aim of reducing the adverse consequences of flooding, to prioritise projects to reduce surface water and groundwater flood risk.	Physical Development	Short 1- 2 years
2.	Stipulate the requirement for the design and specification of urban stormwater drainage systems including SuDS (sustainable urban drainage systems) for new development to take account of the potential future impact of climate change.	Economic Development	Short 1- 2 years
3.	Maintain Clare County Council Flood Emergency Plan, this includes specific flood response plans for identified areas	Physical Development	Short 1- 2 years

## G4 DRAINAGE AND FLOOD MANAGEMENT

### OBJECTIVE 2: To ensure that areas that are at risk of Flooding are clearly identified and to ensure that inappropriate development does not take place within areas that are at risk of flooding.

No	Action	Lead	Timeframe S/M/L
1	Through the Development Management process ensure that proposals for development in areas where there is a risk of flooding, have regard to the document 'The Planning System and Flood Risk Management (and Technical Appendices) – Guidelines for Planning Authorities 2009' and any current ie CFRAMS and future OPW flood assessment information.	Economic Development	Short 1-2 years Medium 2-5 years Long > 5 years
2.	(a) Ensure that adequate storm water infrastructure is in place to accommodate the planned level of growth in County Clare.  (b) Require developments to provide a separate foul and surface water drainage system and request the submission of details regarding Surface Water Attenuation Systems for multi-unit development applications in the county.	Physical Development	Short 1-2 years Medium 2-5 years Long > 5 years
3.	Through land use and development policy and zoning objectives, facilitate green infrastructure developments as a means of managing flood risk and enhancing the natural environment.	Economic Development	Short 1-2 years Medium 2-5 years Long > 5 years

## G4 DRAINAGE AND FLOOD MANAGEMENT

### OBJECTIVE 3: To mitigate the risk and impact of flooding

No	Action	Lead	Timeframe S/M/L
1.	Incorporate considerations of the impact of climate change into proposals submitted under the Minor Works Programme to ensure that measures proposed are adaptable to future changes.	Physical Development Social Development	Short 1-2 years Medium 2-5 years Long > 5 years
2.	Ensure that potential future flood information is obtained/generated by way of a Flood Risk Assessment (FRA) and used to inform suitable adaptation requirements within the Development Management process in line with the Guidelines for Planning Authorities on Flood Risk Management (DoECLG & OPW, 2009)	Economic Development	Short 1- 2 years Medium 2-5 years Long > 5 years
3.	Assess the impact of Climate Change on the potential shock flows of surface water on to Clare's beaches during severe weather events, and how increased surface water flows will impact on bathing water quality and erosion of the beach infrastructure.	Physical Development	Short 1- 2 years Medium 2-5 years Long > 5 years
4.	Liaise with Irish Water to identify Waste Water Treatment plants which are subject to flooding from severe weather events, the consequence of which impact negatively on amenity and sensitive areas and Prioritise these plants for suitable upgrades.	Physical Development	Short 1- 2 years Medium 2-5 years Long > 5 years

## G4 DRAINAGE AND FLOOD MANAGEMENT

### OBJECTIVE 4: To undertake measures to reduce coastal flooding and to proactively react to incidences of coastal flooding in County Clare.

No	Action	Lead	Timeframe S/M/L
1.	(a) Engage with the Office of Public Works to develop appropriate strategies for the management of identified coastal flood and erosion hazards and associated risks.  (b) Seek funding for defence works based on the outcome of detailed Coastal Erosion and Flood Risk Management Studies undertaken in areas identified as being at risk.	Physical Development	Short 1- 2 years Medium 2-5 years Long > 5 years

## G5 NATURAL RESOURCES AND CULTURAL INFRASTRUCTURE

**OBJECTIVE 1: To provide for enhancement of natural environment to work positively towards climate action.**

No	Action	Lead	Timeframe S/M/L
1.	Develop a strategy to undertake and implement an active Tree Planting programme in the context of climate adaptation in conjunction with an awareness campaign that informs of the benefits to communities.	Physical Development Rural Development	Short 1-2 years
2.	Make provision for natural borders/buffers and include as an integral component of the design of greenways / blueways, tracks and trails and amenity areas to promote natural enhancement.	Physical Development Social Development Rural Development	Short 1-2 years Medium 2-5 years Long > 5 years

## G5 NATURAL RESOURCES AND CULTURAL INFRASTRUCTURE

**OBJECTIVE 2: To protect heritage and cultural infrastructure.**

No	Action	Lead	Timeframe S/M/L
1.	Undertake a risk assessment of the Heritage and Cultural Assets in the county to assess the vulnerability and the risk to the historical environment from the impacts of climate change and to help build resilience to these important assets.	Economic Development	Medium 2-5 years

## G5 NATURAL RESOURCES AND CULTURAL INFRASTRUCTURE

### OBJECTIVE 3: To promote effective Bio-diversity management and enhance protection of natural habitats and landscapes.

No	Action	Lead	Timeframe S/M/L
1.	<p>Review Bio-diversity Plans/habitat conservation strategies, plans and projects to ensure that:</p> <ul style="list-style-type: none"> <li>• all risks from adverse climate change have been identified;</li> <li>• future changes are assessed and measures employed to address issues identified</li> <li>• carbon capture within habitats is considered</li> <li>• to protect all designated European sites in County Clare in accordance with the relevant Directives and Legislation</li> </ul>	Economic Development	<p>Short 1- 2 years</p> <p>Medium 2-5 years</p> <p>Long &gt; 5 year</p>
2.	(a) Research and map areas considered beneficial for use as local carbon offset through carbon sequestration and (b) include the development of a Green Infrastructure strategy.	Economic Development	<p>Short 1-2 years</p> <p>Medium 2-5 years</p> <p>Long &gt; 5 years</p>

## G5 NATURAL RESOURCES AND CULTURAL INFRASTRUCTURE

### OBJECTIVE 4: To promote and facilitate the provision of high quality, secure, efficient and reliable renewable energy sources along with appropriate energy storage facilities in order to assist in the creation of a low carbon County Clare.

No	Action	Lead	Timeframe S/M/L
1.	(a) Encourage proposals for renewable energy developments and ancillary facilities in order to meet national, regional and county renewable energy targets, and to facilitate a reduction in CO2 emissions and the promotion of a low carbon economy through Planning Policy and land use objectives.	Economic Development	<p>Short 1- 2 years</p> <p>Medium 2-5 years</p> <p>Long &gt; 5 year</p>
	(b) Through land use policy and objectives, support and facilitate the development of new alternatives and technological advances in relation to renewable energy production and storage.	Economic Development	<p>Short 1-2 years</p> <p>Medium 2-5 years</p> <p>Long &gt; 5 years</p>
	(c) Support the implementation of the policy document 'Ireland's Transition to a Low Carbon Energy Economy 2015-2030'	Management Team	<p>Short 1-2 years</p> <p>Medium 2-5 years</p> <p>Long &gt; 5 years</p>

## G5 NATURAL RESOURCES AND CULTURAL INFRASTRUCTURE

**OBJECTIVE 5: To support the Strategic Integrated Framework Plan for the Shannon Estuary in order to harness the significant energy resources of the Shannon Estuary.**

No	Action	Lead	Timeframe S/M/L
1.	Work to promote and harness the potential of the Shannon Estuary for the sustainable development of renewable energy sources to assist in meeting renewable energy targets.	Economic Development	Short 1-2 years Medium 2-5 years Long > 5 years
2.	Ensure that all development in the Shannon Estuary that is associated with the energy sector has regard to the Strategic Integrated Framework Plan (SIFP) – as per Volume 7 of the Clare County Development Plan 2017-2023.	Economic Development.	Short 1- 2 years Medium 2-5 years Long >5 years

## G5 NATURAL RESOURCES AND CULTURAL INFRASTRUCTURE

**OBJECTIVE 6: To protect and preserve the Burren and Cliffs of Moher Geopark while only allowing for appropriate development in accordance with environmental legislation.**

No	Action	Lead	Timeframe S/M/L
1.	Advocate for the funding and preparation, by the National Parks & Wildlife Service, of a Conservation Management Plan for the Burren National Park.	Economic Development	Short 1-2 years Medium 2-5 years
2.	Continue to work in partnership with all relevant stakeholders to support the on-going work of the Burren and Cliffs of Moher Geopark and to secure the retention of the 'Geopark' status into the future.	Rural Development	Short 1-2 years
3.	Seek, on an on-going basis, new funding mechanisms for the work of the Geopark e.g. from national and EU sources.	Rural Development	Medium 2-5 years

## G5 NATURAL RESOURCES AND CULTURAL INFRASTRUCTURE

**OBJECTIVE 7: To liaise and work with other bodies and agencies responsible for the management of water resources.**

No	Action	Lead	Timeframe S/M/L
1.	Work with and support Irish Water and Group Water Scheme Sector in identifying public drinking water sources vulnerable to climate change and develop source protection or alternative sources, in order to maintain water quantity and quality levels.	Physical Development	Medium 2-5 years
2.	Work with Irish Water and LAWPRO (Local Authority Water Programme) to identify the impacts of critical and vulnerable receptors in accordance with the River Basin Management Plan and Water Framework Directive.	Physical Development	Short 1-2 years
3.	Liaise and work with Irish Water in the development, conservation and upgrade of the water supply systems so as to ensure County Clare has robust infrastructure and adequate supply of water to address climate change demands.	Physical Development	Medium 2-5 years



## G5 NATURAL RESOURCES AND CULTURAL INFRASTRUCTURE

**OBJECTIVE 8: To expand the cultural infrastructure of County Clare through the development of the tourism industry, the green infrastructure and public amenities and facilities of the county.**

No	Action	Lead	Timeframe S/M/L
1.	Facilitate the on-going development and improvement of green infrastructure in County Clare, including green networks, green amenities and linked green corridors which ensure the provision of recreational amenities, natural areas for the growth of wildlife and biodiversity, and a network of infrastructure which results in a better quality of life for visitors and inhabitants alike.	Economic Development  Physical Development	Short 1-2 years  Medium 2-5 years  Long > 5 years
2.	Undertake a review of the Gardening Section operations to determine what current operations should be adapted and to support the All Ireland Pollinator Plan 2015-2020	Physical Development	Short 1-2 years  Medium 2-5 years



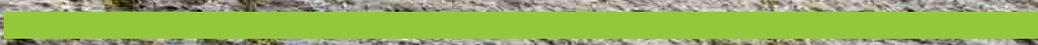
## G6 COMMUNITY HEALTH AND WELLBEING

### OBJECTIVE 1: To build capacity and resilience within communities.

No	Action	Lead	Timeframe S/M/L
1.	Through public participation network raise awareness of the impacts of climate change and ways for communities to increase response and resilience to these impacts.	Rural Development	Short 1- 2 years
2.	Assess communities across the county in the context of their vulnerability to the impacts of climate change. Identify vulnerable communities and the risks to the community.	Rural Development	Short 1- 2 years
3.	For identified vulnerable communities, develop and implement a programme to enhance their capacity to respond to and recover from extreme weather events with specific aims to: <ul style="list-style-type: none"> <li>• help the vulnerable community to develop a stronger facilitating role for mitigating risks</li> <li>• provide advice on the risk of extreme events affecting their locality</li> <li>• devise actions to enhance preparedness</li> <li>• provide support to develop appropriate resilience arrangements to enable response and recovery</li> </ul>	Rural Development	Medium 2 - 5 years
4.	Ensure that future development proposals contribute to the creation of sustainable communities throughout County Clare.	Economic Development	Short 1- 2 years – Medium 2 - 5 years Long > 5 years



**6. IMPLEMENTATION,  
MONITORING AND  
REPORTING.**



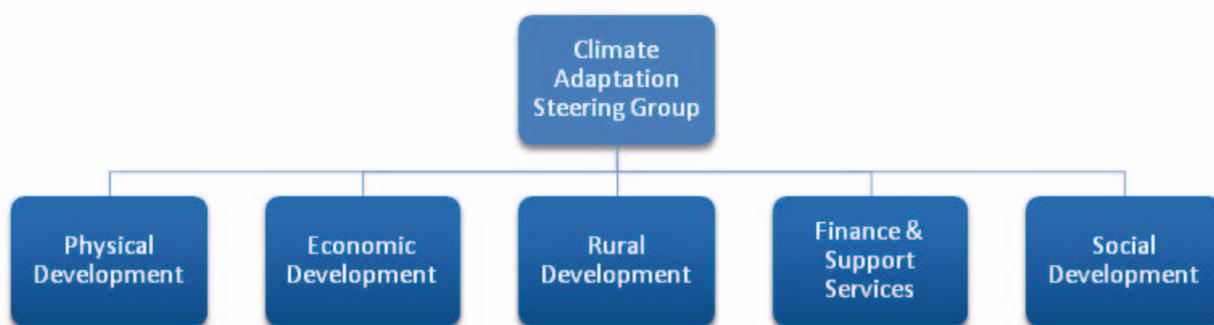
## 6.1 Implementation.

This Climate Adaptation Strategy will need to be a flexible process in its implementation due to the pace of change required. Unlike other plans which have a statutory timeline for their revisions it is expected that the strategy, although notionally to be reviewed every 5 years, will be reviewed on a more frequent basis to respond to new legislation, innovation and unknown challenges which lie ahead.

## 6.2 Steering Group.

The first action identified under the Local Adaptation Governance and Business Operations is to establish a Climate Adaptation Steering Group. The fundamental aim of the Group is to co-ordinate and implement the adaptation actions throughout the local authority. The Group should be chaired by a Director of Service and the members, drawn from each Directorate, should be of sufficient seniority to ensure the successful implementation of the objectives.

The inclusion of all Directorates will ensure a balanced and even approach across the organisation.



## 6.3 Implementation to Date.

It is important to appreciate that we are not starting from the lowest point with regard to adaptation measures. Clare County Council has extensive experience to date in responding to climate related events. In accordance with the National Framework for Major Emergency Management (MEM), Clare County Council has a Major Emergency Management Programme to ensure a systems approach to Major Emergency Management. This systems approach involves a continuous cycle of activity, which are all included in the five stages of the emergency management paradigm.

The principal elements are:

- Hazard analysis/Risk assessment,
- Mitigation/Risk management,
- Planning and preparedness,
- Co-ordinated response, and
- Recovery.



Using this structured approach Clare County Council has used the resources, facilities and procedures for Major Emergency Management (MEM) to respond and adapt to a number of severe climate related events since 2008.

## 6.4 Early Stage Adaptation Measures.

In addition to the MEM Clare County Council has also instigated a number of other early Adaptation measures to deal with the ongoing effects of climate change.

Adaptation Action Categories	Early stage measures
Support existing initiatives	<p>Major Emergency Management Plan and Severe Weather Plans in place. Severe Weather Assessment Team (SWAT) in place.</p> <p>A number of early warning systems are in place, for example:</p> <ul style="list-style-type: none"> <li>• River level guage system on river Fergus in place for Ennis;</li> <li>• OPW Coastal Surge warning protocol in place;</li> <li>• ESB protocol for water discharge from Parteen Headrace;</li> <li>• <a href="https://www.esb.ie/our-businesses/generation-energy-trading-new/hydrometric-information/river-shannon">https://www.esb.ie/our-businesses/generation-energy-trading-new/hydrometric-information/river-shannon</a></li> <li>• IceCast Road Weather Information System in place for National Roads</li> </ul> <p>Existing Plans and Resources.</p> <ul style="list-style-type: none"> <li>• The 2017-2023 County Development Plan (CDP) references climate change in chapter 18 and the need for adaptation. The CDP further envisages the development of a Green Infrastructure Strategy to identify, manage and develop green infrastructure resources.</li> <li>• Project Management Office dealing with flooding and coastal projects in Ennis South , Clonlara and Shannon Embankments.</li> </ul>
Prepare inventories and undertake vulnerability assessments of assets	<ul style="list-style-type: none"> <li>• Corporate Services Property Register has details of Council owned properties</li> <li>• Catchment Flood Risk And Management Study (CFRAMS) complete</li> <li>• Roads database holds records of road classifications and condition</li> <li>• Eirspan bridge data base has records of Regional and Local road bridges, including rated condition and damage type</li> </ul>
Identify opportunities	<p>Local Enterprise Office has expertise in project/product development with business and industry.</p>
Raise awareness	<p>Existing mainstream and social media channels widely used by Communication Department.</p>
Further develop relationships	<p>Important relationships include:</p> <ul style="list-style-type: none"> <li>• stakeholders such as Irish Water, SEAI, OPW ,EPA, ESB</li> <li>• 3rd level Institutions with research interests in climate change</li> <li>• Local communities</li> </ul>

Clare County Council has also been actively promoting Energy climate change mitigation measures for some years. Examples of measures taken to date include-

Establishment of the Limerick Clare Energy Agency (LCEA) with Limerick County Council in 2005

Published first County Energy & Emissions Balance and Climate Change Action Plan in 2006

Contributed to the Mid-West Regional Energy & Emissions Balance, 2007

Published revised Energy & Emission Balance and Low carbon Energy Plan, 2012

Conducted an Sustainable Energy Plan for Shannon, 2011

Support of the Clare Wood Energy Group

Implemented the forest resource management plan for Central Waste Management Facility

Supported the Renewable Energy Skills Network

Published County Clare Renewable Energy Resource Report, 2010

Published Clare Renewable Energy Strategy, 2011 and updated the strategy in 2017

Installation of public water refill station on a trial basis in main Council headquarters

All new Social Housing schemes have Near Zero Energy Building (NZEB) specifications.

However although the above schedules of early adaptation and mitigation measures are a positive step we need to build on this and plan in a more formulised prescribed method such as through the Steering Group to ensure the entire organisation responds to the challenges we are facing.

Public communication and outreach will also be essential for local community buy-in to climate mitigation and adaptation measures. The strategy will help to build awareness on the challenges of climate change, keep the public informed on the implementation of this strategy and improve information flows during extreme weather events.

## 6.5 Monitoring.

The Steering Group will develop the appropriate monitoring tools and flexible adaptation pathways to ensure the strategy objectives are achieved in the timelines required.

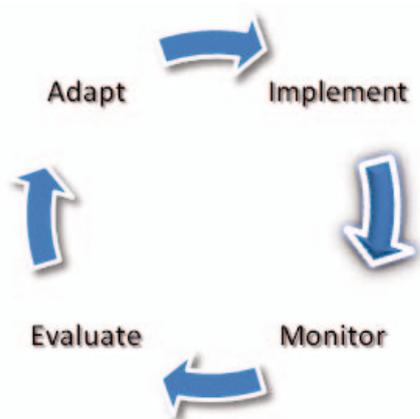
A range of performance indicators will be utilised across the 6 core theme objectives.

These indicators will undoubtedly evolve over time as the adaptation process matures and becomes integral to service delivery. The indicators will provide the basis for analysis and capture the intended and perhaps the unintended effects of adaptation actions.

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**These indicators will give a dashboard view and will assist in managing the following;**

- Monitor the implementation of adaptation policies and actions.
- Provide financial accountability and monitor funding for adaptation programmes.
- Compare adaptation achievements across CARO regions.
- Inform and report climate change adaptation progress to the Atlantic Seaboard South CARO



Although the broad effects of climate change are understood it is important to remain flexible in our approach and to be able to quickly adapt to changing circumstances. In this way the system will continually evolve through an iterative process of implementation, monitoring, evaluating and adapting.

## 6.6 Reporting.

Under Section 15(2) of the Climate Action and Low Carbon Development Act, 2015 the relevant Minister may from time to time require a report specifying the measures and progress that the relevant body has adopted for the purposes of compliance with its relevant sectoral adaptation plan.

The Steering Group will co-ordinate the preparation of an annual report from each Directorate which will document in a prescribed format the progress in implementing the strategy.

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**The report as a minimum should cover areas such as;**

- Key Performance Indicators
- Staff Training
- Financial provisions and outcomes
- Community and stakeholder engagement
- Staff Awareness, Engagement and Behaviour change
- Project reviews to determine effectiveness

The report will be presented to the Strategic Policy Committees, Management Team and to the Council or as otherwise deemed appropriate.

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