



comhairle chontae na mí  
meath county council



# COUNTY MEATH'S CLIMATE CHANGE RISK ASSESSMENT CCRA REPORT (ADAPTATION)

## ANNEX 1

Meath County Council  
Climate Action Plan 2024 - 2029



### CORE



### ADDITIONAL



# Annex 1: COUNTY MEATH'S CLIMATE CHANGE RISK ASSESSMENT

## Contents

Figure and Table Listing .....	03
1.0 Executive Summary .....	04
2.0 Introduction .....	07
2.1 Climate change mitigation and adaptation .....	08
2.2 Regulatory connect for climate action .....	08
3.0 Data Collection and Climate Change Risk Assessment Methodology .....	09
3.1 Data Collection .....	09
3.2 Characterising exposure, vulnerability, and impacts .....	09
3.3 Climate Change Risk Assessment Methodology .....	09
3.4 Climate Change Risk Assessment Phases .....	10
4.0 Current Climate Change Risk and Impact Assessment .....	10
4.1 Meath County Council and Administrative Area Climate Change Risk Areas .....	10
4.2 Climate Hazards Profile for Meath .....	11
4.3 Current Frequency of Climate Hazard events .....	14
4.4 Characterising Exposure, Vulnerability, and Assessing the Impacts of Current Climate Hazards .....	15
4.5 Current Climate Impacts Assessment: Summary of Service Level Impacts .....	23
4.6 Current Climate Impacts Assessment Summary: Administrative area – County Meath .....	24
5.0 Future Climate Risks and Impacts .....	26
5.1 County Meath's Changing Climate .....	26
5.2 Projected changes in climate hazard frequency .....	27
5.3 Future changes in exposure and vulnerability .....	28
5.5 Uncertainty .....	37
6.0 Conclusion and Summary.....	38
Appendix 1: Resources and references .....	40
Appendix 2: Glossary .....	41

## Figure and Table Listing

Table Number	Table Details
Table 1	Future frequency and impact of climate hazards in Co. Meath
Table 2	Risk areas that are considered in the Disruption to Meath County Council Services Climate Change Risk Assessment Areas (Adopted from: Section 2.4 Technical Annex B: Climate Change Risk Assessment)
Table 3	Risk areas that are considered in the Administrative Area Climate Change Risk Assessment Areas (Source: Technical Annex B: Climate Change Risk Assessment)
Table 4	Main climate hazards that occur (or could occur) in Meath
Table 5	Extreme weather events that have impacted Meath and Ireland from 1986 to 2022. Major Weather Events - Met Éireann - The Irish Meteorological Service
Table 6	Frequency ranking matrix
Table 7	Current climate hazard frequency for County Meath
Table 8	Impact ranking matrix - Meath County Council Services
Table 9	Impact ranking matrix - Administrative Area: Co. Meath
Tables 10-1 to 10-6	Impact ranking matrices
Table 11	Summary of climate hazards currently impacting Meath County Council services.
Table 12	Summary of climate hazards currently impacting administrative area, County Meath.
Table 13	Projected changes in climate hazard frequency for County Meath.
Table 14-1 to 14-6	Assessment of changes in future exposure, vulnerability, and impact of climate events.
Table 15	Summary of climate hazards currently impacting administrative area, County Meath.
Table 16	Summary of future projected changes to climate hazard risk

Figure Number	Figure Details
Figure 1	Examples of climate action mitigation and adaptation actions
Figure 2	The evolution of Ireland's regulatory context
Figure 3	Graphical timeline of extreme weather events in County Meath (1986 - 2022)
Figure 4	Current frequency and impact of climate hazards in County Meath.
Figure 5	Ireland's increasing temperature- Met Eireann
Figure 6	Future frequency and impact of climate hazards in County Meath

## Acronyms

Acronym	Full Form
CAP	Climate Action Plan
CAROs	Climate Action Regional Offices
CCRA	Climate Change Risk Assessment
CDP	County Development Plan
CRA	Climate Risk Assessment
EPA	Environmental Protection Agency
GHG	Greenhouse gases
IPCC	Intergovernmental Panel on Climate Change
LA	Local Authority i.e., Meath County Council
RCP	Representative Concentration Pathways
UN SDGs	United Nations Sustainable Development Goals

## 1.0 Executive Summary

Climate change is already having a profound impact on Ireland's weather, this pattern will continue and likely get worse over the coming years as temperatures increase. These increased temperatures will lead to more frequent and extreme weather events, which will exacerbate current and introduce new climate risks in the coming decades. The weather has been changing rapidly over the last decade with 2022 being the hottest year on record. However, it's also important to understand what is impacting the County Meath today as this will be a good barometer for the near-term impacts.

Climate change will result in a wide range of impacts across County Meath, from damaging infrastructure such as roads and bridges, to social and financial impacts, to biodiversity and restrictions on water supply. These bring substantial implications for Meath County Council and to the people who reside in, travel to and work in County Meath. While Meath County Council may not be directly responsible for some of the locations that were modelled, through the changing demands of services, the impact of a climate related event will have a profound impact on local authority resources.

The purpose of this climate change risk assessment (CCRA) is to better understand the current risks that the county faces and provide a view on the potential frequency and impact of future climate events. The CCRA has been carried out in line with the Local Authority Climate Action Plan Guidelines.

This CCRA used data from the IPPCC fifth assessment report to model the changes in climate and the hazards that will likely impact the country and county over three-time horizons and three temperature increases. The scenario's modelled were:

- A 1.5°C increase by 2030 scenario
- A 2-3°C increase by 2040 scenario
- A 4°C increase by 2050 scenario

Data from EY's Climate Analysis Platform, Meath's monitoring systems, Met Eireann Climate Ireland and Nolan and Flanagan (2020) was also used to inform this CCRA.

The key findings are summarized in Table 1 below.




Climate Hazard	Change Projections	Summary	Future Frequency
<b>Droughts Heatwaves Flooding</b>	The climate risks associated with droughts, heatwaves and floods are expected to increase significantly for County Meath as a result of projected increases in the frequency of hazard events and also due to an increase in the areas, assets and populations exposed to these hazards. The risk is exacerbated by not only projected changes in the frequency occurrence of drought and heatwaves but also as a result of projected increases in population and the proportion of population considered vulnerable (those aged 65 years and over). Meath County service are likely to be impacted by these changes with increased pressure on services before, during and after extreme weather events. There will likely be a significant financial impact to Meath County Council due to the likely need to allocate more financial resources toward climate towards mitigation and adaptation measures.	<b>These are emerging and increasing risks</b>	
<b>Windstorms</b>	The impact of severe windstorms will likely increase marginally in County Meath. There will be an increase in the intensity of storms but not necessarily the frequency. There will be an increase in the cost of the actions the local authority takes before, during, and after an event e.g., removal of fallen trees, repair of public infrastructure	<b>This is an increasing risk</b>	
<b>Extreme Cold Heavy Snowfall</b>	The impact of heavy snowfall and cold spells on County Meath will likely decrease due to the decrease intensity and duration of these events., The overall risk of these hazards is projected to reduce in the future, resulting in less risk. These are decreasing risks.	<b>These are decreasing risks</b>	

Table 1: Future frequency and impact of climate hazards in Co. Meath

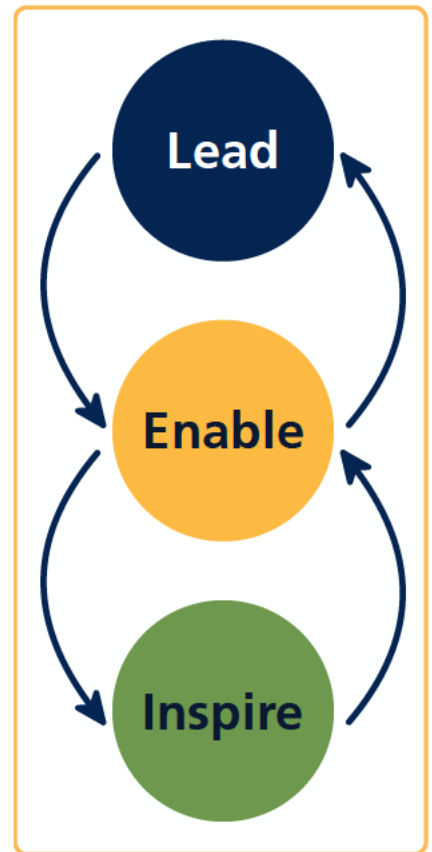
The CCRA focuses on the direct risks posed by climate change for County Meath and the implications of these for Meath County Council. It is important to note that climate change will also pose indirect risks for County Meath as a result of changes in climate conditions at international and global scales. These include amongst others forced migration of populations, increase in vector-borne disease and disruption of supply chains. To increase climate change resilience, Meath County Council will need to proactively plan for and adapt to the current and future climate change risks identified through this CCRA.

## 2.0 Introduction

A changing climate will have unique impacts on County Meath. Understanding the hazards, exposures and vulnerabilities associated with climate change and weather-related hazards impacting upon activities occurring within, and under the jurisdiction of, Meath County Council is an essential step to developing effective and efficient adaptation responses to climate change impacts and in building resilience to these challenges.

The purpose of this Climate Change Risk Assessment is to better understand potential climate risk to Meath, its citizens and how the county operates. While Meath County Council may not be directly responsible for some of the locations that were modelled, the services that Meath County Council provides to the citizens of the county would likely be more in demand in the event of any climate related incident. Another expected outcome of the project is to support the development of all adaptation initiatives that may be undertaken by the county.

Meath County Council's focus is on climate-proofing the areas which may impact the provision of its services. In areas outside its remit, Meath County Council will work to support the implementation of the sectoral adaptation and mitigation plans developed by, but not limited to, the Department of Housing, Planning and Local Government (DHLGH), the Department of Transport, Tourism and Sport (DTTAS), the Office of Public Works (OPW), the Department of Agriculture, Food and the Marine (DAFM), and the Department of Communications, Climate Action and Environment (DECC), thereby supporting the whole of government approach to climate action. In recognising this, Meath County Council is committed to leading by example in limiting the impact of climate change, firstly through mitigation and secondly through adaptation measures. Key to this will be implementing, monitoring and reporting on the Climate Action Plan.



## 2.1 Climate change mitigation and adaptation

**Climate Change Mitigation** refers to either reducing the amount of greenhouse gases (GHG) that are emitted into the atmosphere or extracting gases that are currently present. The purpose of this is to slow the current trend of increasing weather events and ideally keep the world to within a 1.5-degree temperature increase. Meath's efforts in relation to climate change mitigation can be found in the baseline emissions inventory.

**Climate Change Adaptation** refers to dealing with the impacts of climate change and involves taking practical actions to manage risks, protect communities and strengthen the resilience of the economy (e.g., from flooding, sea level rise etc). Adaptation will be key to supporting communities where weather events are likely to be more extreme and more frequent. Typical climate change mitigation and climate change adaptation activities are outlined in Figure 1 below.

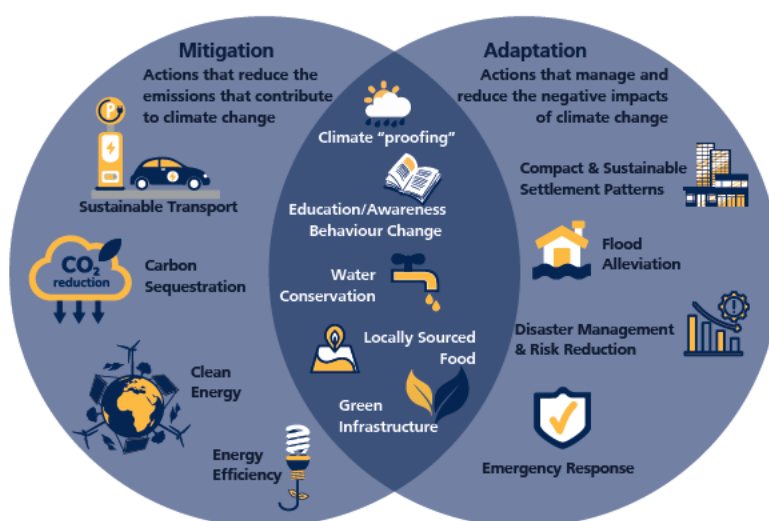


Figure 1 – Examples of climate action mitigation and adaptation actions

## 2.2 Regulatory connect for climate action

Ireland's approach to how it will both mitigate and manage the impacts of climate change have evolved over the last decade. Ireland's approach to combating climate change is aligned to the overall European Union approach.

Ireland's Climate Action and Low Carbon Development (Amendment) Act, 2021 highlights the role of the Local Authority in meeting national emission reductions targets and achieving climate resilience. The Act stipulates that local authorities need to prepare a Local Authority Climate Action Plan (LACAP) that will drive local response to the challenges posed by climate change, translating the national climate policy to the local level.



Figure 2 - The evolution of Ireland's regulatory context



### 3.0 Data Collection and Climate Change Risk Assessment Methodology

#### 3.1 Data Collection

This CCRA used data from the IPCC fifth assessment report to model the changes in climate and the hazards that will likely impact the country and county over three-time horizons and three temperature increases. The scenario's modelled were:

- A 1.5°C increase by 2030 scenario
- A 2-3°C increase by 2040 scenario
- A 4°C increase by 2050 scenario

These scenarios are consistent with the Intergovernmental Panel on Climate Change (IPCC) models and industry best practice, which refer to GHG concentration pathways scenarios up to 2050.

Data from EY's Climate Analysis Platform tool, Meath's monitoring systems, Met Eireann Climate Ireland and Nolan and Flanagan (2020) was also used to inform this CCRA.

#### 3.2 Characterising exposure, vulnerability, and impacts

Climate change risks are a combination of three inter-related factors:

**Hazards:** refers to potential source of harm or weather event that may occur within or affect county Meath. These hazards are driven through natural variability but also man's impact on climate change through the emission of greenhouse gases.

**Exposure:** Refers to the presence of assets, infrastructure, property, people, livelihoods, species or ecosystems, environmental functions, services, resources in places or settings that could be affected.

**Vulnerability:** Refers to the propensity or predisposition to be adversely affected.

There are also socioeconomic processes underway to try and adapt and mitigate the potential impacts of these physical climate risks.

Beyond doing an historical evaluation of the impact of climate change, future changes in a variety of scenarios were modeled to understand the potential impacts. This climate change risk assessment used the latest science a large IPCC data set to support the development of a model that outlined the future climate risks that may impact County Meath.

#### 3.3 Climate Change Risk Assessment Methodology

A Climate Change Risk Assessment (CCRA) has been undertaken, in accordance with 'Technical Annex B: Climate Change Risk Assessment' of the 'Local Authorities Climate Action Planning Guidelines' and provides a qualitative CCRA. A qualitative CCRA supports the identification and prioritisation of potential future climate risks for more detailed analysis and provides a broad understanding of where adaptation actions could be required.

1. The Technical Annex B provides a stepped approach to carrying out a climate change risk assessment:  
Assess the climate impact baseline, identifying, assessing and characterising the climate and weather-related impacts already being experienced by the authority, and
2. Identify and assess potential future climate impacts and risks.

Therefore, the approach is built of two phases, where both current and future risks and impacts were assessed.

### 3.4 Climate Change Risk Assessment Phases

#### Phase 1 - Current climate risk and impact assessment

Phase one of the climate change risk assessment looked at understanding the current climate risk impact for county Meath by:

1. Developing profile of climate hazards for County Meath
2. Identifying the range of climate hazards that have previously affected County Meath Developing an understanding of the frequency of the identified hazards and describe the meteorological or climatological conditions that comprised the hazard events.
3. Assessment of current exposure, vulnerability and impacts for County Meath and Meath County Council.
4. Determine current impact for service delivery and risk areas.
5. Develop current climate risk matrix to plot current climate change hazard risks.

#### Phase 2 - Future climate risk and impact assessment

Phase Two of a climate risk assessment looked to understand the future impacts that County Meath and Meath County Council will likely face.

To do this a climate modeling tool was used to understand how weather events will likely change along with their frequency and intensity along with data from Meath’s monitoring systems, Met Eireann Climate Ireland and Nolan and Flanagan (2020) was also used to inform this CCRA. The steps are:

1. Defining the local authority service areas and general climate change risk areas
2. Assessment of future changes in Climate hazard frequency and intensity
3. Assessment of current exposure, vulnerability and impacts for County Meath
4. Assess emerging hazards and potential Future Climate Risks
5. Develop future climate risk matrix to determine emerging, increasing and decreasing climate hazard risks.

### 4.0 Current Climate Change Risk and Impact Assessment

#### 4.1 Meath County Council and Administrative Area Climate Change Risk Areas

The impact of climate risks will result in disruption to the delivery of services and functions by Meath County Council and these are considered as part of this assessment. The risk areas considered for this are in Table 2 below.

Risk Areas – Disruption to Local Authority Services			
LA Governance, IT, HR, Finance Planning & Administration	Roads, Transportation & Critical Infrastructure Services	Housing, Building & Built Asset Management Services	Community Services, Tourism, Business Services
Arts, Culture, Heritage, Leisure, Recreation & Library Services	Water Supply Services	Environment Services	Emergency Services & Response

Table 2: Risk areas that are considered in the Disruption to Meath County Council Services Climate Change Risk Assessment Areas (Adopted from: Section 2.4 Technical Annex B: Climate Change Risk Assessment)

The climate change risk areas for the administrative area are considered for the climate change risk assessment are listed in Table 3 below. This list is extracted from Section 2.5. of Technical Annex B Climate Change Risk Assessment.

Risk Areas – Disruption to Local Authority Services			
LA Governance, IT, HR, Finance Planning & Administration	Roads,Transportation & Critical Infrastructure Services	Housing,Building & Built Asset Management Services	Community Services, Tourism, Business Services
Arts, Culture, Heritage, Leisure, Recreation & Library Services	Water Supply Services	Environment Services	Emergency Services & Response

Table 3: Risk areas that are considered in the Administrative Area Climate Change Risk Assessment Areas (Source: Technical Annex B: Climate Change Risk Assessment)

#### 4.2 Climate Hazards Profile for Meath

Understanding current climate impacts is critical to developing an understanding of future climate risks. Table 4 below highlights the key climate hazards that have previously affected Meath County Council and County Meath.

Climate Hazard Type	Climate Hazard Type Details
Drought	A period of abnormally dry weather long enough to cause a serious hydrological imbalance. This may cause water stress for crops, pressure on water supply and adverse impacts on water quality
Heatwave	A heatwave refers to a prolonged period of abnormally hot weather. In Ireland, it's classified as 5 consecutive days with a maximum temperature in excess of 25°C.
Windstorm	A windstorm is a wind that can cause at least light damage to trees and buildings, typically exceeds 34 mph (55 km/h) and may or may not be accompanied by rain. Since 2015 storms are named when they could cause 'medium' or 'high' impacts.
Flooding	The threat of an area being inundated by water due typically to excessive precipitation or obstructions to the natural flow. There are four main types of flooding. Coastal Flooding: Coastal flooding occurs when sea levels along the coast or in estuaries exceed neighbouring land levels, or overcome coastal defences where these exist, or when waves overtop over the coast. Fluvial flooding occurs when rivers and streams break their banks and water flows out onto the adjacent low-lying areas (the natural floodplains). Groundwater flooding occurs when the water table rises above the land surface. It generally requires sustained rainfall over relatively longer duration than other forms of flooding, its location is discontinuous, and they can last for weeks or months. Pluvial flooding occurs when the amount of rainfall exceeds capacity of urban stormwater drainage systems or the ground to absorb it.
Extreme Cold	A sustained period of cold weather, where extreme low temperatures are recorded that have an adverse impact on the functioning of society and impact nature.
Heavy Snowfall	A substantial prolonged snowfall event resulting in substantial accumulations of snow on the ground over a period of consecutive days.

Table 4 – Main climate hazards that occur (or could occur) in County Meath

#### 4.2.1 Extreme Weather Events in County Meath

Climate hazards include extreme weather events and periods of climate variability.

Figure 4 provides an illustration of a profile of the extreme weather and climate variability events in Meath over the same time period.

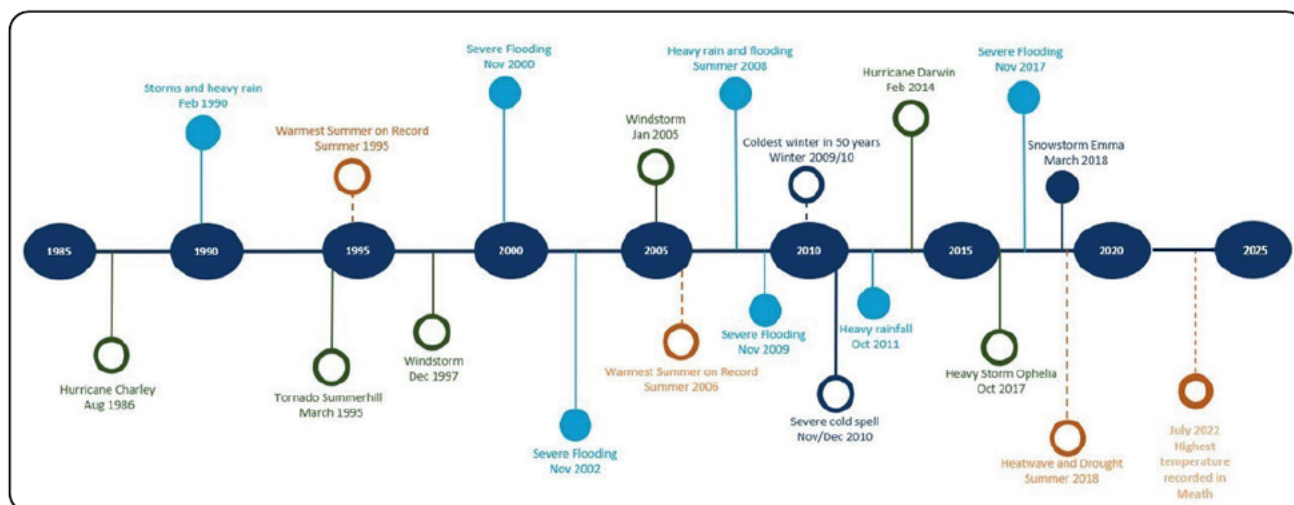


Figure 3 - Graphical timeline of extreme weather events in County Meath (1986 - 2022)

Table 5 below highlights the extreme weather and climate variability events that have impacted Meath and Ireland from 1986 to 2022. While this table is not exhaustive, it illustrates the potential impacts of severe weather events and climate variability events on the county, its citizens, and the economy of Meath.

Date	Weather Event	Description
Aug-86	Windstorm: Hurricane Charlie	Gale force winds and heavy rain hit the county. (Met Eireann)
Feb-90	Wind and rainstorm	Very wet and windy period with over twice the average monthly rainfall (Met Eireann)
Mar-95	Windstorm: Tornado	A tornado was recorded on St. Patrick's day between 14:10 and 14:30. It caused damage in a straight line over a path of 18 miles. It was accompanied by lightning strikes and large hailstones up to 5cm in diameter. Wind speeds near the centre of the tornado were predicted to be more than 160kph. The tornado caused significant structural damage to several houses and farm buildings, including blowing a roof off a house and taking roof tiles off several other houses. Mature trees were also felled, and several farm animals were killed. (Met Eireann)
Summer 1995	Heatwave	Warmest summer on record. Temperatures were over 2 degrees above the average summer temperatures. (Met Eireann)
Dec-97	Windstorm	Conditions were severe in much of Leinster, especially the south and east. (Met Eireann)
Nov-00	Flooding	24-hour heavy rainfall event. (Met Eireann)
Nov-02	Flooding	Dunboyne and Clonee were very badly affected by floods. Soldiers and emergency service workers rescued people from their homes which were flooded with up to four feet of water. Up to 100 cars were abandoned along roads in the area.
Nov-09	Flooding	Very wet period with over twice the average monthly rainfall (Met Eireann)

Date	Weather Event	Description
Winter 2009/10	Extreme Cold	Long cold spell with temperatures about 2°C.
November/ December 2010	Severe cold spell	The county experienced an extreme and prolonged cold spell from November 2010 through December. Temperatures fell to below -13°C in the county during this period, with some places in the county receiving over 21cm of snow.
Oct-11	Heavy rainfall	Roads were flooded, some electricity customers had no power supply in the County. (Met Éireann)
Feb-14	Hurricane Darwin	Considerable damage to housing and other buildings. Gusts of wind at 63 knots were recorded at Dunsany, Co. Meath.
Oct-17	Violent Storm Ophelia	There were several trees in full leaf uprooted because of the high winds. There were several power outages because of fallen electricity poles and power lines. All schools, HSE appointments and bus services were cancelled due to the status red weather warning. (Met Éireann)
Nov-17	Flooding	Heavy rain across the county caused flooding and damage to houses in Trim. Commuters' travel was disrupted when the M3 between Dunboyne and Blanchardstown was badly flooded due to the Tolka River bursting its banks. There was also flooding in Navan and Clonee.
February / March 2018	Snowstorm Emma	Thousands of homes throughout the county were left without power. Some rural areas were cut off due to high snow drifts blocking roads while schools and businesses were closed. Public transport was badly affected with buses and trains at a standstill with widespread cancellations in the county. Farmers were also badly affected with sheds collapsing due to the weight of the snow and there was also fodder shortages experienced. Some crops, such as soft fruits, were also badly affected. (Met Éireann)
Summer 2018	Heatwave and Drought	Drier and warmer weather than normal throughout Ireland, with drought conditions in many areas. Water restrictions were in place for the country for most of the summer.
Summer 2022	Heatwave	In May 2022, the temperature recorded at the weather station in Dunsany, Co. Meath was the warmest recorded for May on record. The highest daily maximum temperature for Meath, for any month, on record, was recorded Monday 18th July at the weather station in Dunsany, Co. Meath. A heatwave lasting 5 days was recorded in August 2022 at Dunsany, Co. Meath.

Table 5: Extreme weather events that have impacted County Meath and Ireland from 1986 to 2022. Major Weather Events - Met Éireann - The Irish Meteorological Service

### 4.3 Current Frequency of Climate Hazard events

The current frequency of occurrence of each climate hazard identified in Table 4 in 4.2 Climate Hazards Profile for Meath was classified using the frequency ranking matrix below in Table 6. This current frequency was informed by information from past climate and weather events, and data from Meath’s monitoring systems, Met Eireann and Climate Ireland. The current frequency of each climate hazard is shown in Table 7 below.

Frequency Ranking	Frequency Occurrence in a Year	Description
5 - Very Frequent	>100%	Occurs several times in a single year
4 - Frequent	50 to 100%	Occurs once in a 1-to-2-year period
3 - Common	10 to 50%	Occurs once in a 2-to-10 years period
2 - Occasional	1 to 10%	Occurs once in a 10-to-100-year period
1 - Rare	<1%	Occurs once in over 100 years

Table 6: Frequency ranking matrix

Climate Hazards	Current Frequency	Evidence base
Drought	3 - Common	Data from Meath’s monitoring systems; Met Eireann and Climate Ireland.
Heatwave	3 - Common	
Windstorm	4 - Frequent	
Flooding	3 – Common	
Extreme Cold	2 – Occasional	
Heavy Snowfall	2 – Occasional	

Table 7: Current climate hazard frequency for County Meath

#### 4.4 Characterising Exposure, Vulnerability, and Assessing the Impacts of Current Climate Hazards

Having developed a local level profile of climate hazards, the local-scale exposures and associated vulnerabilities to the hazard that result in direct and indirect impacts to the delivery of services by Meath County Council and for the administrative area, County Meath were identified. For each of the climate hazards identified, the impact level for each was assessed for each risk area identified in accordance with the criteria provided through Technical Annex B: Climate Change Risk Assessment - according to the impact ranking matrix below in Table 8 & Table 9 below.

	Impact Ranking				
Risk Area	1 -Negligible	2 - Minor	3 - Moderate	4 - Major	5 - Catastrophic
<b>Disruption to Meath County Council Services</b>	Appearance of threat but no actual impact on service provision	Isolated but noticeable examples of service decline.	Service provision under severe pressure.Appreciable decline in service provision at community level.	Services seen to be in danger of failing completely with severe/widespread decline in service provision.	Widespread service failure with services unable to cope with wide-scale impacts
<b>Asset Damage</b>	Impact can be absorbed through normal activity	An adverse event that can be absorbed by taking business continuity action	A serious event that requires additional emergency business continuity actions	A critical event that requires extraordinary/emergency business continuity actions	Disaster with the potential to lead to shut down or collapse or loss of assets/network
<b>Health &amp; Wellbeing</b>	First aid case	Minor physical injury or mental health impact, medical treatment required	Serious physical or mental health impact, or lost work	Major or multiple injuries or mental health impact, permanent physical or disability	Single or multiple fatalities
<b>Environment</b>	No impact on baseline environment. Localised in the source area. No recovery required	Localised within site boundaries. Recovery measurable within one month of impact	Moderate harm with possible wider effect. Recovery in one year	Significant harm with local effect. Recovery longer than one year. Failure to comply with environmental regulations / consent	Significant harm with widespread effect. Recovery longer than one year. Limited prospect of full recovery
<b>Social</b>	No negative social impact	Localised, temporary social impacts	Localised, long- term social impacts	Failure to protect poor or vulnerable groups. National, long- term social impacts	Loss of social licence to operate. Community protests
<b>Financial</b>	< 2% of turnover	2-10% of turnover	10-25% of turnover	25-50% of turnover	> 50% of turnover
<b>Reputation Damage</b>	Localised, temporary impact on public opinion	Localised, short-term impact on public opinion	Local, long-term impact on public opinion with adverse local media coverage	Significant damage with national and international impact	National, long- term impact with potential to affect the stability of the government
<b>Cultural Heritage</b>	Insignificant impact	Short term impact. Possible recovery or repair	Serious damage with wider impact to tourism industry	Significant damage with national and international impact	Permanent loss with resulting impact on society

Table 9: Impact ranking matrix - Administrative Area: County Meath

For each of the climate hazards identified, the impacts of these climate hazards are identified and described along with the specific exposure area for disruption to Meath County Council's services and operations and to County Meath are detailed in Table 10-1 to Table 10-6 below.

In addition the associated physical, socio-economic, and environmental vulnerabilities for each exposure area to the impacts are described and ranked using the Impact Ranking Matrices.



Hazard	Key Impacts	Area	Service / Risk Area	Key exposures and vulnerabilities (Physical, social, and environmental)	Current Impact Ranking
Drought	<p>Reduced availability of water resources often coinciding with an increase demand for water.</p> <p>Water stress for crops and livestock, pressure on water supply and adverse impacts on water quality.</p> <p>Decreased grass growth. Impact on grass-based livestock. Supplementary livestock feed may be required.</p> <p>Biodiversity loss due to reduced water sources for animals and plants.</p> <p>Increase in frequency of forest and vegetation fires.</p> <p>Reduced river flow and groundwater.</p>	Disruption to Meath County Council Services	LA Governance, IT, HR, Finance Planning & Administration	Bottled water can be used for personal consumption but availability in offices may be restricted.	1 - Negligible
			Roads, Transportation & Critical Infrastructure Services	Increased health and safety risk due to dehydration for local authority staff working outdoors.	2 - Minor
			Housing, Building & Built Asset Management Services	Toilet and hygiene facilities may be affected due to lack of water.	2 - Minor
			Community Services, Tourism, Business Services.	Some tourism facilities may be affected or access restricted.	1 - Negligible
			Arts, Culture, Heritage, Leisure, Recreation & Library Services	Events may be cancelled and access to culture and heritage sites may be impacted due to low availability of water	2 - Minor
			Water Supply Services	Reduced reservoir levels may lead to rationing of public water supply.	3 - Moderate
			Environment Services	Water restrictions may impact operation of wastewater treatment plants.	2 - Minor
			Emergency Services & Response	Emergency services may need to be utilised to distribute water. Increased callouts for fire services due to forest and vegetation fires.	2 - Minor
		Administrative Area: County Meath	Asset Damage	Some assets where water is a critical resource may be damaged by water shortages.	2 - Minor
			Health & Wellbeing	Access to water may be restricted for livestock on farms and may result in increased levels of dehydration and stress.	1 - Negligible
			Environment (Including Biodiversity)	Potential for biodiversity impact and habitat loss. Increased potential for wildfires due to dry conditions.	3 - Moderate
			Social & people	Increased costs of buying water from private sources e.g., bottled water. Water rationing will affect people's ability to prepare food, maintain hygiene appropriately and operate home appliances.	2 - Minor
			Financial	Increased costs for farmers for buying supplementary feed and water. Increased costs for business if tanked water is used. Increased cost for public if they must buy bottled water.	2 - Minor
			Reputation Damage	Reduced water availability may impact business reputation. Water restrictions and hose-pipe bans may cause localised, short-term adverse impact on public opinion.	1 - Negligible
Cultural Heritage and Premises	Some cultural events may be cancelled and facilities may be affected or access restricted due to water restrictions. Some heritage facilities may be damaged from increased weathering.	1 - Negligible			

Table 10-1: Impact Ranking Matrix

Hazard	Key Impacts	Area	Service / Risk Area	Key exposures and vulnerabilities(Physical, social, and environmental)	Current Impact Ranking
Heatwave	Public and LA staff discomfort due to high temperatures damage to road and transport infrastructure and hazardous driving conditions.  Increased demand at outdoor recreational facilities often occurs concurrently with drought conditions and reduced water availability. Increase in frequency of forest and vegetation fires.	Disruption to Meath County Council Services	LA Governance, IT, HR, Finance Planning & Administration	Potential for decreased productivity due to staff discomfort.	2 - Minor
			Roads, Transportation & Critical Infrastructure Services	Road surfaces may be damaged from extreme heat and become unsafe	2 - Minor
			Housing, Building & Built Asset Management Services	Increased requirement for cooling of buildings.	2 - Minor
			Community Services, Tourism, Business Services	Likely increased traffic and strain on parking facilities at outdoor tourist sites.	2 - Minor
			Arts, Culture, Heritage, Leisure, Recreation & Library Services	Events may be cancelled and access to culture and heritage sites may be impacted due to excess heat.	2 - Minor
			Water Supply Services	Increased water demand may lead to rationing of public water supply.	3 - Moderate
			Environment Services	Bins in key leisure areas such as parks and beaches may fill faster.	2 - Minor
			Emergency Services & Response	Demand for emergency services will likely increase due to heat-related illnesses and incidences. Increased callouts for fire services due to forest and vegetation fires and water safety related incidences.	3 - Moderate
		Administrative Area: County Meath	Asset Damage	Asset damage from heatwaves is likely to be minimal.	2 - Minor
			Health & Wellbeing	High temperatures may result in uncomfortable working conditions in particular sectors. Incidences of heat stroke, dehydration and sunburn are likely to increase, especially among vulnerable populations e.g. The elderly and infants.	2 - Minor
			Environment (Including Biodiversity)	Potential for biodiversity impact and habitat loss. Potential for wildfires	3 - Moderate
			Social & people	May result in congestion at key outdoor leisure and recreation facilities.	2 - Minor
			Financial	The financial effects are likely to be limited unless there is a concurrent drought event.	1 - Negligible
Reputation Damage	Heatwaves and the associated disruption of public opinion may have short-term adverse impact on public opinion.		2 - Minor		
Cultural Heritage and Premises	Some cultural heritage sites e.g., earthworks may be susceptible to increased weathering due to drying out of earth.	2 - Minor			

Table 10-2: Impact Ranking Matrix

Hazard	Key Impacts	Area	Service / Risk Area	Key exposures and vulnerabilities (Physical, social, and environmental)	Current Impact Ranking
Windstorm	<p>Damage to domestic and commercial buildings and infrastructure including roads, powerlines and communications systems.</p> <p>Blocked roads due to fallen trees.</p> <p>Hazardous driving conditions due to high winds and debris on roads. Increased risk of injuries to public from debris. Disruption to waste collection facilities.</p> <p>Financial costs of clean-up and repair.</p>	Disruption to Meath County Council Services	LA Governance, IT, HR, Finance Planning & Administration	Disruption may occur due to inaccessibility of facilities for public and staff.	3 - Moderate
			Roads, Transportation & Critical Infrastructure Services	Roads may be blocked by fallen trees and damaged infrastructure. Power lines may be damaged by fallen trees. Complete removal of trees and blockages and repair to power lines may take several days.	3 - Moderate
			Housing, Building & Built Asset Management Services	Damage to domestic and public buildings may be significant.	3 - Moderate
			Community Services, Tourism, Business Services	Services may be impacted if facility is damaged, or it is unsafe to travel to service for public, tourists and staff.	3 - Moderate
			Arts, Culture, Heritage, Leisure, Recreation & Library Services	Activities and access to sites may be restricted due to inaccessibility for public and staff.	3 - Moderate
			Water Supply Services	Water supply infrastructure may be damaged causing disruption to supply.	3 - Moderate
			Environment Services	Waste collection services may be suspended during windstorms and for a period afterwards.	3 - Moderate
			Emergency Services & Response	Increased demand on emergency response units across the county. Increase in response times due to hazardous road conditions around the county.	3 - Moderate
		Administrative Area: County Meath	Asset Damage	Domestic and commercial buildings, roads and infrastructure are vulnerable to damage from windstorms. Asset value may higher insurance costs post insurance claim.	4 - Major
			Health & Wellbeing	Increased risk or injuries to public.	3 - Moderate
			Environment (Including Biodiversity)	Can cause widespread damage to trees and forests.	3 - Moderate
			Social & people	Communication infrastructure is vulnerable to wind damage. Windstorms will also restrict movement of people due to blocked roads and hazardous conditions. Job losses or temporary layoffs may occur if business premises are severely damaged.	2 - Minor
			Financial	Financial impacts are due to increased insurance costs, clean-up and repair costs for businesses and public.	3 - Moderate
			Reputation Damage	Limited, associated with customer perception of windstorm preparedness, notification, and response.	2 - Minor
Cultural Heritage and Premises	Windstorms can cause damage to cultural and heritage sites.	2 - Minor			

Table 10-3: Impact Ranking Matrix

Hazard	Key Impacts	Area	Service / Risk Area	Key exposures and vulnerabilities (Physical, social, and environmental)	Current Impact Ranking
Flooding	Roads may be blocked due to flooding. Isolation of communities.  Farmland may be flooded restricting animals access to pasture.  Farm buildings may be inundated with water, causing feed access and animal welfare issues.  Business activity will decrease due to inaccessibility.  Damage to cultural, heritage and recreational sites.	Disruption to Meath County Council Services	LA Governance, IT, HR, Finance Planning & Administration	Disruption may occur due to inaccessibility of facilities for public and staff.	2 - Minor
			Roads, Transportation & Critical Infrastructure Services	Roads and bridges may be impassable or there may be hazardous driving conditions. Blocked drains may	3 - Moderate
			Housing, Building & Built Asset Management Services	cause severe localised flooding. Stormwater and drainage systems may be overwhelmed and damaged.	3 - Moderate
			Community Services, Tourism, Business Services	Services may be impacted if facility is damaged, or it is unsafe to travel to service for public, tourists and staff.	2 - Minor
			Arts, Culture, Heritage, Leisure, Recreation & Library Services	Activities and access to sites may be restricted due to inaccessibility for public and staff.	2 - Minor
			Water Supply Services	Water treatment plants may be overwhelmed by rainfall and water from drainage systems, causing disruption to supply or issuing of 'boil-water notices'.	2 - Minor
			Environment Services	Waste collection service routes may be blocked by flooding. Pollutants from grounds may enter the water treatment systems	2 - Minor
			Emergency Services & Response	Demand for emergency services will increase in areas affected by floods. However, access by emergency services may be affected due to the flooded, impassable roads.	2 - Minor
		Administrative Area: County Meath	Asset Damage	Flooding has resulted in the temporary inundation of buildings and other assets. High water levels and fast flowing rivers can result in damage to bridges, riverbanks and riverside amenities. Asset value may be affected by unavailability of flood insurance in flood-prone areas.	3 - Moderate
			Health & Wellbeing	Flooding can isolate communities impacting mental health and injuries can be caused to residents and workers.	2 - Minor
			Environment(Including Biodiversity)	Biodiversity may be affected by destruction of habitats by floodwater and associated pollutants	2 - Minor
			Social & people	Road closures can result in significant social isolation for communities and restrict the movement of people. Job losses or temporary layoffs may occur if business premises are severely damaged.	2 - Minor
			Financial	The financial implications of flooding can be significant, including the pumping and emergency response, clean-up and repair.	3 - Moderate
			Reputation Damage	For areas that are flood-prone and are without interventions, there may be localised, long-term adverse impact on public opinion.	3 - Moderate
Cultural Heritage and Premises	Many significant cultural heritage sites are prone to flooding. Access for tourists and public may be restricted during flood events.	2 - Minor			

Table 10-4: Impact Ranking Matrix

Hazard	Key Impacts	Area	Service / Risk Area	Key exposures and vulnerabilities (Physical, social, and environmental)	Current Impact Ranking
Extreme Cold	Freeze-thaw damage to buildings.  Facilities may become inaccessible.  Disruption of road and rail transport.  Isolation of communities and vulnerable groups.  Disruption to waste collection services  Increased injuries due to fall injuries.  Increased demand for energy and electricity supply to heat homes and buildings and disruption to supply.	Disruption to Meath County Council Services	LA Governance, IT, HR, Finance Planning & Administration	Increased safety risk for public and staff when accessing LA buildings and facilities.	3 - Moderate
			Roads, Transportation & Critical Infrastructure Services	Public and commercial transportation activity will be affected. Road fittings and safety barriers may be damaged by incidents caused by ice.	3 - Moderate
			Housing, Building & Built Asset Management Services	Poorly insulated housing stock with vulnerable residents. Building projects may be halted.	3 - Moderate
			Community Services, Tourism, Business Services	Facilities, Housing, Community, Tourism, and Business Services may become unsafe due to damage from ice,	3 - Moderate
			Arts, Culture, Heritage, Leisure, Recreation & Library Services	Facilities may become unsafe due to damage from ice.	3 - Moderate
			Water Supply Services	Supply pipes may freeze and may burst causing disruption to supply.	3 - Moderate
			Environment Services	Environment services may be suspended.	3 - Moderate
			Emergency Services & Response	Increased demand on emergency response units across the county. Increase in response times due to hazardous road conditions around the county.	3 - Moderate
	Financial impact of increased energy and electricity use.  Strain on animals and biodiversity	Administrative Area: County Meath	Asset Damage	Domestic and commercial buildings, infrastructure, water and waste systems can be damaged by the freeze thaw effect e.g., burst pipes. Some affected business premises will have to close until repair is completed	2 - Minor
			Health & Wellbeing	There will be an increase in slip and fall incidences causing injuries. There are more pronounced detrimental health impacts on vulnerable elderly people and people who work outdoors.	3 - Moderate
			Environment (Including Biodiversity)	Long cold spells have a detrimental effect on biodiversity as animals require more energy intake to maintain body heat. Extreme cold will have a detrimental effect on agriculture, crop and milk yields will be reduced.	2 - Minor
			Social & people	Long periods of extreme cold will affect vulnerable groups such as elderly people due to the lack of social interaction. Schools may close causing detrimental effects on school children and their parents and guardians.	3 - Moderate
			Financial	Maintenance and repair costs of roads, buildings, and infrastructure.	2 - Minor
			Reputation Damage	Isolation of communities and council response to cold conditions in county receives media attention has short-term impact on public opinion.	2 - Minor
			Cultural Heritage and Premises	Accumulations of heavy snowfall can result in damage to cultural heritage sites.	2 - Minor

Table 10-5: Impact Ranking Matrix

Hazard	Key Impacts	Area	Service / Risk Area	Key exposures and vulnerabilities (Physical, social, and environmental)	Current Impact Ranking
Heavy Snow	Damage to buildings. Facilities may become inaccessible.	Disruption to Meath County Council Services	LA Governance, IT, HR, Finance Planning & Administration	Activities may be restricted due to inaccessibility for public and staff.	3 - Moderate
			Roads, Transportation & Critical Infrastructure Services	Secondary roads may be impassable and / or unsafe.	3 - Moderate
	Disruption of road and rail transport.		Housing, Building & Built Asset Management Services	Buildings with flat roofs at risk of damage. Building projects may be halted.	3 - Moderate
			Community Services, Tourism, Business Services	Activities may be restricted due to inaccessibility for public and staff.	3 - Moderate
	Isolation of communities and vulnerable groups.		Arts, Culture, Heritage, Leisure, Recreation & Library Services	Activities may be restricted due to inaccessibility for public and staff.	3 - Moderate
			Water Supply Services	Water services may be vulnerable due to increased risk of burst pipes.	2 - Minor
	Disruption to waste collection services		Environment Services	Activities may be restricted due to inaccessibility for public and staff.	3 - Moderate
			Emergency Services & Response	Demand for emergency services may increase due to increased accidents and damage for burst pipes. Increase in response times due to hazardous road conditions around the county. Some areas may be inaccessible for emergency services.	3 - Moderate
	Increased injuries due to fall injuries.	Administrative Area: County Meath	Asset Damage	Accumulation of snow on flat roofs can cause damage and danger of collapse.	2 - Minor
			Health & Wellbeing	There will be an increase in slip and fall incidences causing injuries. There are more pronounced detrimental health impacts on vulnerable elderly people and people who work outdoors.	3 - Moderate
			Environment (Including Biodiversity)	Long cold spells of snow cover will have a detrimental effect on biodiversity as animals require more energy intake to maintain body heat.	2 - Minor
			Social & people	Long periods of snow cover will affect vulnerable groups such as elderly people due to the lack of social interaction. Schools may close causing detrimental effects on school children and their parents and guardians.	3 - Moderate
			Financial	Maintenance and repair costs of roads, buildings, and infrastructure.	2 - Minor
			Reputation Damage	Isolation of communities and council response to cold conditions in county receives media attention has short-term impact on public opinion.	2 - Minor
Financial impact of increased energy and electricity use.	Administrative Area: County Meath	Cultural Heritage and Premises	Accumulations of heavy snowfall can result in damage to cultural heritage sites.	2 - Minor	
Snow cover affecting livestock and animal welfare.					

Table 10-6: Impact Ranking Matrix

## Current Climate Change Risk

The assessment identified windstorms as posing the highest level of climate change risk for County Meath. Key impacts from windstorms include damage to buildings and infrastructure including roads, powerlines, and communications systems. Also, the financial impacts of clean-up and repair are significant.

Flooding have been identified as posing a relatively high risk for County Meath with impacts experienced at the localised scale including damage to assets and infrastructure and potential for isolation of communities and reduction in business activities.

Cold spells and heavy snowfall occur on an occasional basis across County Meath resulting in damages to critical energy, communication and water infrastructure while closure of transport infrastructure has the potential to result in isolation of remote communities.

Heatwaves and droughts occur on a common frequency across County Meath and the overall impact is currently considered moderate. The impacts of heatwaves are less than for flooding but are associated with an increase in the frequency of uncontrolled fire, damage to road surfaces and increased pressure on recreational sites.

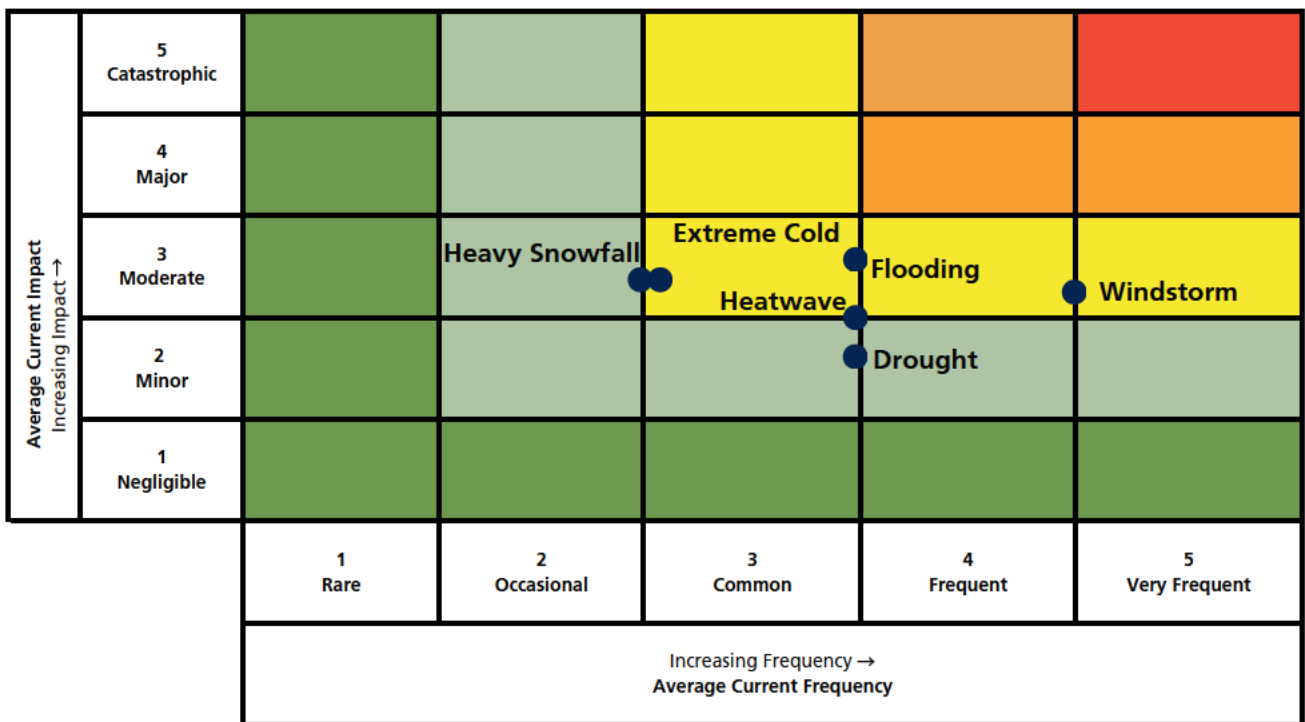


Figure 4: Current frequency and impact of climate hazards in County Meath.

## 5.0 Future Climate Risks and Impacts

The weather has been changing rapidly over the last decade with 2022 being the hottest year on record. The historical impacts of extreme weather events can be used as a barometer for potential impacts of future climate events over the near term out to 2030.

Climate risks may develop or increase in the future because of the change frequency and intensity of climate hazards or may reduce in frequency or impact.

To understand how climate change risks, and the subsequent impacts, might change into the future, it is useful to first consider how the frequency of climate hazards might change and how levels of impact may also change as a result in changes in the hazard, exposure, and vulnerability components of risk.

## 5.1 County Meath's Changing Climate

In general temperatures in Ireland have been increasing since the turn of the millennium as shown in figure 5. Ireland is warming in line with global average.

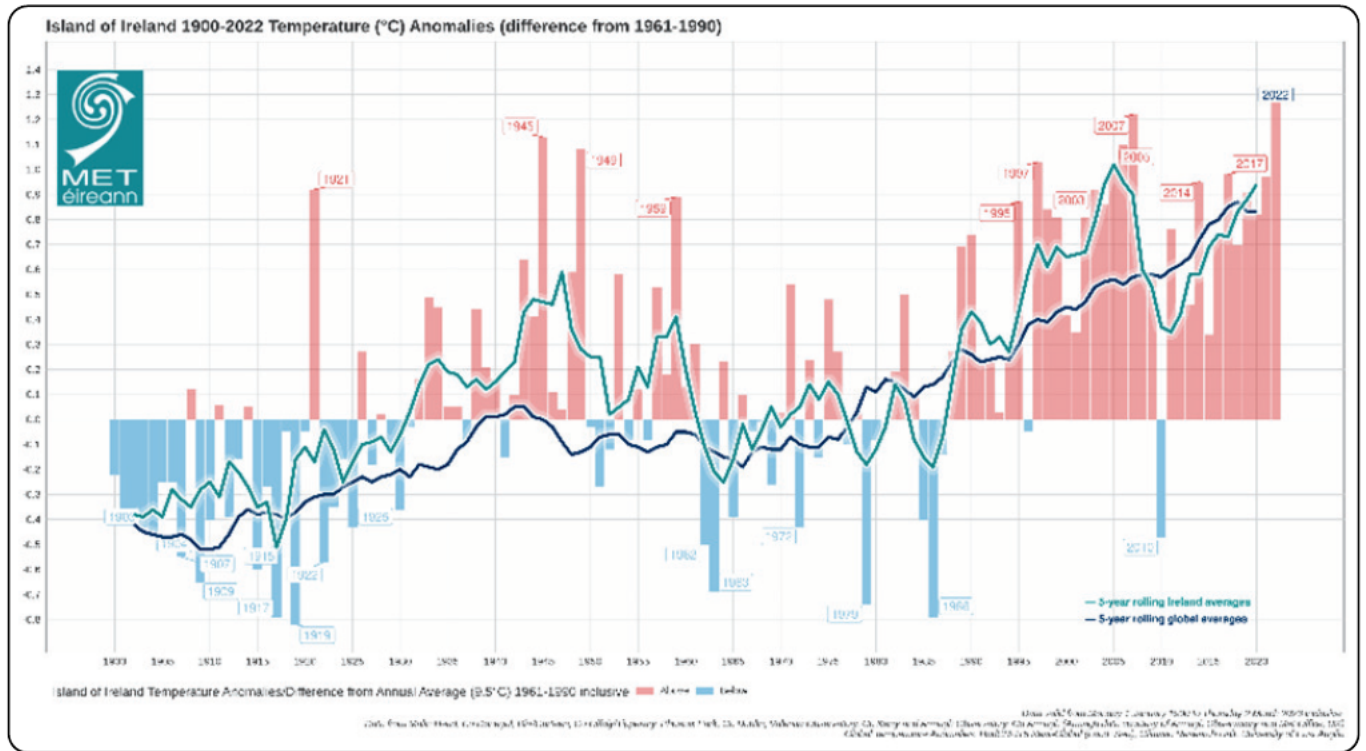


Figure 5 – Ireland’s increasing temperature- Met Eireann - link

As records continue to be broken for the highest annual temperatures, 2022 is currently the highest average temperature on record. There has also been a marked increase in high energy weather events that have secondary impacts. In May 2022, the temperature recorded at the weather station in Dunsany, Co. Meath was the warmest recorded for May on record. The highest daily maximum temperature for Meath, for any month, on record, was recorded Monday 18th July at the weather station in Dunsany, Co. Meath. A heatwave lasting 5 days was recorded in August 2022 at Dunsany, County Meath.

The latest Irish climate change projections indicate further warming in the future, drier summers on average and an increased chance of heatwaves and periods of drought. The Irish summer of 2022 is broadly consistent with projected future trends.

## 5.2 Projected changes in climate hazard frequency

For each of the climate hazards identified through the assessment of current climate hazards and impacts, and on the basis of available projection data, the projected frequency change of each of the identified climate hazards in County Meath are detailed in Table 13 below.



### 5.3 Future changes in exposure and vulnerability

In addition to the changes in the frequency of hazard events, levels of impact of each climate hazard may also change as a result in changes in the hazard, exposure, and vulnerability components of risk. To estimate the potential change in risk, available projections of non-climatic factors on a local level were examined. Not every climate hazard will have changes in exposure and vulnerability. Taking into account the changes in exposure and vulnerability, the future change in impact for each of the climate hazards was assessed. This assessment was informed by EYs Climate Analysis Platform and data from Met Eireann, Climate Ireland, Nolan and Flanagan (2020).

For example, Ireland's population is projected to increase to between 5.58 and 6.69 million people by 2051. Within this, a substantial rise in older populations (aged 65 years and older) is expected to increase from 13.3% of the population in 2016 to between 23.9% and 27.4% by 2051. This will likely result in a higher level of vulnerability to climate hazards such as heatwaves and associated impacts (heat-related illness). There is likely to be an increased population in the region, possibly resulting in new buildings being constructed. This will potentially increase the number of assets exposed to climate hazards.

CSO, Population and Labour Force Projections 2017 - 2051,  
<https://www.cso.ie/en/releasesandpublications/ep/plfp/populationandlabourforceprojections2017-2051/>, 2018

The assessment outcomes are recorded below in Table 14 – Assessment of changes in future exposure, vulnerability and impact of climate events.

## Future Climate Change Risk

The climate risk associated with droughts, heatwaves and flooding are expected to increase significantly as a result of projected increases in the frequency of hazard events and also due to an increase in the areas, assets and populations exposed to these hazards. The risk is exacerbated by not only projected changes in the frequency occurrence of drought and heatwaves but also because of projected increases in population and the proportion of population considered vulnerable (those aged 65 years and over). These are merging and increasing risks.

The impact of severe windstorms will likely increase marginally. There will be an increase in the intensity of storms but not necessarily the frequency. This is an increasing risk.

The impact of heavy snowfall and cold spells on County Meath will likely decrease due to the decrease intensity and duration of these events., The overall risk of these hazards is projected to reduce in the future, resulting in less risk. These are decreasing risks.

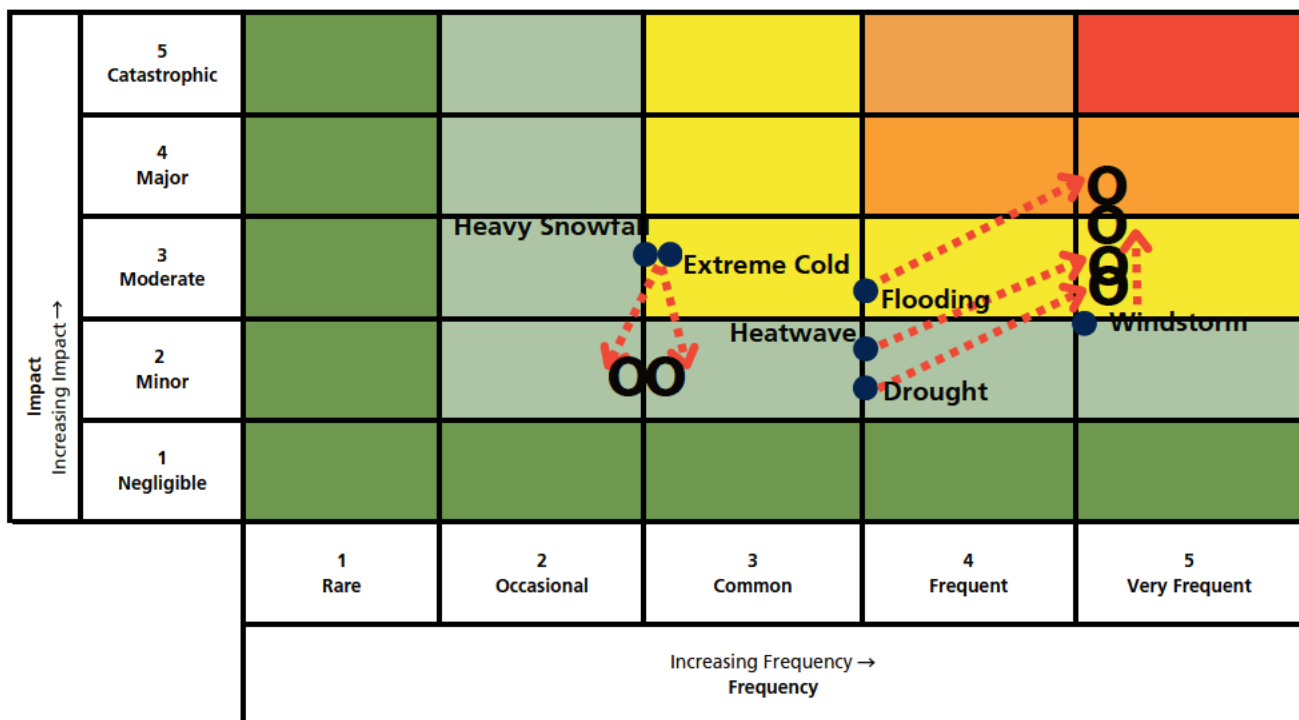


Figure 6: Risk Matrix showing the future changes in risk for the identified hazards within County Meath

The future frequency ranking & average impact score for each climate hazard for each risk area are plotted in the Figure 7. Current Climate Risk Summary Matrix below. Hazards that closer to the top right occur more frequently and result in a larger impact to local authority services and the administrative area. Solid circles identify the current hazard risk, hollow circles identify the future risk. The dotted line between these markers shows the change between the current and future risk level.

#### 4.5 Current Climate Impacts Assessment: Summary of Service Level Impacts

The impacts of climate change hazards on County Meath will have direct and indirect consequences for the delivery of services by Meath County Council before, during and after climate and weather-related event.

An assessment of the impacts of identified climate change hazards and impacts on the delivery of services by Meath County Council was undertaken in accordance with the criteria provided through Technical Annex B: Climate Change Risk Assessment (Appendix 2), with each service delivery area assigned an impact category of either negligible, minor, moderate, major, or catastrophic.

Below provides a summary of the impacts on the delivery of services of Meath County Council as a result of the climate hazards identified within the climate hazard profile. This assessment was undertaken in accordance with the criteria provided in Section 2.4 of Technical Annex B: Climate Change Risk Assessment, with each identified service delivery area assigned an impact category of either negligible, minor, moderate, major, or catastrophic.

Hazard Type	Current Frequency Ranking	LA Governance, IT, HR, Finance Planning & Administration	Roads, Transportation & Critical Infrastructure Services	Housing, Building & Built Asset Management Services	Community Services, Tourism, Business Services	Arts, Culture, Heritage, Leisure, Recreation & Library Services	Water Supply Services	Environment Services	Emergency Services & Response
Drought	3 - Common	1 - Negligible	2 - Minor	2 - Minor	1 - Negligible	2 - Minor	3 - Moderate	2 - Minor	2 - Minor
Heatwave	3 - Common	2 - Minor	2 - Minor	2 - Minor	2 - Minor	2 - Minor	3 - Moderate	2 - Minor	3 - Moderate
Windstorm	4 - Frequent	3 - Moderate	3 - Moderate	3 - Moderate	3 - Moderate	3 - Moderate	3 - Moderate	3 - Moderate	3 - Moderate
Flooding	3 - Common	2 - Minor	3 - Moderate	3 - Moderate	2 - Minor	2 - Minor	2 - Minor	2 - Minor	2 - Minor
Extreme Cold	2 - Occasional	3 - Moderate	3 - Moderate	3 - Moderate	3 - Moderate	3 - Moderate	2 - Minor	3 - Moderate	3 - Moderate
Heavy Snowfall	2 - Occasional	3 - Moderate	3 - Moderate	3 - Moderate	3 - Moderate	3 - Moderate	2 - Minor	3 - Moderate	3 - Moderate

Table 11 - Summary of climate hazards currently impacting Meath County Council services.

#### 4.6 Current Climate Impacts Assessment Summary: Administrative area – County Meath

On the basis of identified exposures, vulnerabilities and impacts for County Meath identified in Section 4.3, the impact of climate and weather-related hazards on key categories of exposure for County Meath was assessed according to the criteria provided through Technical Annex B: Climate Change Risk Assessment (catastrophic, major, moderate, minor and negligible) (Appendix 2). This assessment was undertaken on the basis of existing information on impacts and in consultation with Meath County Council. Below provides a summary of impacts across the key categories of exposure for the seven climate hazards identified.

The level of impact is calculated as the average level of impact across the identified impact categories.

Hazard Type	Current Frequency Ranking	Asset Damage	Health & Wellbeing	Environment (including Biodiversity)	Social & people	Financial	Reputation Damage	Cultural Heritage and Premises	Average Current Impact Score
Drought	3 - Common	2 - Minor	1 - Negligible	3 - Moderate	2 - Minor	2 - Minor	1 - Negligible	1 - Negligible	1.7
Heatwave	3 - Common	2 - Minor	2 - Minor	3 - Moderate	2 - Minor	1 - Negligible	2 - Minor	2 - Minor	2.0
Windstorm	4 - Frequent	4 - Major	3 - Moderate	3 - Moderate	2 - Minor	3 - Moderate	2 - Minor	2 - Minor	2.7
Flooding	3 - Common	3 - Moderate	2 - Minor	2 - Minor	2 - Minor	3 - Moderate	3 - Moderate	2 - Minor	2.4
Extreme Cold	2 - Occasional	2 - Minor	3 - Moderate	2 - Minor	3 - Moderate	2 - Minor	2 - Minor	2 - Minor	2.3
Heavy Snowfall	2 - Occasional	2 - Minor	3 - Moderate	2 - Minor	3 - Moderate	2 - Minor	2 - Minor	2 - Minor	2.3

Table 12 - Summary of climate hazards currently impacting administrative area, County Meath.

The current frequency ranking & average impact score for each climate hazard for each risk area are plotted in the Figure 5. Current Climate Risk Summary Matrix below. Hazards that are closer to the top right occur more frequently and result in a larger impact to local authority services and the administrative area

Climate Hazards	Current Frequency	Future Projected Frequency	Projected change	Evidence base
Drought	3 - Common	4 – Frequent ↑	An increase in the annual number of drought periods for the RCP4.5 and RCP8.5 scenarios (mean value ≈16% for both RCPs)	Data from EY’s Climate Analytics Platform, Met Eireann and Climate Ireland. Nolan and Flanagan (2020).
Heatwave	3 - Common	4 – Frequent ↑	Under medium and high emission scenarios, projections indicate that heatwaves will become more frequent by mid-century relative to the 1981-2000 period	
Windstorm	4 - Frequent	4 – Frequent ↔	Projections of storms are subject to a high level of uncertainty. By mid-century, projections indicate that average wind speed will remain similar to those currently experienced. There is limited evidence of a potential increase in the frequency of more intense storms which are currently rare events. However, more research is needed to confirm this increase.	
Flooding	3 – Common	4 – Frequent ↑	The projected increase in the annual number of very wet days, (days with precipitation >30mm), is substantial, with mean values of 21% and 31% for the RCP4.5 and RCP8.5 scenarios, respectively. This will likely result in an increased frequency flooding.	
Extreme Cold	2 – Occasional	2 – Occasional ↔	A decrease in the number of frost days and ice days in the 2041-2060 future period when compared with the baseline period of 1981 to 2000, is projected for both the RCP4.5 and RCP8.5 scenario. Although the frequency will reduce the ranking will remain as Occasional (Occurs once in a 10-to-100-year period).	
Heavy Snowfall	2 – Occasional	2 – Occasional ↔	The annual snowfall in the region is projected to decrease substantially by the middle of the century for the RCP4.5 (mean value 52%) and RCP8.5 scenarios (mean value 63%). Although the frequency will reduce the ranking will remain as Occasional (Occurs once in a 10-to-100-year period).	

Table 13. Projected changes in climate hazard frequency for County Meath.

Hazard Type:	Drought		
Risk Area	Changes in exposure and vulnerability (Physical, social, and environmental)	Key Impact Changes	Future Impact Ranking
Asset Damage	Expected increase in County Meath's population. Increase in the number of domestic buildings and number of assets exposed to climate hazards	More assets damaged during climate hazard events.	3 - Moderate
Health & Wellbeing	A substantial rise in older populations (aged 65 years and older) is expected to increase from 13.3% of the population in 2016 to between 23.9% and 27.4% by 2051. Flooding events will become more extreme and more frequent. People who were previously unaffected by flooding events may be affected in the future as flooding becomes widespread.	A greater number of vulnerable people who are more affected by hazards. Greater impact on physical health and wellbeing.	2 - Minor
Environment (Including Biodiversity)	The environment and biodiversity are expected to be more vulnerable in the future due to combined and cumulative effects of climate hazards and extreme weather events.	Reduced water levels can decrease water quality. There could be an increase in the adverse impact on environmental assets and habitats including increase fire risk.	4 - Major
Social & people	A substantial rise in total and elderly older populations. More concentration of population in expanded urban areas.	Water rationing events will become more frequent and are likely to last longer. Increased costs of buying water from private sources e.g., bottled water. Water rationing will affect people's ability to prepare food, maintain hygiene appropriately and operate home appliances.	3 - Moderate
Financial	Potential increase in frequency of hazard events and exposure across County Meath, there will be an associated increase in the actions the local authority takes before, during, and after an event.	There will be an increase in the cost of the actions the local authority takes before, during, and after an event e.g., repairing of damaged roads.	2 - Minor
Reputation Damage	Potential increase in frequency of hazard events and exposure across County Meath during an event.	There will be increasing pressure on services potentially reducing the level of service delivery and harming the reputation of the local authority	3 - Moderate
Cultural Heritage and Premises	Potential increase in frequency of hazard events and exposure across County Meath.	More cultural heritage sites and premises impacted and for longer periods.	2 - Minor

Table 14-1 – Assessment of changes in future exposure, vulnerability and impact of climate events.

Hazard Type	Heatwave		
Risk Area	Changes in exposure and vulnerability (Physical, social, and environmental)	Key Impact Changes	Future Impact Ranking
Asset Damage	Expected increase in County Meath's population. Increase in the number of domestic buildings and number of assets exposed to climate hazards	More assets damaged during climate hazard events. Road assets will likely have increased damage due to excessive heat,	3 – Moderate
Health & Wellbeing	A substantial rise in older populations (aged 65 years and older) is expected to increase from 13.3% of the population in 2016 to between 23.9% and 27.4% by 2051. Heatwave events will become more extreme and more frequent.	Greater impact on physical health and wellbeing due to a greater number of vulnerable people who are more affected by heat stress and dehydration.	3 – Moderate
Environment (Including Biodiversity)	The environment and biodiversity are expected to be more vulnerable in the future due to combined and cumulative effects of climate hazards and extreme weather events.	Increased water temperatures can decrease water quality. There could be an increase in the adverse impact on environmental assets and habitats.	4 - Major
Social & people	A substantial rise in total and older populations. More concentration of population in expanded urban areas.	Increase demand on outdoor recreational amenities causing traffic and litter problems.	3 – Moderate
Financial	Potential increase in frequency of hazard events and exposure across County Meath, there will be an associated increase in the actions the local authority takes before, during, and after an event.	There will be an increase in the cost of the actions the local authority takes before, during, and after a heatwave event e.g., provision of cooling facilities.	2 - Minor
Reputation Damage	Potential increase in frequency of hazard events and exposure across County Meath during an event.	There will be increasing pressure on services potentially reducing the level of service delivery and harming the reputation of the local authority	3 - Moderate
Cultural Heritage and Premises	Potential increase in frequency of hazard events and exposure across County Meath.	More cultural heritage sites and premises impacted and for longer periods.	2 - Minor

Table 14-2 – Assessment of changes in future exposure, vulnerability and impact of climate events.

Hazard Type:	Windstorm		
Risk Area	Changes in exposure and vulnerability (Physical, social, and environmental)	Key Impact Changes	Future Impact Ranking
Asset Damage	Expected increase in County Meath's population. Increase in the number of domestic buildings and number of assets exposed to climate hazards	More intense, severe storms will cause more damage to assets and recovery time will be longer.	4 - Major
Health & Wellbeing	A substantial rise in older populations (aged 65 years and older) is expected to increase from 13.3% of the population in 2016 to between 23.9% and 27.4% by 2051	A greater number of vulnerable people who are more affected by hazards e.g falling trees and other windstorms hazards. Greater impact of injuries due to more intense storms	3 - Moderate
Environment (Including Biodiversity)	The environment and biodiversity are expected to be more vulnerable in the future due to combined and cumulative effects of climate hazards and extreme weather events.	Increased damage to trees and forests from more intense storms	3 - Moderate
Social & people	A substantial rise in total and older populations. More concentration of population in expanded urban areas.	Increased damage to communication infrastructure due to more intense storms	3 - Moderate
Financial	Potential increase in frequency of hazard events and exposure across County Meath, there will be an associated increase in the actions the local authority takes before, during, and after an event.	There will be an increase in the cost of the actions the local authority takes before, during, and after an event e.g., removal of fallen trees, repair of public infrastructure	3 - Moderate
Reputation Damage	Potential increase in frequency of hazard events and exposure across County Meath during an event.	There will be increasing pressure on services potentially reducing the level of service delivery and harming the reputation of the local authority	3 - Moderate
Cultural Heritage and Premises	Potential increase in frequency of hazard events and exposure across County Meath.	Increased damage to cultural heritage sites and premises due to more intense storms.	3 - Moderate

Table 14-3 – Assessment of changes in future exposure, vulnerability and impact of climate events.



Hazard Type:	Flooding		
Risk Area	Changes in exposure and vulnerability (Physical, social, and environmental)	Key Impact Changes	Future Impact Ranking
Asset Damage	Expected increase in County Meath's population. Increase in the number of domestic buildings and number of assets exposed to climate hazards	More severe flooding from higher levels of rainfall will cause more damage to assets and recovery time will be longer.	4 - Major
Health & Wellbeing	A substantial rise in older populations (aged 65 years and older) is expected to increase from 13.3% of the population in 2016 to between 23.9% and 27.4% by 2051. Flooding events will become more extreme and more frequent. People who were previously unaffected by flooding events	A greater number of vulnerable people who are more affected by flood hazards and isolation. Greater impact of injuries due to more severe flooding from higher levels of rainfall.	3 - Moderate
Environment (Including Biodiversity)	The environment and biodiversity are expected to be more vulnerable in the future due to combined and cumulative effects of climate hazards and extreme weather events.	Increased and more widespread damage to the environment and habitats from more severe flooding with longer recovery time	4 - Major
Social & people	A substantial rise in total and older populations. More concentration of population in expanded urban areas.	Longer and more widespread road closures will cause longer periods of isolation and restrictions to movement of people. School closures may impact families. Increased impact on businesses and services including delivery services.	3 - Moderate
Financial	Potential increase in frequency of hazard events and exposure across County Meath, there will be an associated increase in the actions the local authority takes before, during, and after an event.	There will be an increase in the cost of the actions the local authority takes before, during, and after flooding events.	3 - Moderate
Reputation Damage	Potential increase in frequency of hazard events and exposure across County Meath during an event.	There will be increasing pressure on services potentially reducing the level of service delivery and harming the reputation of the local authority	3 - Moderate
Cultural Heritage and Premises	Potential increase in frequency of hazard events and exposure across County Meath.	More severe and widespread damage to cultural heritage sites. Access for tourists and public may be restricted during flood events for longer periods.	3 - Moderate

Table 14-4 – Assessment of changes in future exposure, vulnerability and impact of climate events.

Hazard Type:	Extreme Cold		
Risk Area	Changes in exposure and vulnerability (Physical, social, and environmental)	Key Impact Changes	Future Impact Ranking
Asset Damage	Expected increase in County Meath's population. Increase in the number of domestic buildings and number of assets exposed to climate hazards	Reduced impact of extreme cold due to reduction in the duration and intensity of extreme cold events	1 - Negligible
Health & Wellbeing	A substantial rise in older populations (aged 65 years and older) is expected to increase from 13.3% of the population in 2016 to between 23.9% and 27.4% by 20511	Reduced impact of extreme cold due to reduction in the duration and intensity of extreme cold events	2 - Minor
Environment (Including Biodiversity)	The environment and biodiversity are expected to be more vulnerable in the future due to combined and cumulative effects of climate hazards and extreme weather events.	Reduced impact of extreme cold due to reduction in the duration and intensity of extreme cold events	1 - Negligible
Social & people	A substantial rise in total and older populations. More concentration of population in expanded urban areas.	Reduced impact of extreme cold due to reduction in the duration and intensity of extreme cold events	2 - Minor
Financial	Potential decrease in frequency of extreme cold hazard events and exposure across County Meath, there will be an associated increase in the actions the local authority takes before, during, and after an event.	Reduced impact of extreme cold due to reduction in the duration and intensity of extreme cold events	1 - Negligible
Reputation Damage	Potential decrease in frequency of extreme cold hazard events and exposure across County Meath during an event.	Reduced impact of extreme cold due to reduction in the duration and intensity of extreme cold events	1 - Negligible
Cultural Heritage and Premises	Potential decrease in frequency of extreme cold hazard events and exposure across County Meath.	Reduced impact of extreme cold due to reduction in the duration and intensity of extreme cold events	1 - Negligible

Table 14-5 – Assessment of changes in future exposure, vulnerability and impact of climate events.

Hazard Type:	Heavy Snowfall		
Risk Area	Changes in exposure and vulnerability (Physical, social, and environmental)	Key Impact Changes	Future Impact Ranking
Asset Damage	Expected increase in County Meath's population. Increase in the number of domestic buildings and number of assets exposed to climate hazards	Reduced impact of heavy snow events due to reduction in the duration and intensity of extreme cold events	1 - Negligible
Health & Wellbeing	A substantial rise in older populations (aged 65 years and older) is expected to increase from 13.3% of the population in 2016 to between 23.9% and 27.4% by 20511	Reduced impact of heavy snow events due to reduction in the duration and intensity of extreme cold events	2 - Minor
Environment (Including Biodiversity)	The environment and biodiversity are expected to be more vulnerable in the future due to combined and cumulative effects of climate hazards and extreme weather events.	Reduced impact of heavy snow events due to reduction in the duration and intensity of extreme cold events	1 - Negligible
Social & people	A substantial rise in total and older populations. More concentration of population in expanded urban areas.	Reduced impact of heavy snow events due to reduction in the duration and intensity of extreme cold events	2 - Minor
Financial	Potential decrease in frequency of extreme cold hazard events and exposure across County Meath, there will be an associated increase in the actions the local authority takes before, during, and after an event.	Reduced impact of heavy snow events due to reduction in the duration and intensity of extreme cold events	1 - Negligible
Reputation Damage	Potential decrease in frequency of extreme cold hazard events and exposure across County Meath during an event.	Reduced impact of heavy snow events due to reduction in the duration and intensity of extreme cold events	1 - Negligible
Cultural Heritage and Premises	Potential decrease in frequency of extreme cold hazard events and exposure across County Meath.	Reduced impact of heavy snow events due to reduction in the duration and intensity of extreme cold events	1 - Negligible

Table 14-6 – Assessment of changes in future exposure, vulnerability and impact of climate events.

5.4 Future Climate Impacts Assessment Summary: Administrative area –

The level of impact is calculated as the average level of impact across the identified impact categories.

Taking into account the changes in exposure and vulnerability, the future change in impacts for each of the identified climate hazard types was assessed. The potential future changes in impact are outlined below in Table 15.

Hazard Type	Future Frequency Ranking	Asset Damage	Health & Wellbeing	Environment (including Biodiversity)	Social & people	Financial	Reputation Damage	Cultural Heritage and Premises	Average Future Impact Score
Drought	4 – Frequent ↑	3 - Moderate	2 – Minor	4 - Major	3 – Moderate	2 – Minor	3 - Moderate	2 - Minor	2.7 ↑
Heatwave	4 – Frequent ↑	3 – Moderate	3 – Moderate	4 - Major	3 – Moderate	2 – Minor	3 – Moderate	2 – Minor	2.9 ↑
Windstorm	4 – Frequent ↔	4 - Major	3 – Moderate	3 – Moderate	3 – Moderate	3 – Moderate	3 – Moderate	3 – Moderate	3.1 ↑
Flooding	4 – Frequent ↑	4 - Major	3 – Moderate	4 - Major	3 – Moderate	3 – Moderate	3 – Moderate	3 – Moderate	3.3 ↑
Extreme Cold	2 – Occasional ↔	1 - Negligible	2 – Minor	1 - Negligible	2 – Minor	1 - Negligible	1 - Negligible	1 - Negligible	1.3 ↓
Heavy Snowfall	2 – Occasional ↔	1 - Negligible	2 – Minor	1 - Negligible	2 – Minor	1 - Negligible	1 - Negligible	1 - Negligible	1.3 ↓

Table 15 - Summary of climate hazards currently impacting administrative area, County Meath.

## 5.5 Uncertainty

When assessing future climate risks, there will be uncertainty in how hazards, exposure, and vulnerability will change. These are the interrelationships between climate hazard types that are difficult to assess for future projections.

Also, there will be uncertainty related to the future frequency of climate hazards occurring.

Mitigation against this uncertainty is assessed by using a range of data and information sources. However, there will still be varying degrees of uncertainty present when assessing future changes. When assessing climate risks with a qualitative approach, it is best practice to take a conservative or 'worst case scenario' to ensure that climate risks are not underestimated and dismissed as low or no risk.

A Representative Concentration Pathway (RCP) is a greenhouse gas concentration (not emissions) trajectory adopted by the IPCC.

Future projections has been considered within these scenarios.

### 1.5 degree rise by 2030

The main climate exposures for Meath relate to changing wind patterns, flooding, drought, and temperature variability. These exposures will end up having different impacts, a combination of precipitation variability and heavy precipitation which are deemed to be high exposures for the county in 1.5°C temperature increase by 2030 scenario will likely increase the frequency and extremity of flooding events at the tail end of this decade. Due to temperature variability and drought during summer months there will likely be a higher frequency of drought and water stress as predicted from the IPCC data.

### 2-3 degree rise by 2040

In a 2040, 2-3°C hotter world, the IPCC data predicts that water stress and drought would be of increasing concern as the county would be exposed to more frequent high temperatures which are prolonged in nature. There will also be continuing exposure to changing wind patterns with the potential for strong wind gusts and the average wind speed being higher than in previous decades.

### 4 degrees rise by 2050

In 2050 in a world where the average temperature has increased by 4 °C versus the industrial average, flooding will be of increased concern as the likelihood of one in 25 year and/or 100-year coastal flooding events increases markedly along with sea level rise. This will obviously impact the coastal areas around Laytown and Bettystown. When looking inland, precipitation variability and heavy precipitation are still key exposures that could potentially impact the county alongside summer heat waves and drought.

## 6.0 Summary and Conclusion

### 6.1 Summary

Below is a summary table of the projected changes in climate hazard risk.




Climate Hazard	Change Projections	Summary	Future Frequency
<b>Droughts Heatwaves Flooding</b>	The climate risks associated with droughts, heatwaves and floods are expected to increase significantly for County Meath as a result of projected increases in the frequency of hazard events and also due to an increase in the areas, assets and populations exposed to these hazards. The risk is exacerbated by not only projected changes in the frequency occurrence of drought and heatwaves but also as a result of projected increases in population and the proportion of population considered vulnerable (those aged 65 years and over). Meath County service are likely to be impacted by these changes with increased pressure on services before, during and after extreme weather events. There will likely be a significant financial impact to Meath County Council due to the likely need to allocate more financial resources toward climate towards mitigation and adaptation measures.	<b>These are emerging and increasing risks</b>	
<b>Windstorms</b>	The impact of severe windstorms will likely increase marginally in County Meath. There will be an increase in the intensity of storms but not necessarily the frequency. There will be an increase in the cost of the actions the local authority takes before, during, and after an event e.g., removal of fallen trees, repair of public infrastructure	<b>This is an increasing risk</b>	
<b>Extreme Cold Heavy Snowfall</b>	The impact of heavy snowfall and cold spells on County Meath will likely decrease due to the decrease intensity and duration of these events., The overall risk of these hazards is projected to reduce in the future, resulting in less risk. These are decreasing risks.	<b>These are decreasing risks</b>	

Table 16: Summary of future projected changes to climate hazard risk

## 6.2 Conclusion

The CCRA focuses on the direct risks posed by climate change for County Meath and the implications of these for Meath County Council. It is important to note that climate change will also pose indirect risks for County Meath as a result of changes in climate conditions at international and global scale. These include amongst others forced migration of populations, increase in vector-borne disease and disruption of supply chains. To increase climate change resilience, Meath County Council will need to proactively plan for and adapt to the current and future climate change risks identified through this CCRA.

Assessing the major recent climate events in County Meath shows the risks associated with climate change. It has become clear that the frequency and intensity of weather events are having a more profound impact on not only the county of Meath, but also Meath County Council's services. This analysis helps Meath County Council better understand the potential climate risk to Meath, its citizens, and how the county operates. This process aids the development of mitigation and adaptation initiatives that may be undertaken by the county.

The overall short-term future impacts out to 2030 for Meath County Council and its own operations will not be too dissimilar to the current situation. The demand for Meath County Council's services will however increase as weather patterns continue to evolve, notably with the increasing severity and frequency of climate-related incidents. The potential risks as time progresses out of 2040 and 2050 will likely increase the demand for Meath County Council services due to adverse weather conditions.

Due to different topographical circumstances different locations in County Meath will have different exposures to different climate indicators and hazards. Coastal locations like Laytown and Bettystown will be more exposed to wind indicators as there is no land barriers to slow wind, it will also be exposed to sea level rise in a high warming degree scenario.

From a flooding perspective, inland locations through which rivers run will be exposed to fluvial flooding, and overall precipitation variability and heavy precipitation. While the whole county will be exposed to drought through the increasing frequency and duration of no rain and the impacts of water stress. Flooding is a key issue for County Meath with large rivers including the Boyne flowing through large urban areas. The likelihood of flooding would be a consequence of both heavy precipitation and precipitation variability which will be increasing over the three-time horizons modeled. County Meath is also quite dependent on agriculture as one of the uses of land. Agriculture will be particularly vulnerable to drought and water stress for the growth of crops and grass, with potential impacts to the livestock industries. Coastal flooding in Laytown and Bettystown are also considered to be a potential risk in a four-degree temperature increase scenario in 2050. This climate change risk assessment should be linked in with the ongoing planning for Meath County Council in terms of how it will look to adapt to the changing climate and continue supporting its citizens and businesses. While from a physical risk perspective they're only challenges that arise, Meath should also be aware of the potential emerging opportunities that will arise due to the required transition in meeting government and European targets.

As more data becomes available in a more granular format this exercise should be repeated to take account of the latest scientific thinking around climate impacts. As Meath County Council's response to climate change evolves so too will the impact of future weather events. This residual risk should be continued to be modeled alongside the inherent risk.

This assessment will inform appropriate actions to be taken within County Meath to develop effective and efficient adaptation responses to climate change impacts and in building resilience to these challenges, refer to Section 6.0 Framework of Actions within Meath County Council's Climate Action Plan.

## Appendices

### Appendix 1: Resources and references

Data sources used for modelling climate impacts:

The Climate Analytics Platform used climate model raw outputs hosted on the Earth System Grid Federation (ESGF) platform. This platform develops, deploys, and maintains software infrastructure for the management, dissemination, and analysis of model output and observational data. Its main mission is to support current Coupled Model-Intercomparison Project (CMIP) activities, which is the global initiative that coordinates climate model intercomparison activities and their experiments. These climate model raw outputs are extracted, stored, and cleaned before leading to the computation of climate indicators. It is important to highlight that these raw outputs only contain primary climate variables (temperature, humidity, precipitation). Performing significant mathematical transformations allows the derivation of several indicators from a single primary variable. Data inputs are composed of experiments under the CORDEX initiative, that combine global and regional climate models.

Several indicators come from other external databases:

1. For water stress, coastal and fluvial flooding, the modelling relies on the Aqueduct global platform, hosted by the World Resources Institute.
2. For sea level rise, the climate analytics application relies on the public dataset hosted by Kopp et al., 2014
3. For other Natural Disasters, the application relies on the CATNAT platform that registers a wide range of historical natural disasters over the 2001-2020 period worldwide. As deriving the impact of climate change on the variation in frequency and intensity of multiple natural disasters is still a state-of-the-art open research problem tainted with conflicting results and lack of robustness, future horizons are not included for these indicators in the application. However, looking backward to the 2000-2020 time series strongly informs on the future exposure potential.

#### Other data sources:

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## Appendix 2: Glossary

Term	Definition
Adaptation	In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects.
Anthropogenic	Resulting from or produced by human activities.
Biodiversity or biological diversity	Biodiversity or biological diversity means the variability among living organisms from all sources including, among other things, terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.
Climate	The long-term average weather of an area, usually taken over 30 years. The relevant quantities are most often surface variables such as temperature, precipitation and wind.
Climate projection	A climate projection is the simulated response of the climate system to a scenario of future emission or concentration of greenhouse gases (GHGs) and aerosols, generally derived using climate models
Coastal erosion	The breaking down of land and removal of sediment and rocks by coastal processes. Factors affecting the rate of coastal erosion include sea level rise, strong wave action, and storms.
Cold Spell	A sustained period of cold weather, where extreme low temperatures are recorded.

Coastal Flooding	Coastal flooding occurs when sea levels along the coast or in estuaries exceed neighbouring land levels, or overcome coastal defences where these exist, or when waves overtop over the coast.
Deforestation	Conversion of forested areas to non-forested areas.
Drought	A period of abnormally dry weather long enough to cause a serious hydrological imbalance.
Emission pathways	Modelled trajectories of global anthropogenic emissions over the 21st century are termed emission pathways.
Exposure	The presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected
Extreme weather event	An extreme weather event is an event that is rare at a particular place and time of year
Fluvial flooding	Fluvial flooding occurs when rivers and streams break their banks and water flows out onto the adjacent low-lying areas (the natural floodplains)
Global Warming	Global warming refers to the increase in global surface temperature relative to a baseline reference period, averaging over a period sufficient to remove interannual variations (e.g., 20 or 30 years)
Greenhouse gases	Gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of radiation emitted by the Earth's surface, by the atmosphere itself, and by clouds. This property causes the greenhouse effect. Greenhouse gases include carbon dioxide (CO <sub>2</sub> ), nitrous oxide (N <sub>2</sub> O), methane (CH <sub>4</sub> ) and ozone (O <sub>3</sub> ) and human-made include sulphur hexafluoride (SF <sub>6</sub> ), hydrofluorocarbons (HFCs), chlorofluorocarbons (CFCs) and perfluorocarbons (PFCs).
Groundwater flooding	Groundwater flooding occurs when the water table rises above the land surface. It generally requires sustained rainfall over relatively longer duration than other forms of flooding, its location is discontinuous, and they can last for weeks or months.
Hazard	The potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources.
Heat wave	A period of abnormally and uncomfortably hot weather
Heavy Snowfall	A substantial prolonged snowfall event resulting in substantial accumulations of snow on the ground over a period of consecutive days.
Impact	The consequences of realised risks on natural and human systems, where risks result from the interactions of climate-related hazards (including extreme weather/climate events), exposure, and vulnerability. Impacts generally refer to effects on lives, livelihoods, health and wellbeing, ecosystems and species, economic, social and cultural assets, services (including ecosystem services), and infrastructure. Impacts may be referred to as consequences or outcomes and can be adverse or beneficial.
Landslide	Landslide describes a wide variety of processes that result in the downward and outward movement of ground materials under the force of gravity.
Mitigation (of climate change)	A human intervention to reduce emissions or enhance the sinks of greenhouse gases.
Pluvial flooding	Occurs when the amount of rainfall exceeds the capacity of urban storm water drainage systems or the ground to absorb it.
Representative Concentration Pathways (RCPs)	Scenarios that include time series of emissions and concentrations of the full suite of greenhouse gases (GHGs) and aerosols and chemically active gases, as well as land use/land cover.
RCP4.5	An intermediate stabilization pathway in which radiative forcing is stabilized at approximately 4.5 W/m <sup>2</sup> after 2100 (the corresponding ECPs assuming constant concentrations after 2150)
RCP6.0	An intermediate stabilization pathway in which radiative forcing is stabilized at approximately 6 W/m <sup>2</sup> after 2100 (the corresponding ECPs assuming constant concentrations after 2150)

RCP8.5	One high pathway for which radiative forcing reaches >8.5 W/m <sup>2</sup> by 2100 and continues to rise for some amount of time (The corresponding ECP assuming constant emissions after 2100 and constant concentrations after 2250)
Risk	<p>The potential for adverse consequences for human or ecological systems, recognising the diversity of values and objectives associated with such systems. In the context of climate change, risks can arise from potential impacts of climate change as well as human responses to climate change. Relevant adverse consequences include those on lives, livelihoods, health and well-being, economic, social and cultural assets and investments, infrastructure, services (including ecosystem services), ecosystems and species.</p> <p>In the context of climate change impacts, risks result from dynamic interactions between climate-related hazards with the exposure and vulnerability of the affected human or ecological system to the hazards. Hazards, exposure and vulnerability may each be subject to uncertainty in terms of magnitude and likelihood of occurrence, and each may change over time and space due to socio-economic changes and human decision-making.</p>
Severe Windstorm	A windstorm is a wind that can cause at least light damage to trees and buildings, typically exceeds 55 km/h, and may or may not be accompanied by rain.
Sustainable Development Goals	The 17 Global Goals for development for all countries established by the United Nations through a participatory process and elaborated in the 2030 Agenda for Sustainable Development, including ending poverty and hunger; ensuring health and well-being, education, gender equality, clean water and energy, and decent work; building and ensuring resilient and sustainable infrastructure, cities and consumption; reducing inequalities; protecting land and water ecosystems; promoting peace, justice and partnerships; and taking urgent action on climate change.
Vulnerability	The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt