Moray Coastal Change Adaptation Plan

Regional Plan

Final

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Revision History

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Contract

This report describes work commissioned by Will Burnish, on behalf of Moray Council, by a letter dated 9 August 2022. Moray Council's representative for the contract was Will Burnish. Jenny Shadrick, Doug Pender, and Angus Pettit of JBA Consulting carried out this work.

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Purpose

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Thanks also go to Prof Larissa Naylor and Dr Martin Hurst of the University of Glasgow for their valuable input throughout, and peer review of the draft report.

Carbon Footprint

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Executive summary

The report documents the Regional Coastal Change Adaptation Plan (the Plan) for Moray Council. It provides an overview of the coastal processes, flood, and erosion risk to the coastline now and in the future. It has been developed using available national datasets from Moray Council, SEPA and the Dynamic Coast Project. The Plan was developed in alignment with available guidance, resources and supporting Moray Council plans.

This resulted in four key pillars of adaptation being identified to provide a focal point:

1. Working with Natural Processes
2. Monitoring Change
3. Communication and Engagement
4. Placemaking

The Regional Plan is divided into eleven Community Areas (CA), developed based on local community boundaries and coastal features. A prioritisation exercise was undertaken using available information from SEPA's National Flood Risk Assessment and the Dynamic Coast Project, to understand when and how more detailed Local Plans should be developed.

In addition to the Local Plan prioritisation, regional Triggers were identified whereby, should these conditions be met, Moray Council will undertake further actions to:

- understand the implications on the adaptation process;
- manage changes to that approach, if required.

Finally, a set of nine Proactive Actions were identified and proposed. These are aligned with closing key knowledge gaps and making sure necessary supporting steps are undertaken to align the adaption process locally and nationally. Each of these have been developed alongside the key pillars identified. Actions can be:

- Direct - Moray Council to deliver.
- Indirect - Moray Council to initiate and third-party stakeholders to deliver.

The below actions will be delivered within the Phase 0 adaptation cycle.

Action	Details	Type	Third-party support
1	Undertaken NBS opportunities mapping exercise at the coast and land adjacent to the current coast-land boundary	Direct	NA
2	Establish coordinated and consistent coastal change monitoring plan for Moray Region.	Direct	NA
3	Establish and standardise defence asset condition database, including a mechanism for updating this and for identifying triggers in advance.	Direct	NA
4	Coastal adaptation workshop with Moray Coastal Partnership	Indirect	Moray Coastal Partnership
5	Engagement workshop with key third-party stakeholders. Utilities companies, private marinas, coastal asset owners, golf clubs etc.	Indirect	Various
6	Coastal flood forecasting refresher workshop with SEPA	Indirect	SEPA
7	Undertake land use opportunities mapping exercise	Direct	NA

8	Undertake economic opportunities exercise	Direct	NA
9	Undertake regional risk assessment to determine impact on Moray Coastal Trail.	Direct	NA

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Abbreviations

BGS	British Geological Survey
CCAG	Cross-Council Action Group
CCAP	Coastal Change Adaptation Plan
CA	Community Area
CFB	Coastal Flood Boundary
CMEMS	Copernicus Marine Environmental Monitoring Service
DC	Dynamic Coast
EA	Environment Agency
HAT	Highest Astronomical Tide
HES	High Emission Scenario
LAT	Lowest Astronomical Tide
LDP	Local Development Plan
LFRMP	Local Flood Risk Management Plan
LPD	Local Plan Districts
mAOD	meters Above Ordnance Datum
MC	Moray Council
MHWN	Mean High Water Neaps
MHWS	Mean High Water Springs
MLWN	Mean Low Water Neaps
MLWS	Mean Low Water Springs
MSL	Mean Sea Level
NBS	Nature Based Solutions
NFRA	National Flood Risk Assessment
NRPs	Non-residential Properties
NSCE	National Standards for Community Engagement
PVA	Potentially Vulnerable Areas
RP	Residential Properties
SEPA	Scottish Environment Protection Agency
SIMD	Scottish Index of Multiple Deprivation
SLA	Special Landscape Area
SLR	(relative) Sea Level Rise
SW	Scottish Water
RCP	Representative Concentration Pathway
UKCP18	United Kingdom Climate Projections 2018

Glossary

Accretion*	The build-up of sediment resulting in the seaward movement of the coastline/ Mean High Water Springs.
Actions*	A plan or policy option that promotes an adaptive approach to coastal change that makes use of long term or resilient solutions such as preserving natural features.
Action Plan*	The proposed strategy or course of action to be taken depending on trigger point reached.
Adaptation*	The adjustment in economic, social or natural systems in response to actual or expected climate change, to limit harmful consequences and exploit beneficial opportunities.
Adaptation Pathways*	A flexible way of managing future uncertainty by planning for multiple scenarios without rigid timelines responding to the nature of future changes as they unfold.
Asset*	An item, such as a building, that is deemed to have an economic, social, or cultural value (or combination of).
Decision point*	A management action based on a trigger being reached.
Erosion*	The removal of sediment resulting in the landward movement of the coastline (Mean High Water Springs)
Hard coastline*	Coast that is comprised mainly of materials resistant to erosion such as hard rock types or artificial structures.
Implementation Plan	The framework developed in this first iteration, or Phase 0 of the Adaptation Pathway to support Moray Council in the development of Action Plans for each CMU.
Implementation Plan Actions	Actions that Moray Council will deliver in response to a Trigger being met and will determine the Outcome of the phase of the Adaptation pathway.
Outcomes	Outcomes of the Implementation Plan determines the current path of the Adaptation Pathway.
Soft coast*	A coastline composed of unconsolidated sediments, which is not inherently resilient to erosion, but relies on the balance of natural processes to maintain its shape in response to storms and everyday processes.
Triggers*	Either a physical process or an enabler/inhibitor that when reached or a threshold crossed.

*Term definitions from Scottish Government Coastal Change Adaptation Plan Guidance (https://www.dynamiccoast.com/files/ccapg_2023feb.pdf)

Part A – Background and Motivation

1. Introduction

1.1 Overview

Moray Council (MC) have worked in collaboration with JBA Consulting to develop a series of Coastal Change Adaptation Plans (CCAP) for the Moray local authority area in north Scotland. Plans will be developed at two levels. An overarching **Regional Plan**, covering the entire Moray Council coastline, and **Local Plans** for communities where adaptation actions are deemed a higher priority. These plans are "living documents" whereby changes in knowledge will trigger reviews and the implementation of defined actions.

This document details the Regional CCAP for Moray.

1.2 What is a Coastal Change Adaptation Plan?

Our climate is changing. As a result, sea level driven coastal flooding and erosion risk will increase and inevitably lead to losses for communities and individuals.

Although there is considerable uncertainty associated with this, the science shows that it is no longer a question of *if*, but rather *when* these risks will be realised. We cannot continue to aim to manage and protect against these risks and must, as a society, become more resilient and adapt to our changing planet. To enable resilience and adaptation, we must be proactive and avoid tying future generations to maintaining unsustainable and uneconomic approaches to coastal management. Putting an adaptive framework in place, and taking steps to implement it, will allow us to address these risks now. This will help reduce costs, generate wider benefits and opportunities for coastal communities now and in the future.

Coastal adaptation needs to be embedded into all our thinking across the local authority, businesses, and communities. Adaptation Plans are the first step in this process. They will encourage and reward proactive measures, which aim to build resilience and provide time to develop assessments and monitoring for the longer-term. They need to consider all potential pressures on the coast, including erosion, flooding, aging coastal defences, land use and ecological pressures.

The aim of CCAPs is to consolidate our understanding of the hazards of our changing coast and set out proactive steps Moray Council will take to promote and support increased resilience of our coastal communities.

CCAPs acknowledge that the complexity and uncertainty around coastal hazards mean different communities will be affected in different ways. Measures can be implemented that support more resilient communities, overcoming initial technical and economic barriers. By understanding risks, identifying causes, and implementing a sustainable pathway, all communities can become more resilient.

CCAPs will underpin Local Development Plans (LDPs) moving forward and steer new development away from risk; take opportunities to move assets; protect through appropriate engineered, natural and resilience measures; warn for hazards; and raise awareness of risks and actions that can improve resilience. They should provide a mechanism to proactively engage equitably with a wide array of community members, drawing in their ideas and concerns to co-develop a shared vision for long-term resilience.

While reduction in the impacts of climate change along the coast is of paramount importance, CCAPs will be influenced and supported by other factors including ecological, social, and economic considerations such as how the provision of green space improves societal and ecological well-being. A cross-sectoral, multi-benefits approach to adaptation planning and implementation can thus help open windows of opportunity to fund adaptation. By encouraging adaptation planning and implementation over a multi-generation time horizon, rather than a short-term timeframe, it will help ensure we can address current and future impacts of climate change directly and indirectly. Bold and proactive actions at the coast and on at future risk land adjacent to the coast will be set to:

- Facilitate direct actions to reduce risk and improve resilience;

- Identify and take opportunities for supporting actions that will increase success.

The purpose of the CCAPs is to set Adaptation Pathways for action so that Moray can adapt to climate change induced coastal flooding and erosion. These pathways are flexible to account for uncertainty in the timings and impact of coastal change. However, flexibility of pathways is not an excuse for inaction and CCAPs make sure that the adaptation journey starts now.

1.3 Why is it needed?

Moray has approximately 190 kms of coastline accommodating several large settlements, as well as other assets such as harbours, beaches, coastal trails, and agricultural land. These settlements and assets are important for the economy, natural and cultural heritage of the region. The increasing pressures of climate change, including the consequences of sea level rise, will continue to change our coastline and put existing and planned development and infrastructure at risk.

Around 60% of the Moray coastline is made up of soft material susceptible to erosion. Evidence from the Dynamic Coast project has indicated that the proportion of soft coastline experiencing erosion has increased in recent years from 10% to 34%. A substantial length of the coast has experienced erosion with 13 kms having retreated more than 30 m since the 1970's. There is likely to be increased erosion and flooding to be managed in the future.

1.4 What is the Regional CCAP?

The Plan is the top level covering the entire Moray coastline. Its purpose is simple and will:

- Define and understand coastal flood and erosion risk using the best available data;
- Identify and define region wide **Influence Factors and Indicators** that will inform and support an approach to adaptation planning;
- Prioritise the coastline for detailed Local CCAPs;
- Identify region wide **Triggers** that will influence adaptation decision making;
- Set region wide **Actions** to support a vision for the future Moray coastline.

Fundamentally, the Plan sets out a framework to support coastal change adaptation planning across Moray. It focuses on the management component of adaptation and is supported by the implementation of associated land-based aspects for avoidance of future risk to new developments. Specifically, this is supported by National Planning Framework 4[1] (NPF4) and set out in the following Environmental Policies (EP) of the current Local Development Plan:

- **EP12 Management and Enhancement of the Water Environment** - *New development will not be supported if it would be at significant risk of flooding from any source or would materially increase the possibility of flooding elsewhere. For development at or near coastal locations, this includes consideration of future flooding that may be caused by sea level rise and/or coastal change eroding existing natural defences in the medium and long term.*

- **EP17: Coastal Change** - *New development will not generally be supported in areas that are vulnerable to adverse effects of coastal erosion and/or wider coastal change as identified in Scotland's Dynamic Coast project (National Coastal Change Assessment).*

Application of this CCAP in parallel with the LDP policies provides the overall framework to support coastal adaptation in Moray through delivering sustainable land-based and management practices.

[1] https://www.gov.scot/publications/national-planning-framework-4/

1.5 Where are we on the adaptation journey?

The aim of this first publication of the CCAP is to consolidate our understanding of the physical risks and how these interact with communities and their assets, to identify the present day and future hazards of our changing coast.

The adaptation journey is a continuous and ongoing process given the levels of sea level rise (SLR) that are already "baked in" to the coming years because of climate change (see Part B – Technical information section 2.3). Transitioning the region into a more sustainable and resilient future will require more detailed assessments of risk, economics, community engagement, environmental surveys, engineering assessments that are beyond the level of detail of what can be delivered at this stage.

This CCAP therefore promotes and develops a framework for adaptation across the region that, when followed, will allow Moray Council to undertake the relevant assessments and develop a robust Adaptation Pathway that can ultimately be delivered on with confidence.

2. Supporting Plans and Projects

Critical to implementation of the Plan and adaptation success is incorporation and alignment with key strategic regional and national plans and projects. At national level, Climate Ready Scotland provides the overarching framework to support the nation in adapting and responding to the changing climate[2]. This includes a five-year programme (2019-2024) to prepare Scotland for the challenges ahead.

As well as the Climate Ready Scotland Framework, here more specific plans and projects have been identified and reviewed to aid the development of this Plan. These are summarised below.

2.1 Local Flood Risk Management Plans (LFRMP)- Cycle 2 (2022)

Strategic flood risk planning for Moray is included in the Findhorn, Nairn and Speyside Local Flood Risk Management Plan (LPD05)[3], and the North East Local Plan District Area (LPD06)[4]. The purpose of these are to set out how and when actions to reduce flooding impact will be implemented and to identify areas at greatest risk of flooding and which will benefit from investment. They are cyclical and set to update every six years, with the first cycle running from 2016 to 2022.

A total of four coastal areas in Moray were identified through these as potentially vulnerable to flooding:

- Burghead to Lossiemouth
- Spynie
- Kingston and Garmouth
- Kinloss
- Portgordon

Table 2-1 summaries the LFRMP findings for each Potentially Vulnerable Area (PVA) current and future risk to people and properties.

Table 2-1: Summary of Moray PVAs from the most recent 2022 LFRMPs

Area	Target Areas	Current risk	Future risk due to climate change
Burghead to Lossiemouth	Hopeman (389)	180 people 110 properties	240 people 150 properties
	Lossiemouth (391)	140 people 90 properties	200 people 130 properties
Spynie	Seatown, Lossiemouth (9991)	390 people 200 properties	490 people 250 properties
Kingston & Garmouth	Kingston (463)	30 people 20 properties	70 people properties

[2] Scottish Government. 2019. Climate Ready Scotland: Second Scottish Climate Change Adaptation Programme 2019-2024. - https://www.gov.scot/publications/climate-ready-scotland-second-scottish-climate-change-adaptation-programme-2019-2024/

[3] Moray Council. 2016. Findhorn, Nairn and Speyside Local Flood Risk Management Plan. http://www.moray.gov.uk/downloads/file105636.pdf

[4] Aberdeenshire Council. 2016. North East Local Plan District Local Flood Risk Management Plan. https://www.aberdeenshire.gov.uk/media/17174/north-east-local-flood-risk-management-plan-2016-2022-web-version.pdf

	Garmouth (393)	80 people 50 properties	90 people 60 properties
Kinloss	Kinloss (420)	320 people 220 properties	390 people 270 properties
Portgordon (06/01) (North East Local Plan District)		80 people 20 properties	-

2.2 Moray Local Development Plan – July 2020

In 2020, the Moray Local Development Plan (LDP)[5] was published, that sets the policies and land use proposals for the next ten years and beyond. The LDP aims to deliver three core policies: sustainable economic growth, healthy places, and longer-term infrastructure.

It is underpinned by three primary policies:

1. **Placemaking** – *"Development must be designed to create successful, healthy places that support good physical and mental health, help reduce health inequalities, improve people's wellbeing, safeguard the environment and support economic development."*
2. **Sustainable Economic Growth** – *"Development proposals which support the Moray Economic Strategy to deliver economic growth will be supported where the quality of the natural and built environment is safeguarded, there is a clear locational need, and all potential impacts can be satisfactorily mitigated."*
3. **Infrastructure and Services** – *"Development must be planned and co-ordinated with infrastructure to ensure that places function and proposals are adequately served by infrastructure and services."*

Within the LDP risks associated with current and future flooding and coastal change are addressed through specific policies. This promotes an avoidance principle whereby development will not generally be supported in areas that are at risk.

The Moray LDP 2027 is currently in progress. This Regional CCAP will form part of the Evidence Report required to go through a gate check process as part of the new LDP process.

This CCAP is designed to complement the Adaptation Pathways and actions set out by the LDP. There are 12 coastal communities identified as key settlements in the LDP. Table 2-2 summarises the population and households of each. The Moray coastline is also identified as a Special Landscape Area (SLA), which is an area designated for its special character and quality[1].

Table 2-2: Moray Local Development Plan coastal communities sorted by highest to lowest population (2022) (Source: Moray LDP)

Settlement	Population	Households
Buckie	8,541	3,782
Lossiemouth	7,033	3,056
Burghead	1,945	835
Hopeman	1,724	701
Cullen	1,475	661
Portknockie	1,269	547
Findochty	1,209	525
Findhorn	901	445
Portgordon	884	374
Garmouth	589	254
Kingston	200	85
Cummingston	180	75

[5] Moray Council. 2020. Moray Local Development Plan. http://www.moray.gov.uk/moray_standard/page_133431.html

2.3 Dynamic Coast - 2021

The Dynamic Coast 2 project provided an updated national assessment of coastal change that provides strategic evidence on the risk of coastal erosion across the whole of Scotland[6]. It was delivered and managed through a collaboration between Nature Scot, Scottish Government, and the University of Glasgow.

The aim of the project was to improve the evidence and awareness of coastal erosion at a national scale and support decision makers in adapting and becoming resilient to coastal change as sustainably as possible. Results from Dynamic Coast can be used to identify areas at high risk of coastal erosion and help support decision-making.

It combines evidence-based historic coastal change with anticipated future change based on climate change projections. Here, results from Dynamic Coast inform the extent of past and anticipated coastal change risk along the Moray coast.

Full details of the datasets used in the CCAP are provided in Section 1.2 and Appendix A.1. Dynamic Coast provides a range of datasets with information about past and future risk of erosion, these include:

- Historic MHWS position (as far back as the 1890s);
- Historical rate of coastal erosion;
- Recent MHWS position;
- Predicted future MHWS positions at decadal intervals considering sea level rise;
- Predicted future erosion rates at decadal intervals considering sea level rise;
- Predicted future erosion area in 2100 considering sea level rise;
- Assets at risk from future coastal erosion considering sea level rise.

2.4 Scottish Government Coastal Change Adaptation Plan (CCAP) Interim Guidance*

Coastal management planning in Scotland is changing and moving towards an adaptive approach. To enable national consistency and alignment of opportunities Scottish Government have developed Interim CCAP guidance[7]. The aim of this guidance is to support local authorities in Scotland plan for the long term (50 to 100 years) adaptation and resilience of coastal areas, communities, and assets. The guidance encourages a proactive approach that will maximise opportunities and minimise risk from climate change impacts.

As part of development of this CCAP, the draft guidance was made available by SEPA. The timing of such means that, rather than attempt to align with all aspects in detail, key themes have been identified as being critical to support coastal adaptation in Moray.

This has been distilled into **four key pillars of adaptation** (Figure 2-1). The CCAP therefore aligns with the guidance through focus on these pillars to define the processes, pathway, and actions to support adaptation across the region. This also best reflects the stage that Moray is on the journey to coastal adaptation and aims to guide current, future practices to aid investment.

[6] Rennie et al. (2021) Dynamic Coast, The National Overview (2021) CREW.
[7] Scottish Government (2023) Coastal Change Adaptation Plan Guidance – Interim https://www.dynamiccoast.com/files/ccapg_2023feb.pdf
*This document was prepared and published after review of the DRAFT interim guidance.

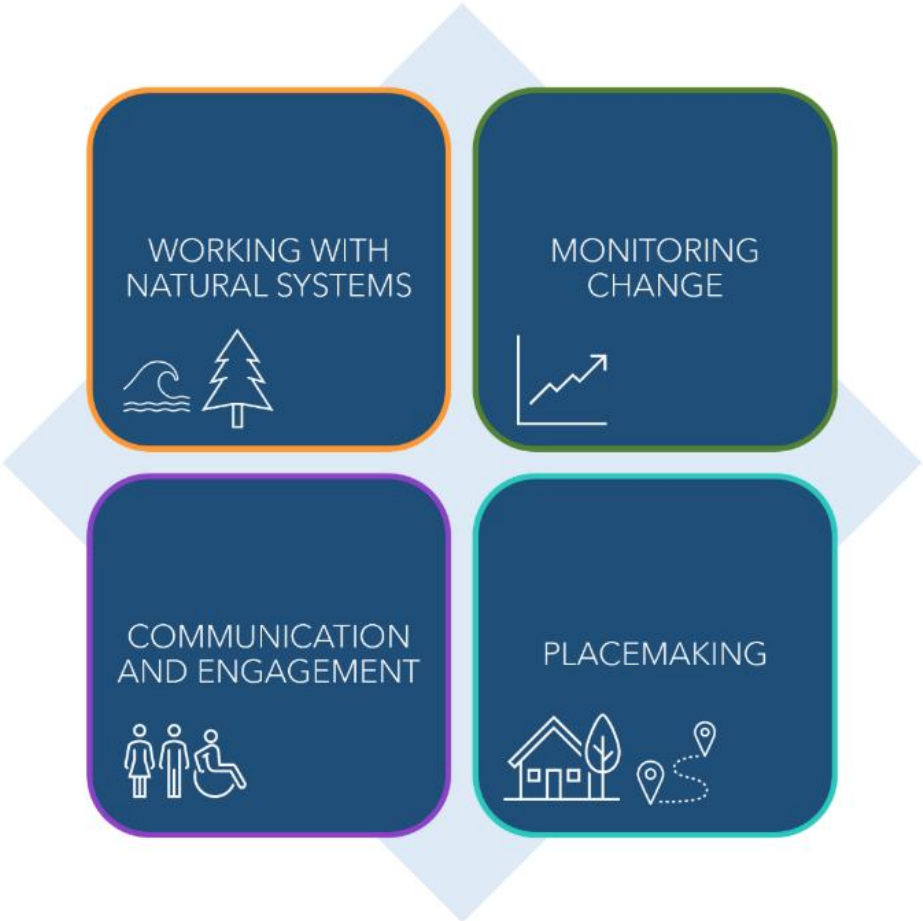


Figure 2-1: Four pillars of coastal adaptation for Moray

The pillars are summarised as:

1. **Working with natural systems:**

   Coasts provide a range of natural systems, including dunes, beaches and saltmarshes which can provide critical protection from coastal flooding, erosion and erosion induced flooding; as evidenced by Dynamic Coast. Maintaining, enhancing, and restoring the protective function of these systems, using nature-based management approaches, can provide relatively low-cost ways to maintain, or increase, resilience. For this natural, and nature-based risk alleviation to continue, especially under the impacts of climate change, space on land needs to be given for these systems to evolve and migrate.

   There is therefore a need for land-based policies to make space to accommodate erosion[8] by designating space for the inland migration and adjustment of such features in statutory policies, such as LDPs. Similarly, avoiding new or replacement "permanent" development, such as traditional housing stock or transport infrastructure such as roads, in locations where there is erosion and/or flood risk, should be a key pillar of climate resilient development pathways. In some locations, it may be possible to allow for temporary developments, which can allow economic activity to continue in areas at risk.

   In areas on land that are already developed, existing assets at risk may require relocation now, or in the future. Accommodation space for these, as well as community engagement, is needed to help manage these risks in the most resilient and cost-effective ways for current and future generations. The interim guidance discourages the installation of new, artificial coastal defences and instead focusses on maintaining existing artificial

8 Rennie et al. (2021) Dynamic Coast, The National Overview (2021) CREW.

structures, maintaining a level of performance deemed acceptable for their function. Where possible, the use of natural processes and solutions should be developed to extend defence life and improve performance. Furthermore, development of spaces should be avoided where inland migration of coastal features is needed.

In addition to the risk reduction benefits, natural processes can create opportunities for environmental enhancement, biodiversity gain and/or the capture of excess greenhouse gas emissions. Habitats such as seagrass, wetlands, saltmarsh, and woodlands are particularly effective. These such opportunities should be considered, when working with natural systems, to develop a multi benefits approach and use coastal adaptation to improve the overall ecological resilience of the coast.

2. Monitoring change:

Adaptation can only be implemented effectively if supported by a robust monitoring and evidence collection programme. This focuses on the collection of data to understand processes and help better identify, review and update Trigger points. Trigger points, at a local level, identify when critical thresholds, in terms of damaging impacts to coastal assets are approached. These, therefore, need to be adjusted in response to data availability and increased knowledge of coastal processes, at both a local and regional level, which can be accomplished with improved monitoring.

While it is important that the processes are understood. It is critical that a monitoring programme is developed in such a way that it can be efficiently integrated into the overall adaptation framework. Monitoring should be proportionate, and explore innovative methods for collection, storage, and assimilation of data, such that it can support fast, robust decision making.

3. Communication and Engagement:

Moving towards an adaptive practice represents a shift in how people, practitioners, and managers typically understand coastal management. It will place more onus on communities and individuals to understand and take responsibility for their own resilience as the climate changes.

The draft CCAP guidance highlights the use of The National Standards for Community Engagement (NSCE)[9] to guide fair and effective involvement of communities, as well as how and who to involve in the CCAPs. The NSCE Standards include seven components to address in any communication of the CCAP process:

1. Inclusion
2. Support
3. Planning
4. Working together
5. Methods
6. Communication
7. Impact

Engagement with groups across administrative boundaries (e.g. Moray Firth Coastal Partnerships) is also critical to enable a joined-up delivery approach to adaptation. Engagement activities specifically focused on knowledge exchange and awareness raising can be critical.

4. Placemaking:

[9] SCDC The National Standards — VOiCE (voicescotland.org.uk)

As with the LDP, placemaking is championed. This promotes an approach[10] to deliver multiple benefits to coastal environments and communities. Taking a place-based approach considers the collective physical, social, and economic aspects of a place, and deals with the complexities of optimising each aspect. For placemaking to be in line with the "climate resilient development planning" goals of the 6th IPCC, it is important that land for future adaptation/landward migration of natural processes is specified in the next cycle of LDPs.

Nevertheless, placemaking needs to be considered up front as a necessary supporting step for the adaptation pillars to be delivered effectively. This will provide a physical window of opportunity to accommodate future erosion and flooding and migration of coastal assets such as beaches and dunes, with minimal future costs (i.e. fewer assets on land will require relocation).

By doing this, positive interrelationships between all aspects of a place, now and in the future, can be identified and enhanced to solve problems that may not be possible if each aspect was considered individually. A place-based approach considers the potential of a place and identifies opportunities driven by community engagement. Using a place-based approach effectively and consistently throughout CCAPs aims to receive greater support from local stakeholders than traditional approaches.

Building a Wellbeing Economy is a policy priority in Scotland[11] as well as the National Strategy for Economic Transformation[12]. A Wellbeing Economy recognises the importance of wellbeing as an indicator for a successful society, not just economic growth. Wellbeing encompasses the quality of life and health of both the people and the relied upon environment. Building a Wellbeing Economy delivers social justice and environmental health, and an inclusive, sustainable, prosperous, and resilient economy.

As well as the four pillars defined here, the CCAP guidance recommends taking a precautionary approach, by using upper estimates for climate change predictions (see Section 3.6). This allows planning for the coast to adapt to long-term climate change and to potential, worst-case, scenarios more effectively.

2.5 Spatial extents

The Moray coastline has been subdivided into 11 smaller Community Areas (CAs) to prioritise Local CCAPs (Figure 2-2). The subdivision of the coastline was informed by Moray Council district boundaries; sediment cell locations; and SEPA flood maps. A 1 km buffer zone of the SEPA future (2080s) flooding spatial extent was used as the inland boundary.

The prioritisation (see part C) was used to schedule the development of Local CCAPs.

[10] Our Place | Our Place
[11] https://www.gov.scot/groups/wellbeing-economy-governments-wego/
[12] https://www.gov.scot/news/scotlands-national-strategy-for-economic-transformation/

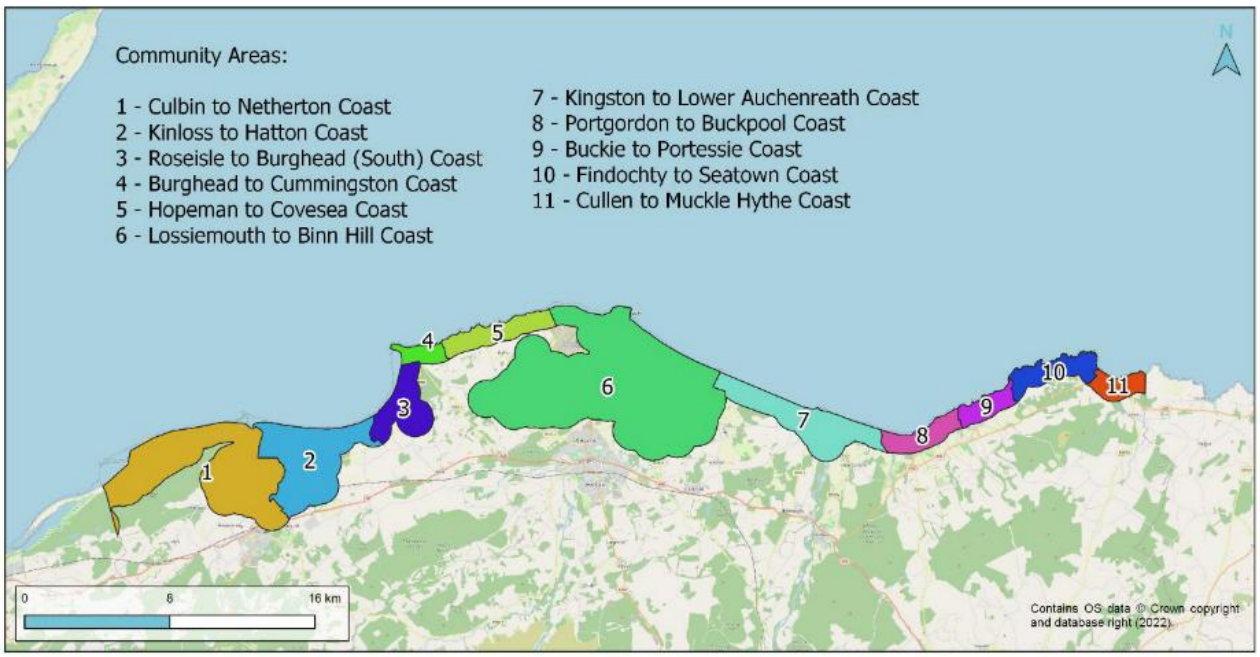


Figure 2-2: Extent and location of CAs within Moray

3. Review, reporting, governance, and connections

For sustainable adaptation, it is critical that key departments of Moray Council work together and takes a holistic approach to climate adaptation. To achieve this, we have developed the Plan in collaboration with a **Cross-Council Action Group** (CCAG, Part D – Section 1.2):

- Adaptation aspects across Moray Council are aligned.
- The contents of this Plan can be adopted more widely into Council policy.
- Barriers to implementation are identified early and resolved.
- A clear and robust reporting and governance structure is implemented.

3.1 Review

Delivery and implementation of the Plan will be the responsibility of the Consultancy Department of Moray Council. The following formal review process will be adopted.

- A full review, revision, and re-publication of the Plan **every 6 years**.
    - This will include details of **all Triggers** realised within the period, the associated **Actions**, and the impact on the revised plan. Revisions of this CCAP will not be made upon each individual Trigger realisation.
- An interim review and publication of Progress Report **every 3 years.**
    - The Progress Report, should include:
        - evidence of delivery of Proactive Actions.
        - evidence and documentation of Trigger Realisation.
        - evidence of delivery of associated Indirect and Direct actions after Trigger realisation.

3.2 Reporting

Outside this formal review period, the Consultancy Department will be responsible for monitoring the underlying data and Triggers that have been identified and, should these be realised, take the necessary actions to address.

Reporting of Trigger realisation and progress on Regional Actions will be made through the Climate Change sections of Council Committee Reports, submitted to the **Economic Development and Infrastructure Services Committee**. This will be disseminated, more widely through Moray Council's **Adaptation Working Group**. While it is acknowledged that this has yet to be finalised, upon doing so it is critical that this be used as a mechanism to support delivery of the Plan.

Relevant details of this Plan should be incorporated into the wider Moray Climate Change Strategy[13] to allow for alignment of wider risks and adaptation measures.

3.3 Governance

The CCAG provides the governance structure for the Plan. It is this group's responsibility to make sure that the Plan is delivered, reviewed, and reported against, as defined in this document.

The CCAG will form part of the wider Adaptation Working Group to make sure that awareness of the Plans contents is Council-wide and that the identified connections below are made and adhered to during Plan delivery.

3.4 Connections

This Plan describes only a small part of how Moray Council must adapt to climate and coastal change. It is therefore critical that the development and delivery of the Plan is not only

[13] http://www.moray.gov.uk/downloads/file136442.pdf

supported by other Moray Council areas and policies, but that the content is used to inform other areas where future coastal flood and erosion risk must be considered.

The below outlines these initial connections and requirements, set out by the CCAG during development. These have been ranked as Low, Medium, and High priority to enable action from the CCAG, with progress reported against these per the structure and governance process outlined above.

- **High Priority - The plan must align with, inform, and support:**
  - the Regional Spatial Strategy.
  - the Local Development Plan through identifying area for future adaptation/landward migration of natural features.
  - the Economic Strategy.
  - areas of land safeguarding for growth and opportunities.
  - the application of NPF4 across Moray.
  - The Climate Change Strategy.
  - a Systems approach to delivery of Nature Based Solutions, Natural Flood Management and Environmental Enhancement activities.
- **Medium Priority - The plan must align with, inform, and support:**
  - delivery of resilience measures within Health and Social care practices.
  - development of a Common Adaptation Delivery programme across Moray.
  - initial discussions with relevant third-party stakeholders, for example:
    - NHS Grampian.
    - Scottish Water.
    - Historic Environment Scotland.
    - Nature Scot.
- **Low Priority - The plan must align with, inform, and support:**
  - delivery of adaptation and resilience measures of third-party stakeholders.

Part B – Technical Information

1. Coastal Processes

1.1 Sediment Cells

The Scottish coast has previously been subdivided into cells related to longshore sediment transport, with boundaries between cells located at points where sediment availability at the coast changes or is interrupted[14]. An idealised sediment cell is to be self-contained, in that there would be no net loss or gain of sediment from inside or outside the cell[15].

These sediment cells are useful for subdividing the coastline in terms of natural processes, rather than with administrative boundaries for Shoreline Management Plans, and in this case a CCAP. Along the Moray coastline there is a dominant westerly sediment drift direction due to the orientation with respect to the predominant wave climate (Figure 1-1).

Of relevance to Moray Council is Sediment Cell 3 which extends between Cairnburg Point to Duncansby Head. Within Cell 3 the Moray coastline contains sections of sub-cell 3a (Cullen to Portknockie), sub-cell 3b (Portknockie to Burghead), and sub-cell 3c (Burghead to Culbin Forest). These sub-cells are further subdivided into smaller sections along the coastline.

The boundary between sediment cell 3a5 and 3b1 is defined by the headland at Portknockie, where this interrupts the westerly direction of sediment transport. The boundary between sediment cell 3b1 and 3b2 is defined by the mouth of River Spey, where the River Spey contributes considerable volumes of sand and gravel to cell 3b2. The boundary between sediment cell 3b2 and 3c1 is defined by the headland at Burghead, where this interrupts the westerly direction of sediment transport.

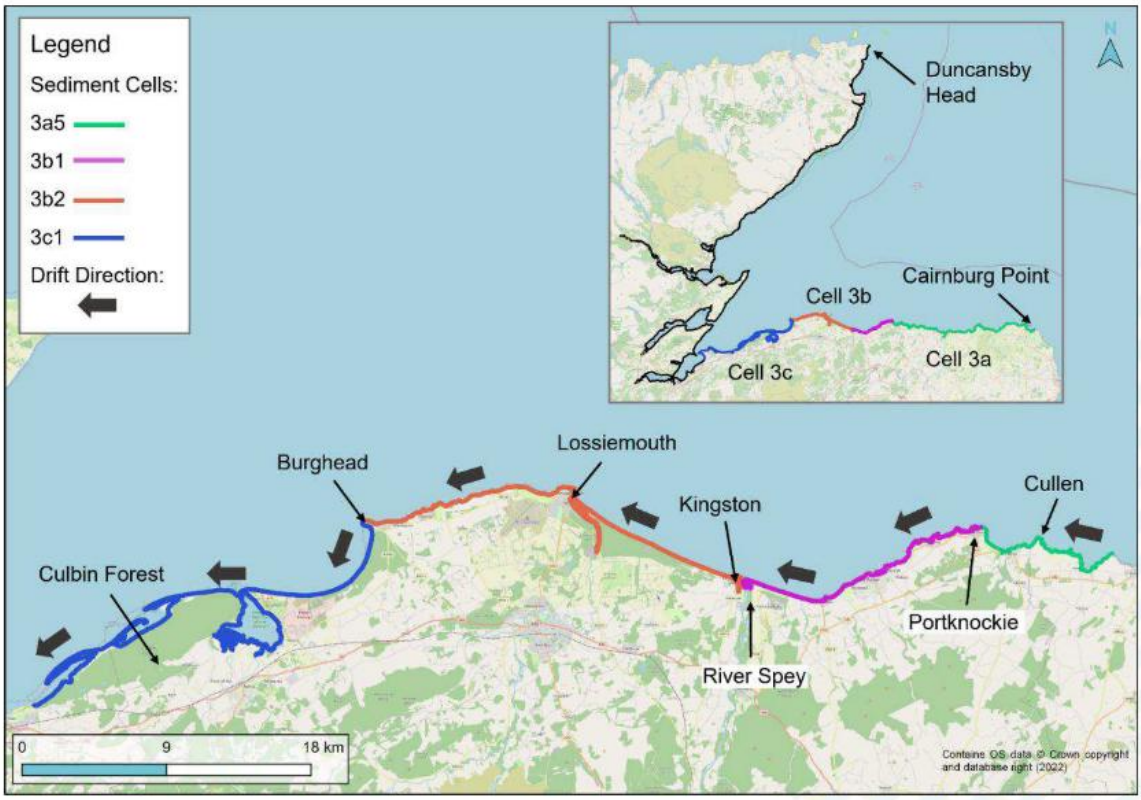


Figure 1-1: Sediment cell boundaries and drift direction at the Moray coastline with key settlements highlighted.

1.2 Geology, morphology, and sediment transport

[14] HR Wallingford (1997) Coastal Cells in Scotland. Scottish Natural Heritage Research, Survey and Monitoring Report No 56.
[15] Ramsay DL and Brampton AH (2000) Coastal Cells in Scotland: Cell 3 – Cairnbulg Point to Duncansby Head. Scottish Natural Heritage.

The type of coastline (soft or hard) is strongly associated to the geology and lithology which, in turn, influences the vulnerability to coastal flooding and erosion in that area. These geological factors also influence the morphology and sediment availability, which can both enhance or reduce risk of flooding and erosion. Bedrock geology and superficial deposits (625k scale) maps sourced from the British Geological Survey (BGS) are shown in Figure 1-2 and Figure 1-3.

Longshore sediment transport is controlled by waves, tides and currents and is also influenced by the type of available sediment (linked to geology) and morphology of the coastline. Coastal erosion or accretion reflects the divergence of alongshore transport, i.e. erosion occurs where there is net sediment deficit and accretion occurs where there is net sediment surplus. Sediment transport is an important consideration when assessing coastal hazards, as the lack, or abundance, of material can greatly influence the level of protection the coast has against flooding and erosion.

The Moray coastline has been subdivided into coastal types at a large spatial scale to help inform the potential type of coastal hazard related to each CA (Figure 1-4, Table 1-1).

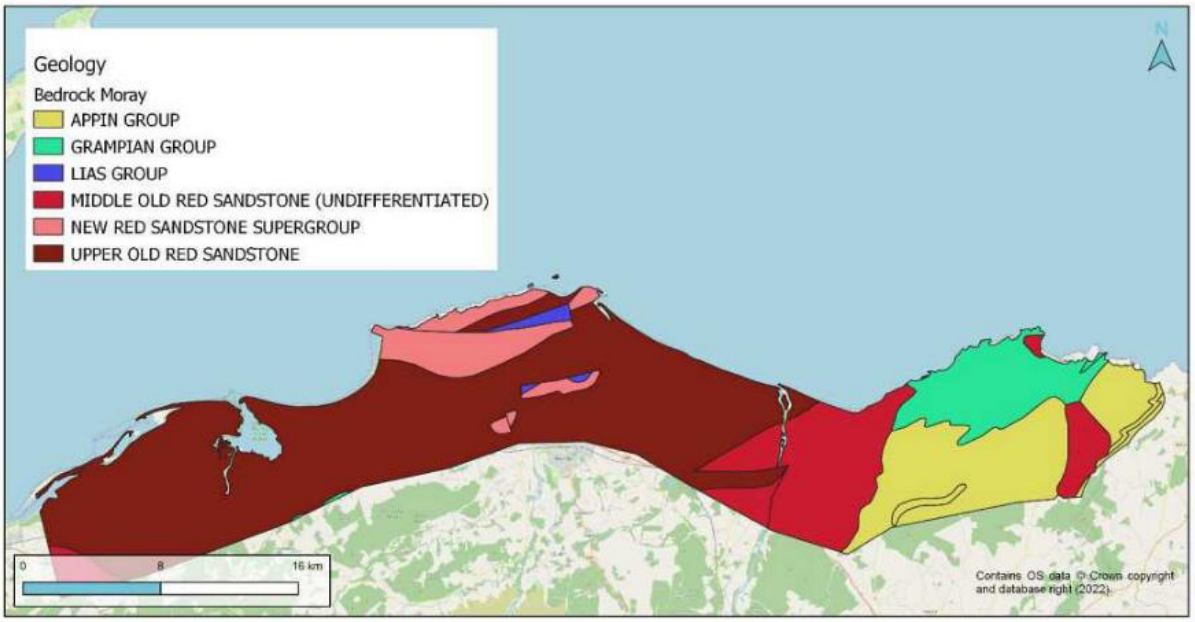


Figure 1-2: Bedrock Geology (BGS) at Moray coast.

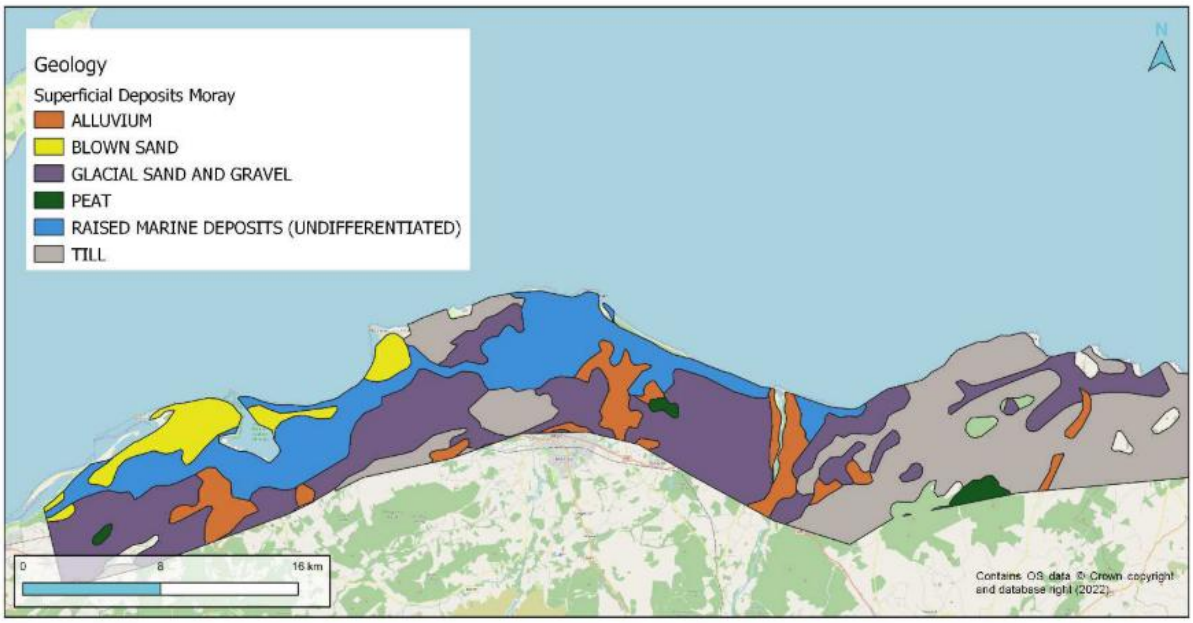


Figure 1-3: Superficial deposits (BGS) at Moray coast.

Figure 1-4: Coast type classification. CA boundaries shown with black dashed lines.

Table 1-1: CAs and coast type classification. Descriptions correspond to coastal type subdivisions in Figure 3-4.

CA	Type	Classification
Culbin to Netherton Coast	Soft	Sand beach
Kinloss to Hatton Coast	Soft	Sand beach and sand dunes
Roseisle to Burghead (South) Coast	Soft	Sand beach
Burghead to Cummingston Coast	Hard	Urban and coastal cliffs
Hopeman to Covesea Coast	Hard	Coastal cliffs, sand beaches and urban
Lossiemouth to Binn Hill Coast	Soft	Sand dunes, sand beaches, rock shore and urban
Kingston to Lower Auchenreath Coast	Soft	Gravel and sand beach
Portgordon to Buckpool Coast	Hard	Rock shore, gravel beach and urban
Buckie to Portessie Coast	Hard	Rock shore and urban
Findochty to Portknockie Coast	Hard	Coastal cliffs
Cullen to Muckle Hythe Coast	Hard	Coastal cliffs, urban and sand beach

1.2.1 Sub-cell 3a

The bedrock geology in sub-cell 3a is dominated by deformed and regionally metamorphosed sedimentary rocks[16]. Slate and Schistose grit dominate at the coast here, and in sub-cell 3b between Portknockie and Buckie.

Old Red Sandstone underlies the Spey Bay coastline but is mostly covered with extensive drift deposits

Between Lossiemouth and Burghead, fine, well-sorted grey to reddish brown sandstones outcrop at the coast.

The cliffs at Hopeman are composed of fine to medium grained, well-sorted aeolian sandstone. Erosion of glacial deposits is the main source of beach material in sub-cell 3b[4].

Old Red Sandstone also dominates the coastal rock between Burghead and Portgordon and the hinterland of Burghead Bay and Culbin is vastly underlain by glacial deposits.

The coastline in sub-cell 3a is dominated by rock coast, with limited and small pocket beaches. Within the Moray section of sub-cell 3a (3a5), a pocket beach is located at Cullen.

1.2.2 Sub-cell 3b

In contrast to sub-cell 3a, sub-cell 3b long beaches are abundant and rock coast is uncommon, except between Portknockie and Portgordon, where the coast is rocky and developed.

To the west of Portgordon, there is extensive quantities of beach sediment occurring within Spey Bay. Shingle dominates the material along the eastern and central section of Spey Bay.

[16] Ramsay D.L. and Brampton A.H. (2000) Coastal Cells in Scotland. Cell 3 – Cairnbulg Point to Duncansby Head. Scottish Natural Heritage.

The hinterland of Spey Bay, extending between Portgordon and Lossiemouth is the largest vegetated shingle complex in Scotland[4]. Sediment transport along the coast at Spey Bay is in a nett westerly direction. New shingle material is supplied by the River Spey and erosion of glacial shingle deposits.

The coast towards Lossiemouth is dominated by sandy sediment and a dune ridge. The westerly direction of material has formed the spit near Lossiemouth and deflected the mouth of River Lossie westwards. The westerly drift and river flows from River Lossie result in transport of material beyond the headland to the west, where sand dominates the beach material between Lossiemouth to Covesea. Rock coast dominates the coastline between Covesea and Burghead.

1.2.3 Sub-cell 3c

In sub-cell 3c, the net wave induced westerly sediment transport continues from Burghead to Whiteness head, east of Nairn.

The plan shape of Burghead Bay is controlled by the headland at Burghead and dominating north-easterly waves and extends to Findhorn. Material eroded from the hinterland is deposited in the centre of Burghead Bay and a healthy shingle ridge has developed at Findhorn.

The Culbin frontage has a complex morphology, controlled mostly by the westward direction of sediment transport. The Bar is a mature feature, is migrating westward and landward and protects the dune system. At present, there is no coastal protection along the Culbin front.

1.3 Hydrodynamics

Hydrodynamics are the ocean processes that influence sediment transport, the shape of the coast and control the flood and erosion risk. For the purposes of coastal adaptation, they are classified into:

- Waves.
- Sea levels (tides and storm surge).

Review, understanding and incorporation of these processes into risk assessments help to inform flood and erosion risk, and how these may change through time. Here we present a range of local and national datasets we can use to help us understand past and future hydrodynamic conditions and associated response of the Moray coastline.

The location of hydrodynamic data points is shown in Figure 1-5 and correspond to data summary points in Table 1-2 and Table 1-3.

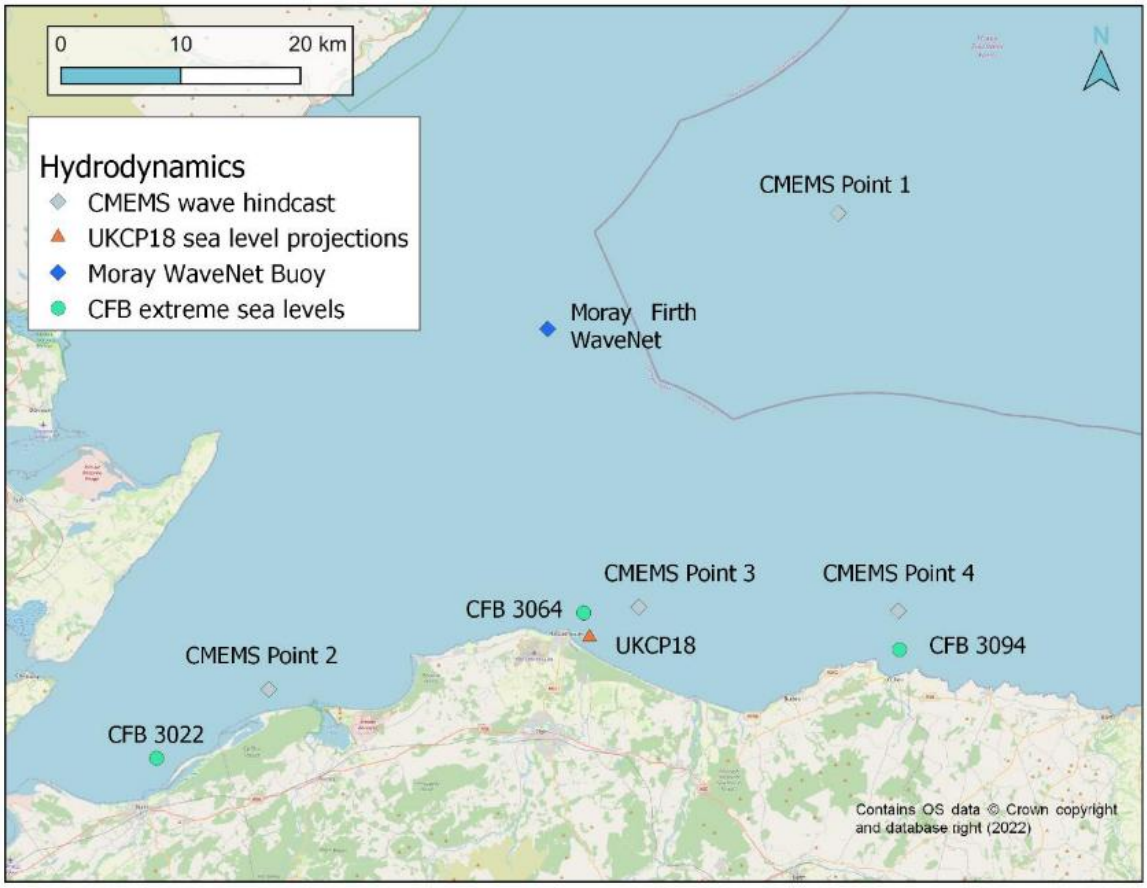


Figure 1-5: Map showing CFB Extreme Sea Levels, CMEMS Wave Hindcast, Moray Firth WaveNet buoy and UKCP18 future sea level projection data points.

1.4 Wave data

Moray Firth WaveNet buoy data collection started in 2008 and can be accessed through Cefas' strategic wave monitoring network WaveNet[17]. This is the only wave buoy located near the Moray coastline, so there is no way to understand how wave climate varies along the coast with this dataset.

To achieve this here, wave data from Copernicus Marine Environmental Monitoring Service (CMEMS) has been used because the consistency in record length, and total coverage of the coastline. This allows consistent relative comparison of wave climate across the coast as well as comparison of offshore to nearshore wave conditions.

CMEMS provides modelled hindcast wave data from 1980 to 2021 using various global and regional models. Here the European NorthWest Shelf Wave Physics Reanalysis product was used (NWSHELF_REANALYSIS_WAV_004_015) to understand variation along the Moray coast. In total four points (1 offshore and 3 nearshore) were extracted and interrogated here (Figure 1-5).

The offshore CMEMS data point (point 1) estimates the highest significant wave heights (H_s), with median H_s of 0.96 m and maximum H_s of 6.95 m between 1980 and 2021 (Table 1-2). Offshore wave direction is most predominantly from north-northeast, east, and east-southeast (Figure 1-6).

Nearshore H_s are smaller than offshore waves, with median H_s ranging from 0.36–0.72 m and maximum H_s ranging from 3.86–6.12 m. Nearshore H_s decreases westwards (as well as

[17] CEFAS (2022) https://wavenet.cefas.co.uk/map

landward): Point 2 has the lowest H_s and with point 4 generally having the highest (Table 1-2).

Wave direction in the nearshore is more focused than offshore, reflecting the transformation processes and refraction due to the bathymetry. Point 2 shows wave direction most frequent from the northeast, but further east, point 3 and point 4, this rotates slightly to north-northeast (Figure 1-7). Overall, this contributes to the net westerly longshore drift of sediment.

Table 1-2: Significant wave height (m) 50th, 75th, 90th-100th percentiles from CMEMS data from 1980 to 2022.

Percentiles	Wave point 1 offshore	Wave point 2	Wave point 3	Wave point 4
50th	0.96	0.36	0.62	0.72
75th	1.41	0.59	0.96	1.12
90th	1.99	0.89	1.43	1.65
95th	2.45	1.14	1.82	2.06
97.5th	2.93	1.38	2.20	2.49
99th	3.53	1.71	2.69	3.03
100th (max)	6.95	3.86	5.60	6.12

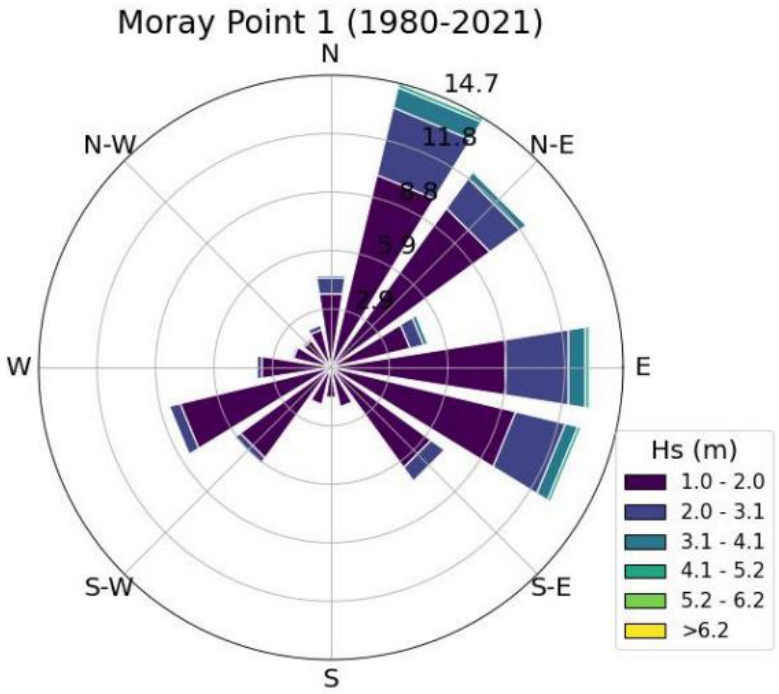


Figure 1-6: Wave rose for the offshore Moray CMEMS data point

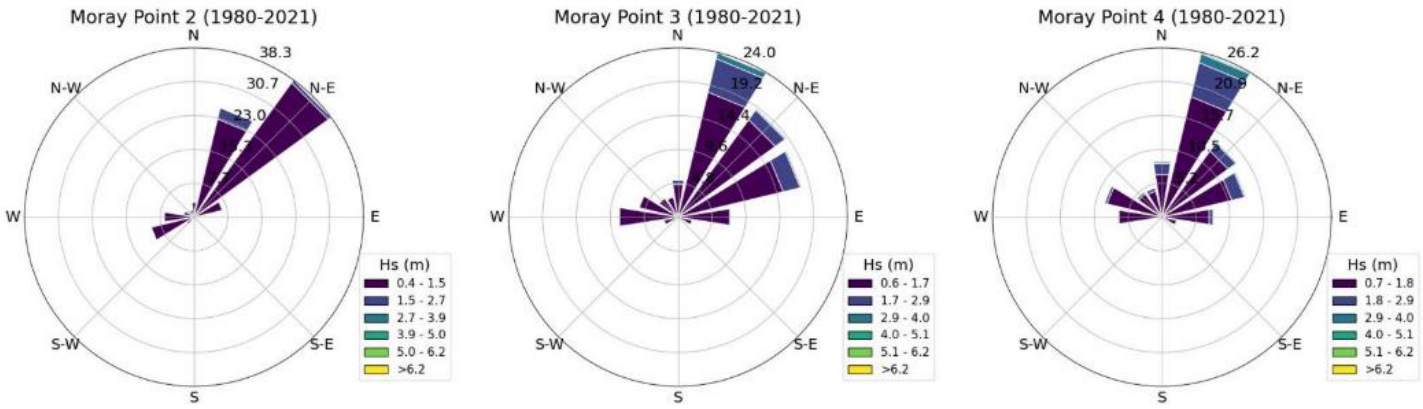


Figure 1-7: Wave roses for the three Moray nearshore CMEMS data points

1.5 Sea levels

The data used to understand present and future sea levels are summaries in Table 1-3. Three secondary non-harmonic port locations from Admiralty TotalTide were used to define astronomical tide levels. The SEPA tide gauge at Buckie provides the only known source of current sea level data collection. This, along with the Class-A gauge at Aberdeen provides the evidence of observed sea levels. Extreme sea level estimates are defined through three Coastal Flood Boundary (CFB) data points. Future sea level projections are taken from the UKCP18 dataset.

Table 1-3: Sea level data summary

Dataset name	Data type	Source	Temporal coverage
SEPA Buckie gauge	Tide Levels	SEPA	2001–2022
Admiralty TotalTide (Burghead, Lossiemouth, Buckie)	Tide Levels	Admiralty UKHO	N/A
Coastal Flood Boundary (CFB) (Points 3022, 3064, 3094)	Extreme sea levels	Environment Agency	2018
Aberdeen mean sea level gauge	Mean sea levels	Permanent Service for Mean Sea Level	1931–2022
UKCP18 (325637, 870712)	Sea level projections	UKCP18	Derived for epochs 2050 and 2100

1.5.1 Tides

Tides are the regular variability in sea level elevation because of the gravitational forces exerted by the sun and moon. They are predictable and form the base component of total sea level. The Moray coast experiences a semi-diurnal regime (two high and low tides per day).

Tide levels for port locations Nairn (just west of Culbin Forest), Burghead, Lossiemouth and Buckie are summarised in Table 1-4. All four locations are secondary non-harmonic ports, with predictions based on the primary harmonic port at Aberdeen.

Tide levels are consistent across the three port locations at Moray coast. The tidal regime of the Moray coastline is mesotidal, with a typical spring range between -1.5–2.0 m. Mean High Water Spring (MHWS) is approximately 2.0 m above ordnance datum (mAOD).

Table 1-4: Tide Levels (mAOD) along the Moray coast from TotalTide.

Tide Level	Nairn	Burghead	Lossiemouth	Buckie
HAT	2.9	2.5	2.5	2.5
MHWS	2.2	2.0	2.0	2.0
MHWN	1.2	1.1	1.1	1.1
MSL	0.13	0.08	-	-
MLWN	-0.5	-0.5	-0.5	-0.5
MLWS	-1.4	-1.5	-1.5	-1.6
LAT	-2.1	-2.1	-2.1	-2.0

1.5.2 Sea levels

SEPA began recording sea level with the Buckie tide gauge 2001[18]. Highest, lowest, and average level recorded by the SEPA Buckie tide gauge is summarised in Table 1-5. The highest level recorded occurred during the December 2013 storm event, estimated to have a 250-year return period at Buckie. This event was responsible for widespread coastal flooding in both Moray and across the UK[19].

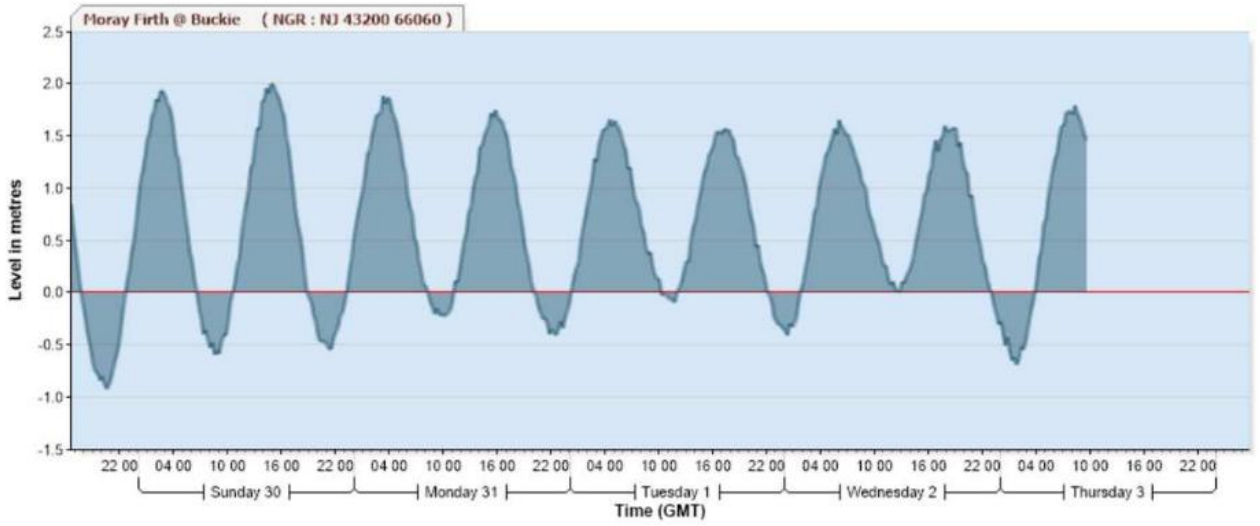


Figure 1-8: Example sea level data record (30 October to 3 November 2022) from Buckie tide gauge.

Table 1-5: Data summary from SEPA Moray Firth Buckie tide gauge.

[18] SEPA (2022) SEPA Water Levels - Moray Firth @ Buckie
[19] https://www.surgewatch.org/events/1/

Buckie Tide Gauge Summary*	
Record start date	June 2001
Record end date	Ongoing
Highest level on record*	3.01 m (05/12/2013)
Lowest level on record	-2.36 m
Average level on record	0.32 m
*levels assumed to be referenced to Ordnance Datum Newlyn	

The Coastal Flood Boundary dataset (CFB)[20] provides extreme sea level estimates at a 2 km spacing around the UK coastline. This project was commissioned by the Environment Agency and Defra. Table 1-6 provides a summary of 2018 referenced sea levels at three points along the Moray coastline, with Culbin at the westward margin, Cullen at the eastward margin and Lossiemouth approximately central. Extreme sea levels increase westwards, towards Moray Firth. While this is partially because of the surge propagation into the inner Firth, it is evident in the underlying tidal regime (for the same reason). In this part of the Scottish coast, the tidal regime itself provides a key control on the overall total sea level.

Table 1-6: Coastal flood boundary extreme sea level estimates across Moray

Return period	CFBD Point_3022 ESL (mAOD) (Culbin)	CFBD Point_3064 ESL (mAOD) (Lossiemouth)	CFBD Point_3094 ESL (mAOD) (Cullen)
MHWS	2.26	2.04	2.00
2 year	2.89	2.75	2.62
50 year	3.19	3.04	2.92
100 year	3.26	3.10	2.98
200 year	3.32	3.17	3.04
1000 year	3.47	3.32	3.18

[20] Environment Agency (2018) Coastal flood boundary conditions for the UK: update 2018

2. Sea level rise

2.1 Mechanisms

Critical to adaptation on the coast is the change in flood, erosion and erosion induced flood risk because of climate change. While changes to the wave and storm surge climate may occur, these are superimposed on the impacts of rising mean sea level. Sea level rise (SLR) is complex and involves both changes to the sea surface and the level of the land. Although there are multiple global and local factors that can influence the rate of SLR, and absolute increase in SLR, the main causes can be reduced to three factors[21]:

1. Ocean expansion as water temperatures increase.
2. Addition of water from melt of land-based ice sheets and glaciers.
3. Changes to land water storage.

Additional factors that may alter SLR at a specific location relative to the global mean SLR include local ocean changes, changes in the Earth's gravity field and vertical land motion. In Scotland, for example, SLR is still being partially offset by glacial isostatic rebound.

During the last glacial period, Scotland was mostly covered by a large ice sheet that suppressed the land. Following the melt of this ice sheet, starting approximately 20,000 years ago, glacial isostatic rebound is causing the ongoing rise of land elevation still today across Scotland[22]. This land uplift caused by glacial isostatic rebound has however slowed over time and is now outpaced by global sea level rise[23].

Greenhouse gases, specifically carbon dioxide, can stay in the atmosphere for centuries after it has been emitted; this causes a lag in the response of the climate system. A further lag is caused by ocean temperature adjustment and glacial melting. Practically, it means that if human-produced carbon dioxide emissions were to stop entirely today, the associated atmospheric warming and sea level rise would continue for decades, and potentially 1,000 years[24]. Although there are uncertainties associated with the magnitude of future SLR, linked to future greenhouse gas emissions, continued SLR because of this system lag is evidenced and guaranteed. A minimum of 30cm of global SLR is projected for the year 2100 no matter what, likely much more[25].

Consequentially, flood and erosion risk are widely expected to increase over the 21st century and beyond under all future emission scenarios considered[26].

2.2 Historic SLR

Global SLR has been measured using satellite altimeters for the past 27 years. From 1993 to present, the average rate of global SLR has been measured as 3.34 mm/yr [27]. In contrast, gauges have shown mean sea level around the UK has risen by 1.4 mm/yr from the start of the 20th century[28]. It is irrefutable that human activities are the main driver of observed global mean SLR since 1971[29].

At a local level, the Class-A tide gauge at Aberdeen has recorded mean sea level from 1931 to present-day. Here, from 1932–2014 (year 0 to year 82, Figure 2-1), mean sea level has risen

[21] Met Office (2022) https://www.metoffice.gov.uk/weather/climate-change/organisations-and-reports/past-and-future-sea-level-rise
[22] SEPA (2022) CCAP
[23] Rennie and Hansom (2011) Sea level trend reversal: Land uplift outpaced by sea level rise on Scotland's coast. Geomorphology. 125-1.
[24] Chu (2017) https://climate.nasa.gov/news/2533/short-lived-greenhouse-gases-cause-centuries-of-sea-level-rise/
[25] Lowe et al. (2019) Met Office Hadley Centre Climate Briefing Note. Met Office.
[26] Met Office (2018) UKCP18 Science Overview report
[27] Beckley et al. (2017) On the "Cal-mode" Correction to TOPEX Satellite Altimetry and Its Effect on the Global Mean Sea Level Time Series. 122 (11) *JGR Oceans.*
[28] SEPA (2022) Coastal Change Adaptation Plan Guidance.
[29] Arias P.A. et al. (2021) Technical Summary. *Climate Change 2021: The Physical Science Basis. Contribution of Working Group 1 to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*.

at an average rate of 0.97 mm/yr [30]. From 1975–2014 (year 43 to year 82, Figure 2-1) however, the rate of average mean sea level rise has increased to 3.8 mm/yr, higher than the global average (Figure 2-1).

Compartmentalising the gauge data shows different trends and supports the suggestion that SLR is increasing, as observed in global satellite data.

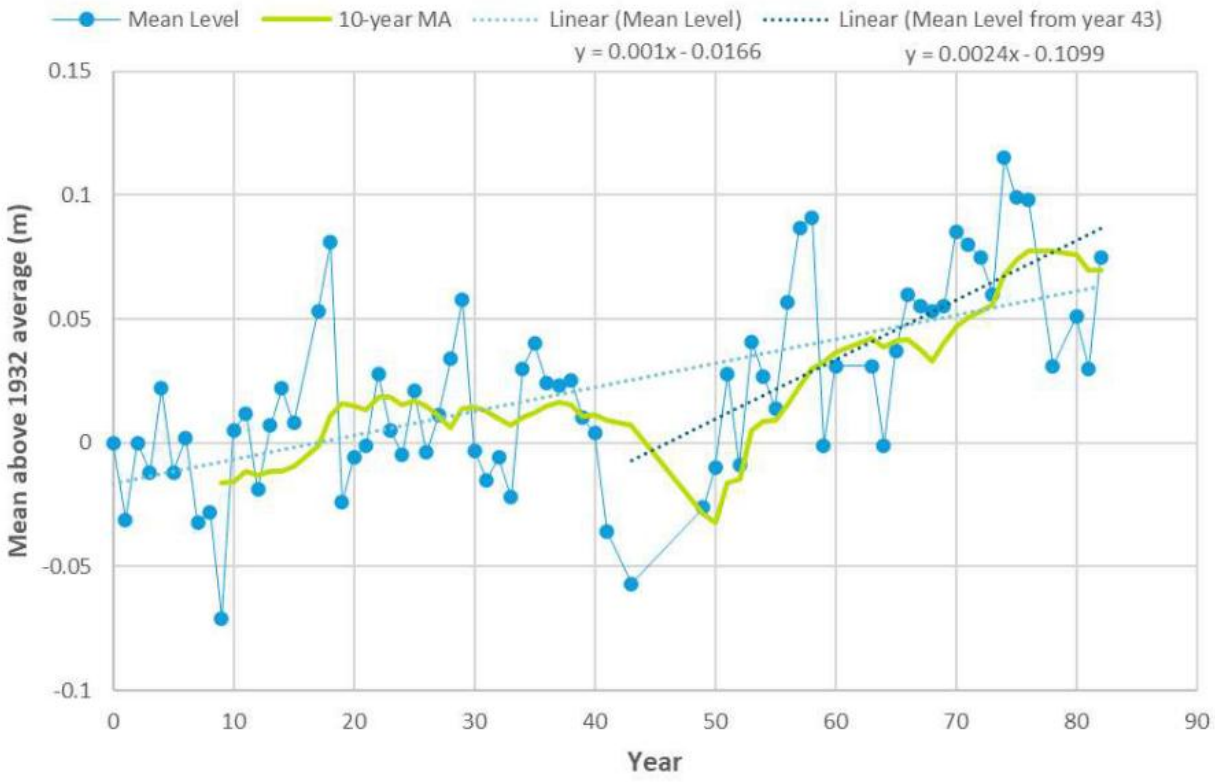


Figure 2-1: Mean sea level above 1932 average at Aberdeen gauge station. The green line shows a 10-year moving average (MA) and the dashed line shows the linear trend in mean sea level from 1932.

2.3 Future predictions

To predict coastal risks under future climate change, forecasts of sea level rise are needed. In 2018 The UK Climate Projections (UKCP18) estimated the potential relative increase in sea level. The data derived in UKCP18 provides the local time-mean sea level projection of relative sea level change around the UK under a range of Representative Concentration Pathways (RCP) scenarios. RCP scenarios are used to model future climate evolution, including SLR, by considering economic, social, and physical changes to the environment that will influence climate change.

RCPs relate to Shared Socio-economic Pathways (SSPs), as used in the 2020 IPCC special report[31]. The concentration of greenhouse gases represented in each RCP scenario results in a range of global mean temperature increases (Table 2-1).

Table 2-1: Representative Concentration Pathways (RCPs) and associated global temperature increase.

[30] Sea level and tides (2022) https://marine.gov.scot/sma/assessment/sea-level-and-tides.
[31] IPCC (2022) Summary for Policy Makers. 2020 Intergovernmental Panel on Climate Change.

RCP	Change in Temperature by 2100 (°C)
RCP2.6	1.6 (0.9–2.3)
RCP4.5	2.4 (1.7–3.2)
RCP6.0	2.8 (2.0–3.7)
RCP8.5	4.3 (3.2–5.4)

In 2015 the Paris Agreement set goals to limit global warming to preferably 1.5°C[32]. Recent reports show that, even with national pledges to reduce greenhouse gas emissions, there is now no credible pathway to 1.5°C[33]. Even if a warming projection of 1.5°C was possible, this would still result in ~20 cm of SLR at the Moray coast by 2100 (Figure 2-3).

The 2030 gap between the, now unachievable, 1.5°C and the current policy and action driven +2.5-2.9°C of warming is substantial (Figure 2-2). The warming projection based on current policy and actions (+2.5-2.9°C) is expected to result in more than 60 cm of SLR at the Moray coast by 2100 (Figure 2-3). This means actions taken in the next ten years are critical to the warming projection pathway and resultant magnitude of sea level rise for the next century and beyond.

Current global policies are projected to result in ~2.7°C of warming[34], but the current trajectory of global warming and associated sea level rise is following the RCP8.5, or High Emission Scenario (HES) scenario[35] (Figure 2-2).

Compared to the recent trend in emissions and global temperature, immediate action is necessary to have any real chance of limiting the impact of SLR.

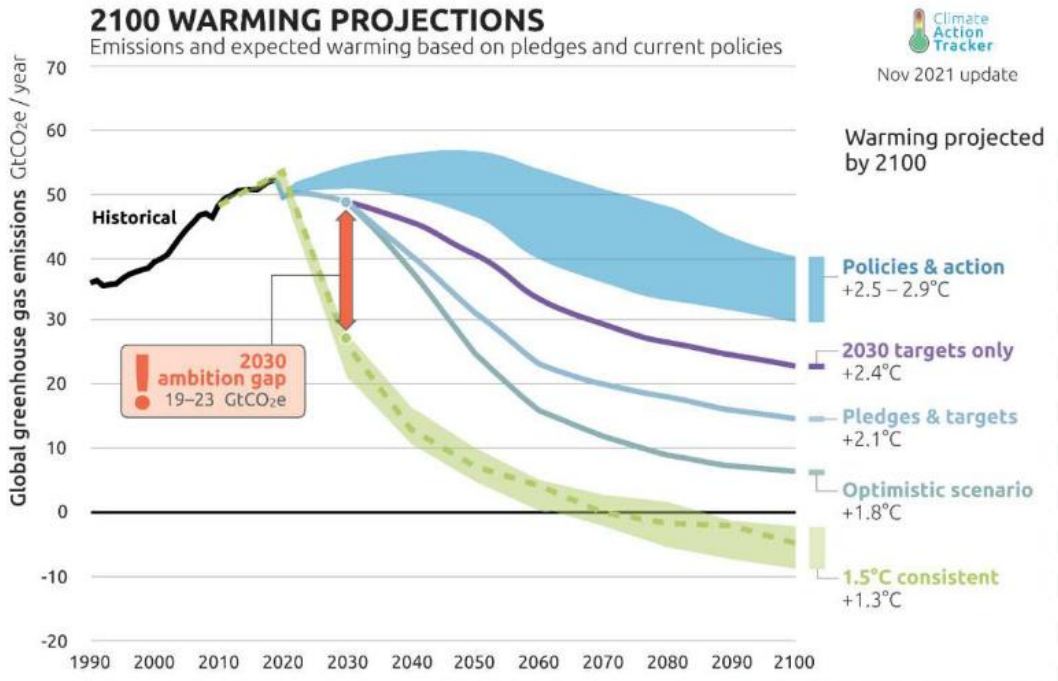


Figure 2-2: 2100 global warming projections based on different emission scenarios. Credit: Climate Action Tracker[36].

[32] UNFCCC (2022) The Paris Agreement. https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement.
[33] United Nations Environment Programme (2022) The Closing Window. Emissions Gap Report 2022
[34] Climate Action Tracker (2021) https://climateactiontracker.org/global/temperatures/
[35] Schwalm, C.R., Glendon, S., & Duffy, P.B. (2020) RCP8.5 tracks cumulative CO2 emissions. Proceedings of the National Academy of Sciences, 117(33), 19656-19657
[36] Climate Action Tracker (2021) https://climateactiontracker.org/global/temperatures/

For the UK, UKCP18 provides estimates of future sea level rise. The UKCP18 SLR data used here were taken from the grid location with latitude longitude coordinates of (57.72, -3.25). The 70th and 95th percentile confidence estimates from the RCP8.5 scenario are summarised in Table 2-2. For the 95th percentile, the relative increase in sea level of 0.2 m in 2050 and 0.84 m in 2100 is relative to the sea level in 2022. The most extreme (low likelihood but credible) scenario projects relative sea level to increase by as much as ca. 1.8 m by 2100[37] and should be considered for very long-term decision making or critical infrastructure planning.

SEPA has as set out a climate change allowance, which is a prediction of anticipated change, in this case in SLR, caused by future climate change[38]. Moray is in the North Highland region and has been assigned a cumulative SLR of 0.89 m between 2017 and 2100.

Table 2-2: UKCP18 relative sea level rise uplifts for years 2050 and 2100, relative to the year 2022.

Year	70th percentile (m)	95th percentile (m)
2050	0.15	0.20
2100	0.59	0.84

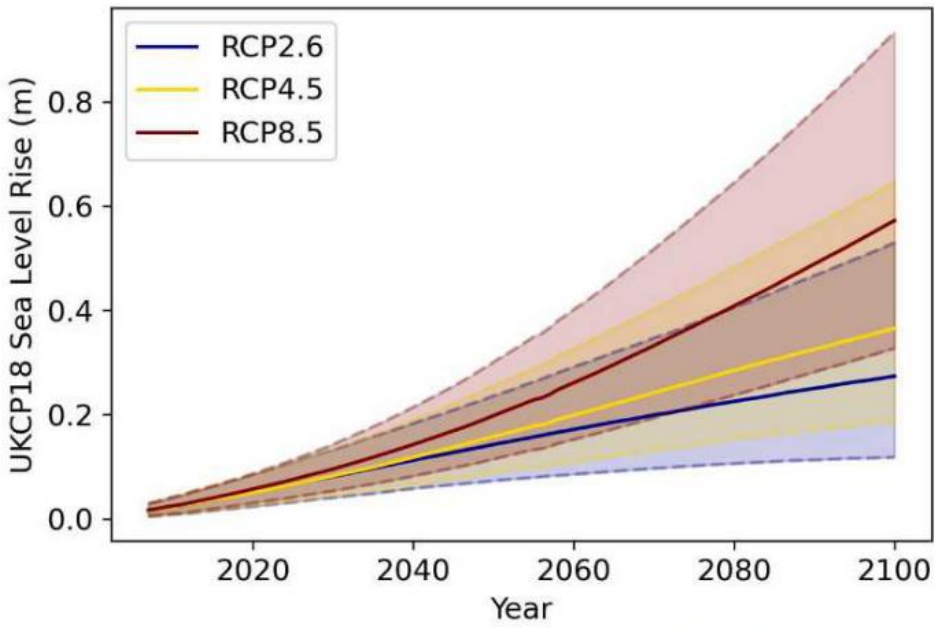


Figure 2-3: UKCP18 future sea level rise projections for RCP2.6, RCP4.5 and RCP8.5 scenarios at Moray. Bold lines show the 50th percentile and dashed lines show the 5th and 95th percentiles with area shaded in between.

[37] Met Office (2023) Past and future sea level rise - Met Office
[38] SEPA (2022) Climate change allowances for flood risk assessment in land use planning. Version 2.

Part C – Local Plan Prioritisation

1. Local Coastal Change Adaptation Plans

1.1 Plan prioritisation

This Coastal Adaptation Plan, and the subsequent Local Plans, form the first phase in the coastal adaptation journey for Moray. To identify initial Local Plans, a prioritisation exercise was undertaken. This developed a prioritisation matrix scoring system to enable relative comparisons of CAs to be made.

1.2 Influence factors and Indicators

The Regional CCAP has been developed by defining a series of **Influence Factors** that underpin the motivations, opportunities, and causes for adaptation. The four key pillars (Part A – Section 2.4) have been used to derive five Influence Factors:

- Flood and erosion hazards
- Climate change
- Present-day demographic make-up
- Development potential
- Economic potential

The prioritisation of each CA uses these factors as a basis and develops a series of quantifiable **Indicators** against which CAs can be evaluated. Using available data, values for each Indicator are calculated for each CA, weighted, standardised, and combined into a prioritisation score. Each CA is then ranked according to their overall score to identify where Local CCAPs will initially be developed.

The section below provides a summary of the Indicators developed for the prioritisation. Full details of the datasets used within each is provided in Appendix A.1.

Please note that planned new or future assets are not included in the assessments below. Given future development outlined in the current LDP[39] , particularly in built-up areas, these indicators are likely underestimating the risks to 2100 and beyond.

Risk Indicators

- **Properties**

From Dynamic Coast, the number of current residential and non-residential properties within the coastal erosion vicinity at 2100 are counted in each CA. The SEPA NFRA data is used to count the number of residential and non-residential properties at risk from a 1 in 200-year flood now and in the future.

Units used: count.

- **Roads**

From Dynamic Coast, the length of road per unit area within the coastal erosion vicinity at 2100 is calculated for each CA. Similarly, the length of road per unit area at risk of flooding from a 1 in 200-year flood event now and in the future is determined using SEPA's NFRA data for CA.

Units used: length/unit area (m/km^2).

- **Utilities**

[39] Moray Council. (2020). Moray Local Development Plan. http://www.moray.gov.uk/moray_standard/page_133431.html

For utilities at risk of damage from coastal erosion, the Dynamic Coast datasets of assets (sourced from Scottish Water, Scottish Government and SEPA) are used. The number of rising mains, outfalls, operational sewers, gravity pipes, clean water, and utilities within the coastal erosion vicinity at 2100 are counted in each CA. SEPA NFRA utilities at risk of flooding from a 1 in 200-year flood now and in the future were also calculated for each CA.

Units used: count.

- **Coastal change**

While future estimates of erosion are important to plan for adaptation, it is also important to consider the evidence of where historic change has taken place and the coastline has changed. Risk to properties, roads and utilities are used to assess potential risk of future coastal change (see above). For evidence of change, Dynamic Coast historic rates are used to quantify the past observed coastal change across the Moray coast. The maximum and average rate of historical shoreline change from as far back as the year 1963 to present-day are used as inputs for each CA.

Units used: rate (m/yr).

Management Indicators

- **Hard measures to alleviate risk**

A recent Environment Agency assessment has shown a staggering increase in predicted future maintenance and repair costs for maintaining hard coastal assets in our changing climate[40]. Adaptation will require in-depth understanding of existing assets and maximisation of performance. Existing built strucutres are therefore key. To incorporate this, length of artificial coastal structure that Moray Council has responsibility for is calculated for each CA. The objective of this is to draw attention to those CAs where these structures are classed as formal "defences" and to prioritise them appropriately for more detailed local actions. These are defined as structures on the coastline (i.e. not harbour walls) that Moray Council has a direct responsibility to maintain. Private defences or other coastal structures are not considered.

As such, defence condition or type is not considered regionally. In the Local CCAPs it will however be important to consider the residual design life of existing assets and to use any planned decommissioning and/or replacement of these as windows of opportunity to initiate a particular phase on an Adaptation Pathway.

Unit used: length (m).

- **Natural assets to alleviate risk**

To highlight the importance of working with natural systems, another defence category is included to represent naturally defended, such as by the dune systems at Lossiemouth and barrier beach at Kingston.

Unit used: yes/ no.

- **Demographic Indicator**

The Scottish Index of Multiple Deprivation (SIMD) is used to assess the deprivation of each local plan area. The SIMD score considers income, employment, education, and accessibility to healthcare. Inclusion of the demographic Influence Factor in the prioritisation ensures a community focus is considered when selecting sites for local development plans. An inverse weighting is applied so the lowest SIMD Rank (the most deprived) will be given the highest weighting in the prioritisation matrix.

Unit used: SIMD rank.

- **Nature-based Risk Alleviation Development Indicator**

[40] Environment Agency. (2020). Impact of climate change on asset deterioration. Report – SC12005/R1

Development opportunities and potential for widening use of nature-based solutions to increase resilience to coastal change forms a large part of adaptive management. The Development Indicator is calculated by summing the area of the greenspace within 1 km of the coast from Dynamic Coast data and the Moray Council designation areas per unit area of the local plan area in each of the units.

Unit used: area/unit area (m^2/km^2).

- **Economic Indicator**

Adaptation should promote multiple benefits and seek to support the economic growth opportunities and targets within Moray. The Economic Indicator is calculated by counting the number of non-residential properties per unit area in each local plan area from the SEPA NFRA dataset. The number of non-residential properties is a basic proxy for current economic value.

Unit used: count/ unit area.

2. Community Area Summaries

2.1 Culbin to Netherton Coast

Overall, Indicator scores for the Culbin to Netherton Coast are average to low in comparison to other CAs. The exception being that it has the highest historical coastal change, with a maximum 5.1 m/yr and average of 1.36 m/yr, located at the Culbin Sands spit.

Despite high historical coastal erosion rates, there are relatively few assets at risk of both erosion and flooding (Figure 2-1). Culbin Forest makes up a large portion of CA. Most assets at risk are of flooding are located south of Findhorn Bay. This CA has one of the lowest Economic Influence Factor compared to the other CAs and currently has no formal coastal defences in place.

Overall, the CA is ranked 6th in the first iteration of the prioritisation calculation.

Table 2-1 summarises influence factor results for Culbin to Netherton Coast.

Table 2-1: Culbin to Netherton Coast influence factor results for prioritisation calculation inputs.

Influence Factor	Description and Unit	Details	Value
Risk	Properties at risk (count)	1 in 200-year flood present day	5
		1 in 200-year flood climate change	10
		DC 2100	0
	Roads at risk (length per unit area (m/km^2))	1 in 200-year flood present day	65.1
		1 in 200-year flood climate change	119.1
		Erosion climate change	0
	Utilities at risk (count)	1 in 200-year flood present day	0
		1 in 200-year flood climate change	0
		DC 2100	0
	Historical Coastal Change Rate (m/year)	Maximum in CA	-5.1
		Average in CA	-1.36
Management	Length of hard Defences (m)	Formal defences under Moray Council responsibility	0
	Natural Defences (Yes/No)	Do natural features form a flood defence	No
Demographics	SIMD (score)	Average SIMD (Inverse corrected)	233
Development	Area of coastal greenspace and identified development (m^2/km^2)	Summation of areas divided by CA area	32,731
Economics	Non-residential Properties (count)	Total number of non-res properties in CA	5.02

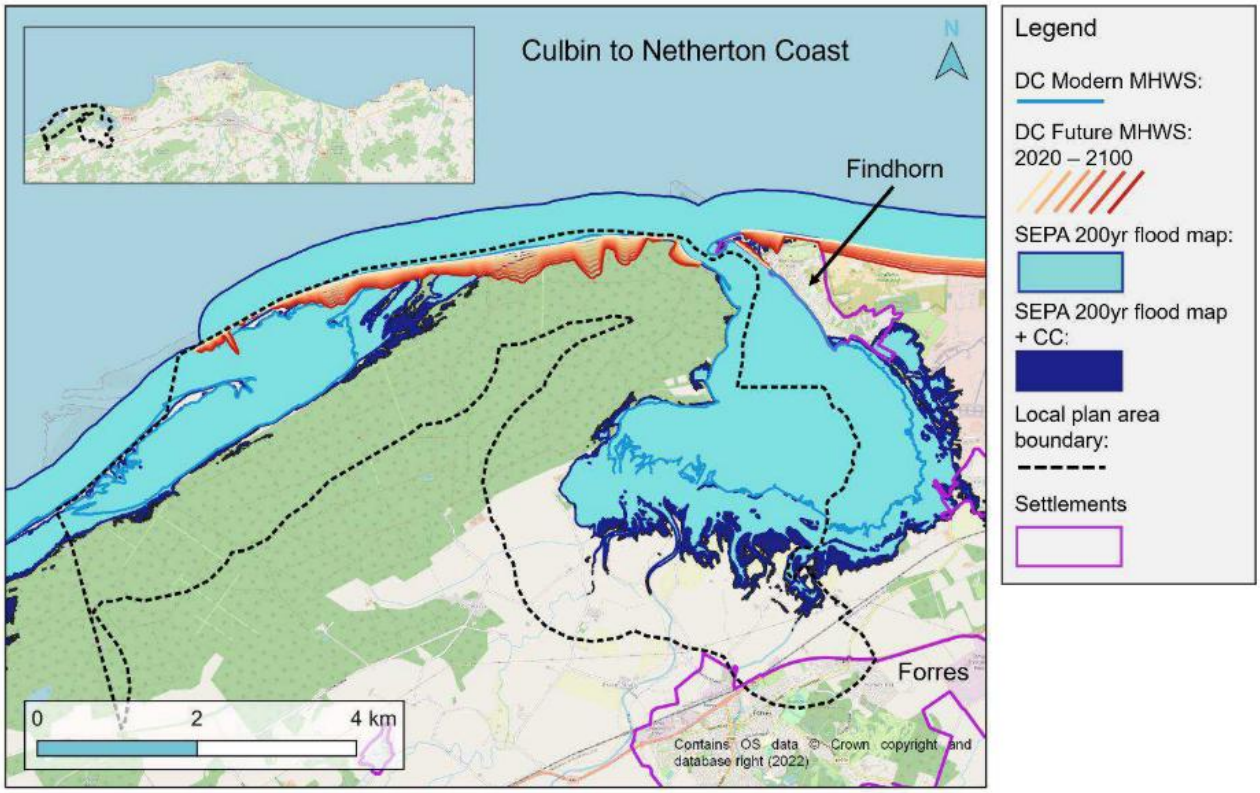


Figure 2-1: Culbin to Netherton Coast Community Area showing settlement areas, SEPA flood maps and Dynamic coast present-day and forecast shorelines.

2.2 Kinloss to Hatton Coast

Kinloss to Hatton Coast CA has the highest scores for assets at risk of flooding, including properties, roads and utilities. Assets at risk from both coastal erosion and flooding are located north-west of Findhorn town, near the spit (Figure 2-2). Whereas assets at risk from flooding alone are located to the east of Findhorn Bay: Findhorn Ecovillage, Kinloss and Kinloss Barracks. Findhorn has no coastal defences maintained by Moray Council. The CA contains the southern part of Burghead Bay, and the historical rate of coastal change and other influence factor are in the mid-range of the other CAs.

Overall, the CA is ranked 7th in the first iteration of the prioritisation calculation.

Table 2-2 summarises influence factor results for Kinloss to Hatton Coast.

Table 2-2: Kinloss to Hatton Coast influence factor results for prioritisation calculation inputs.

Influence Factor	Description and Unit	Details	Value
Risk	Properties at risk (count)	1 in 200-year flood present day	39
		1 in 200-year flood climate change	80
		DC 2100	79
	Roads at risk (length per unit area (m/km^2))	1 in 200-year flood present day	229.4
		1 in 200-year flood climate change	374.6
		DC 2100	35.8
	Utilities at risk (count)	1 in 200-year flood present day	4
		1 in 200-year flood climate change	4
		Erosion climate change	245
	Historical Coastal Change Rate (m/year)	Maximum in CA	-1.6
		Average in CA	-0.26
Management	Length of hard Defences (m)	Formal defences under Moray Council responsibility	0
	Natural Defences (Yes/No)	Do natural features form a flood defence	No
Demographics	SMID (score)	Average SIMD (Inverse corrected)	212
Development	Area of coastal greenspace and identified development (m^2/km^2)	Summation of areas divided by CA area	76,100
Economics	Non-residential Properties (count)	Total number of non-res properties in CA	29.23

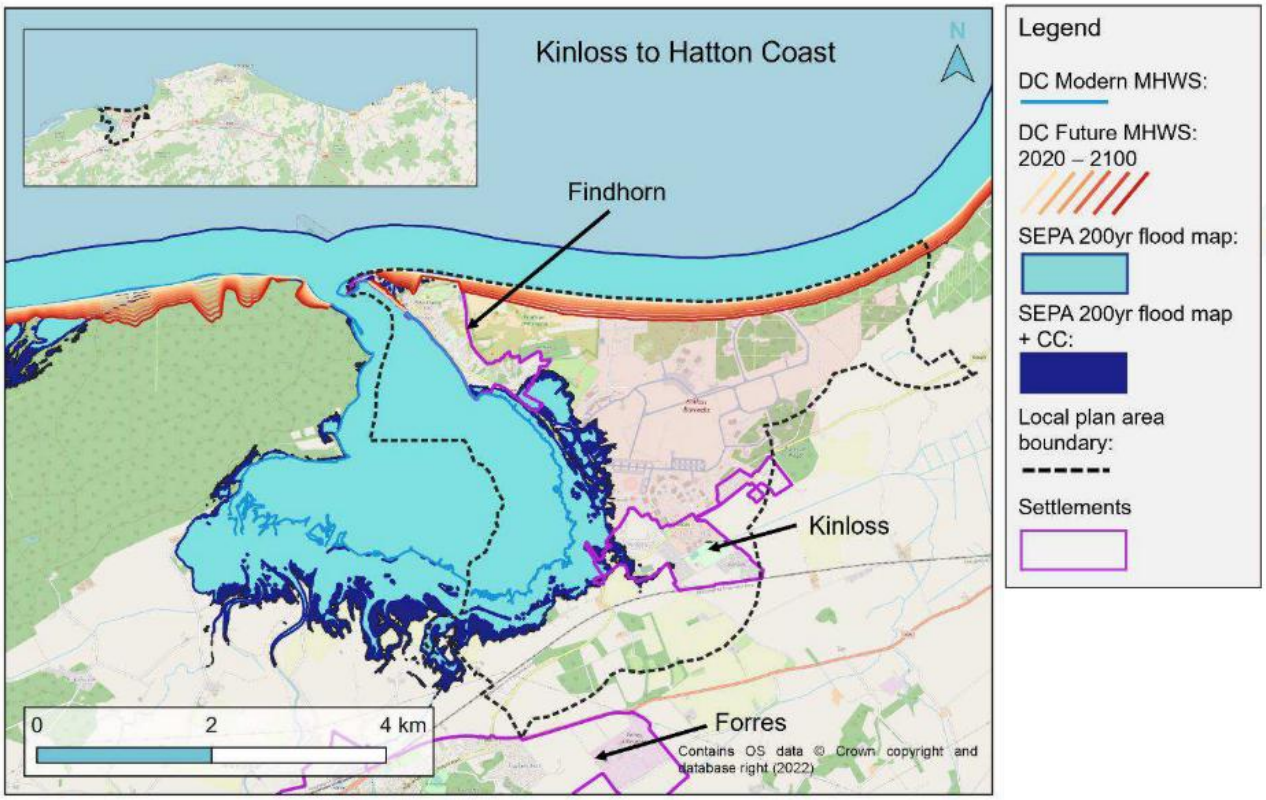


Figure 2-2: Kinloss to Hatton Coast local plan area showing settlement areas, SEPA flood maps and Dynamic coast present-day and forecast shorelines.

2.3 Roseisle to Burghead (South) Coast CA

Roseisle to Burghead (South) Coast has some of the lowest scores in the prioritisation calculation across all influence factors. Risk from flooding and erosion is negligible compared to other CAs. Roseisle Forest makes up the entire coastline of the CA (Figure 2-3). It also has one of the lowest Development Influence Factor of 190 and lowest Economic Influence Factor of 2.17.

Overall, the CA is ranked 11th in the first iteration of the prioritisation calculation.

Table 2-3 summarises influence factor results for Roseisle to Burghead (South) Coast.

Table 2-3: Roseisle to Burghead (South) Coast influence factor results for prioritisation calculation inputs.

Influence Factor	Description and Unit	Details	Value
Risk	Properties at risk (count)	1 in 200-year flood present day	0
		1 in 200-year flood climate change	0
		DC 2100	1
	Roads at risk (length per unit area (m/km^2))	1 in 200-year flood present day	0
		1 in 200-year flood climate change	0
		DC 2100	16.3
	Utilities at risk (count)	1 in 200-year flood present day	0
		1 in 200-year flood climate change	0
		Erosion climate change	0
	Historical Coastal Change Rate (m/year)	Maximum in CA	-0.4
		Average in CA	+0.02
Management	Length of hard Defences (m)	Formal defences under Moray Council responsibility	0
	Natural Defences (Yes/No)	Do natural features form a flood defence	No
Demographics	SMID (score)	Average SIMD (Inverse corrected)	190
Development	Area of coastal greenspace and identified development (m^2/km^2)	Summation of areas divided by CA area	1782
Economics	Non-residential Properties (count)	Total number of non-res properties in CA	2.17

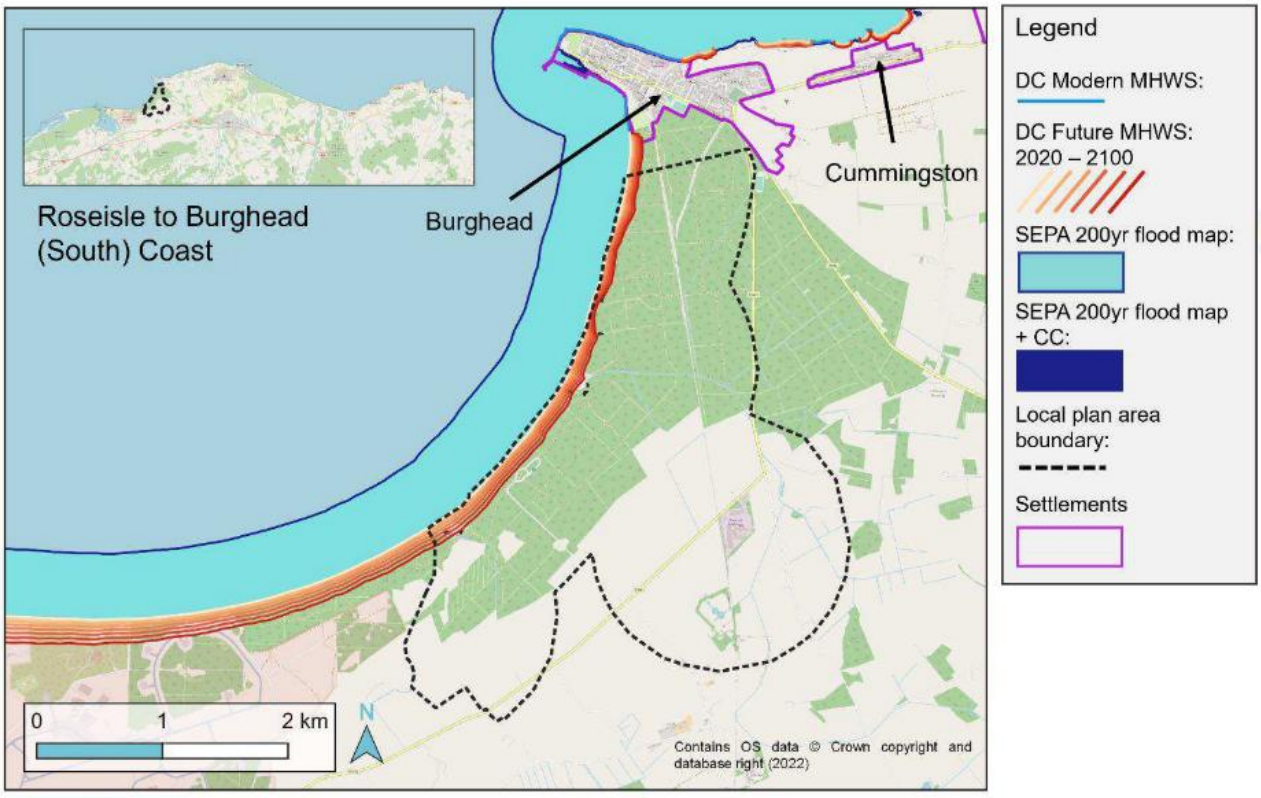


Figure 2-3: Roseisle to Burghead (South) Coast local plan area showing settlement areas, SEPA flood maps and Dynamic coast present-day and forecast shorelines.

2.4 Burghead to Cummingston Coast CA

For all influence factor categories, the scores for Burghead to Cummingston Coast are mid-range compared to all other CAs. Assets at risk from flooding are located at Burghead Harbour (Figure 2-4). Assets at risk from flooding and erosion are located along the coastline east of Burghead town and north of Cummingston.

Overall, the CA is ranked 8th in the first iteration of the prioritisation calculation.

Table 2-4 summarises influence factor results for Burghead to Cummingston Coast.

Table 2-4: Burghead to Cummingston Coast influence factor results for prioritisation calculation inputs.

Influence Factor	Description and Unit	Details	Value
Risk	Properties at risk (count)	1 in 200-year flood present day	1
		1 in 200-year flood climate change	4
		DC 2100	6
	Roads at risk (length per unit area (m/km^2))	1 in 200-year flood present day	10.8
		1 in 200-year flood climate change	42.7
		DC 2100	23.8
	Utilities at risk (count)	1 in 200-year flood present day	0
		1 in 200-year flood climate change	1
		Erosion climate change	232
	Historical Coastal Change Rate (m/year)	Maximum in CA	-0.4
		Average in CA	-0.06
Management	Length of hard Defences (m)	Formal defences under Moray Council responsibility	0
	Natural Defences (Yes/No)	Do natural features form a flood defence	No
Demographics	SMID (score)	Average SIMD (Inverse corrected)	218
Development	Area of coastal greenspace and identified development (m^2/km^2)	Summation of areas divided by CA area	162,142
Economics	Non-residential Properties (count)	Total number of non-res properties in CA	59.23

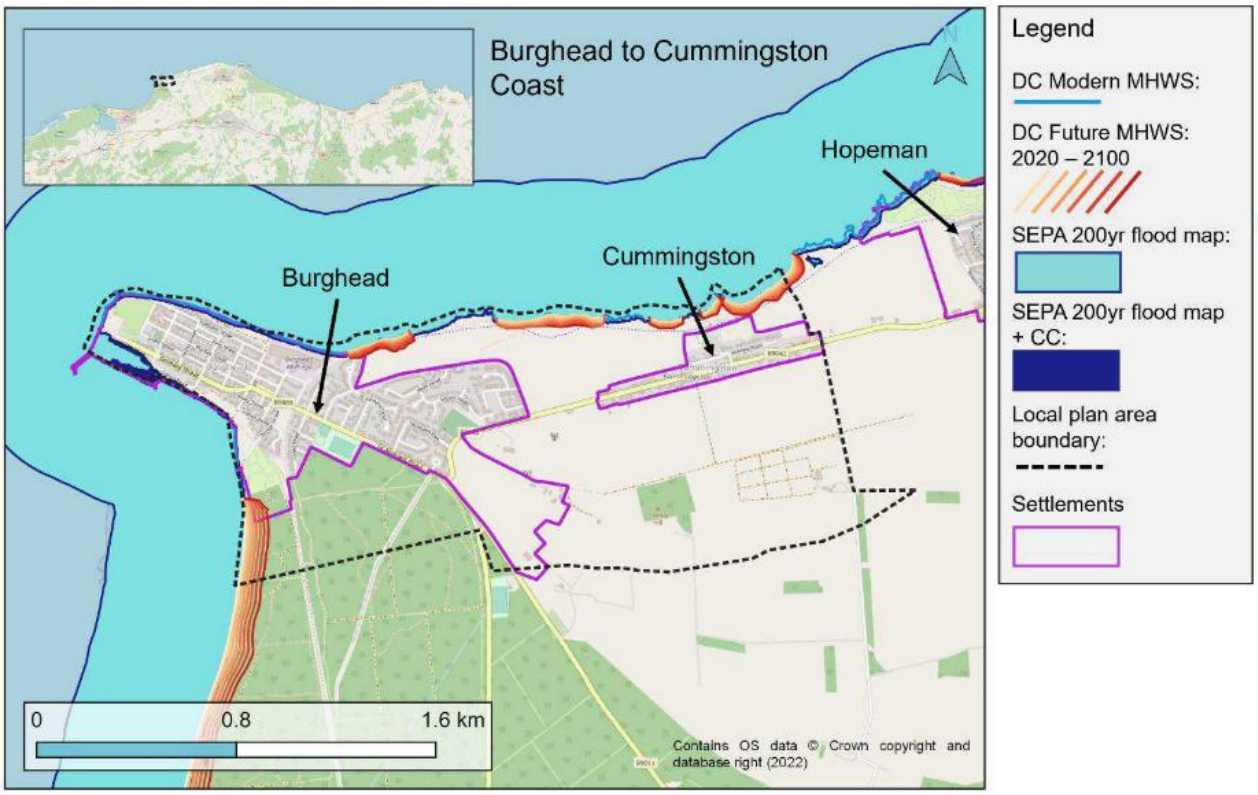


Figure 2-4: Burghead to Cummingston Coast local plan area showing settlement areas, SEPA flood maps and Dynamic coast present-day and forecast shorelines.

2.5 Hopeman to Covesea Coast

The Hopeman to Covesea Coast CA has low to mid-range scores across all influence factors. The CA has the lowest demographic Influence Factor of 177. Assets at risk from flooding and erosion are located at Hopeman Harbour and north of Hopeman town at the coast at Hopeman East Beach (Figure 2-5).

Overall, the CA is ranked 10th in the first iteration of the prioritisation calculation.

Table 2-5 summarises influence factor results for Hopeman to Covesea Coast.

Table 2-5: Hopeman to Covesea Coast influence factor results for prioritisation calculation inputs.

Influence Factor	Description and Unit	Details	Value
Risk	Properties at risk (count)	1 in 200-year flood present day	2
		1 in 200-year flood climate change	3
		DC 2100	16
	Roads at risk (length per unit area (m/km^2))	1 in 200-year flood present day	0
		1 in 200-year flood climate change	0
		DC 2100	98.6
	Utilities at risk (count)	1 in 200-year flood present day	1
		1 in 200-year flood climate change	1
		Erosion climate change	189
	Historical Coastal Change Rate (m/year)	Maximum in CA	-0.7
		Average in CA	+0.05
Management	Length of hard Defences (m)	Formal defences under Moray Council responsibility	0
	Natural Defences (Yes/No)	Do natural features form a flood defence	0
Demographics	SMID (score)	Average SIMD (Inverse corrected)	177
Development	Area of coastal greenspace and identified development (m^2/km^2)	Summation of areas divided by CA area	200,611
Economics	Non-residential Properties (count)	Total number of non-res properties in CA	27.82

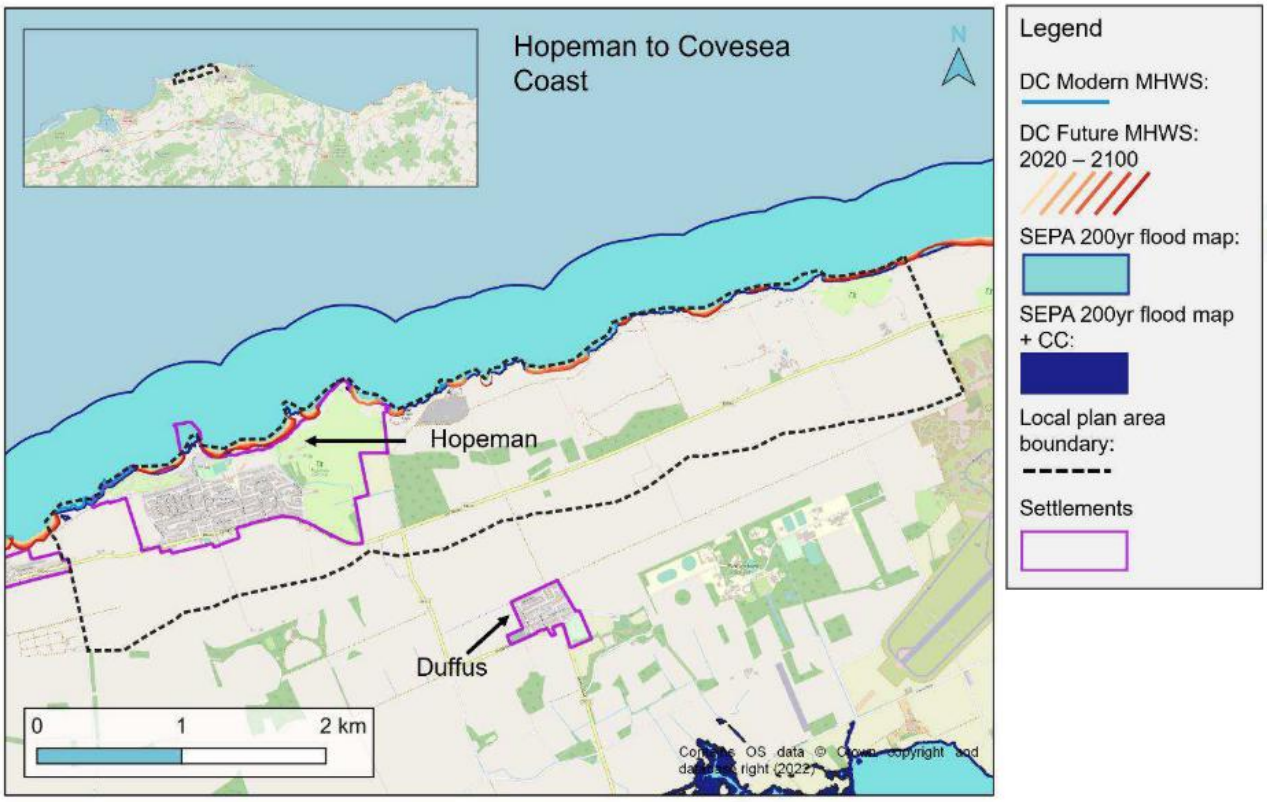


Figure 2-5: Hopeman to Covesea Coast local plan area showing settlement areas, SEPA flood maps and Dynamic coast present-day and forecast shorelines.

2.6 Lossiemouth to Binn Hill Coast

Lossiemouth to Binn Hill Coast scores highly for all assets at risk of flooding, but less for assets at risk of erosion. The highest rates of historical erosion at Lossiemouth to Binn Hill Coast are located at the spit and dune system at Lossiemouth east Beach (Figure 2-6). Assets at risk from flooding and erosion are concentrated at Seatown. There are a number of assets at risk from flooding inland from the coast, due to the flooding risk River Lossie and Spynie Canal. Assets at risk from erosion are concentrated at the coastline in the Brandenburgh area of Lossiemouth.

The CA is also less of a priority in terms of demographic, development and economic Influence Factor. Lossiemouth is naturally defended by a dune system and with a high weighting attributed to place-making opportunities

Overall, the CA ranked 2nd in the first iteration of the prioritisation calculation. As a result of this ranking, a local adaptation plan will be developed.

Table 2-6 summarises influence factor results for Lossiemouth to Binn Hill Coast CA.

Table 2-6: Lossiemouth to Binn Hill Coast influence factor results for prioritisation calculation.

Influence Factor	Description and Unit	Details	Value
Risk	Properties at risk (count)	1 in 200-year flood present day	32
		1 in 200-year flood climate change	48
		DC 2100	61
	Roads at risk (length per unit area (m/km^2))	1 in 200-year flood present day	182.6
		1 in 200-year flood climate change	255.4
		DC 2100	11.8
	Utilities at risk (count)	1 in 200-year flood present day	3
		1 in 200-year flood climate change	4
		Erosion climate change	82
	Historical Coastal Change Rate (m/year)	Maximum in CA	-3.1
		Average in CA	-0.33
Management	Length of hard Defences (m)	Formal defences under Moray Council responsibility	0
	Natural Defences (Yes/No)	Do natural features form a flood defence	Yes
Demographics	SMID (score)	Average SIMD (Inverse corrected)	215
Development	Area of coastal greenspace and identified development (m^2/km^2)	Summation of areas divided by CA area	78,065
Economics	Non-residential Properties (count)	Total number of non-res properties in CA	14.61

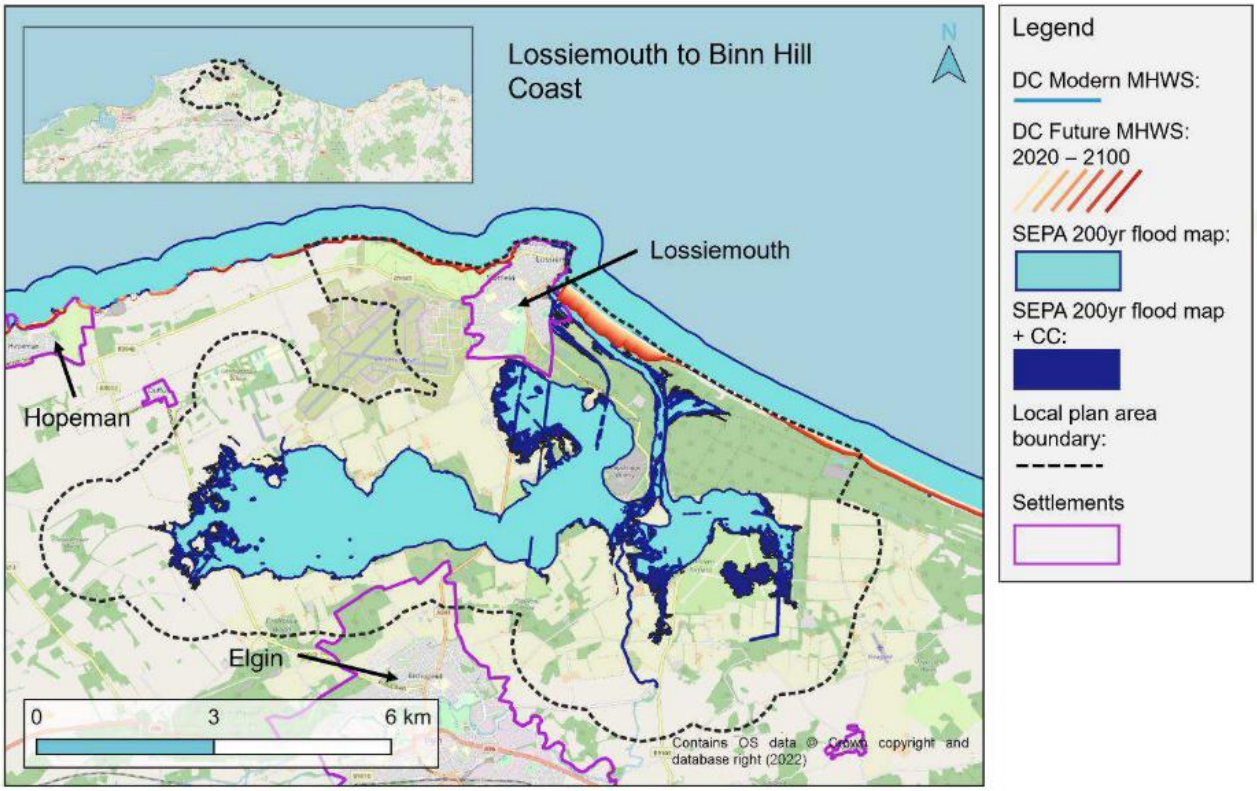


Figure 2-6: Lossiemouth to Binn Hill Coast local plan area showing settlement areas, SEPA flood maps and Dynamic coast present-day and forecast shorelines.

2.7 Kingston to Lower Auchenreath Coast

Kingston to Lower Auchenreath Coast CA influence factor scores are generally mid-range compared to other CAs. It has the highest score utilities at risk of a 200-year flood event plus climate change. Assets at risk from flooding are located at Kingston on Spey and some in the northern part of Garmouth (Figure 2-7). Assets at risk from erosion are located at Spey Bay and Spey Bay Golf Course. The greatest rates of historical erosion are located along Spey Bay Golf Course.

The CA, similar to Lossiemouth to Binn Hill Coast, is less of a priority in terms of demographic, development and economic Influence Factor. Kingston is also naturally defended by a dune system.

Overall, the CA is ranked 5th in the first iteration of the prioritisation calculation and a local adaptation plan will therefore be developed for this area.

Table 2-7 summarises influence factor results for Kingston to Lower Auchenreath Coast.

Table 2-7: Kingston to Lower Auchenreath Coast influence factor results for prioritisation calculation.

Influence Factor	Description and Unit	Details	Value
Risk	Properties at risk (count)	1 in 200-year flood present day	5
		1 in 200-year flood climate change	7
		DC 2100	44
	Roads at risk (length per unit area (m/km^2))	1 in 200-year flood present day	149.5
		1 in 200-year flood climate change	221.4
		DC 2100	45.6
	Utilities at risk (count)	1 in 200-year flood present day	1
		1 in 200-year flood climate change	4
		Erosion climate change	99
	Historical Coastal Change Rate (m/year)	Maximum in CA	-1
		Average in CA	-0.14
Management	Length of hard Defences (m)	Formal defences under Moray Council responsibility	0
	Natural Defences (Yes/No)	Do natural features form a flood defence	Yes
Demographics	SMID (score)	Average SIMD (Inverse corrected)	205
Development	Area of coastal greenspace and identified development (m^2/km^2)	Summation of areas divided by CA area	59,640
Economics	Non-residential Properties (count)	Total number of non-res properties in CA	13.41

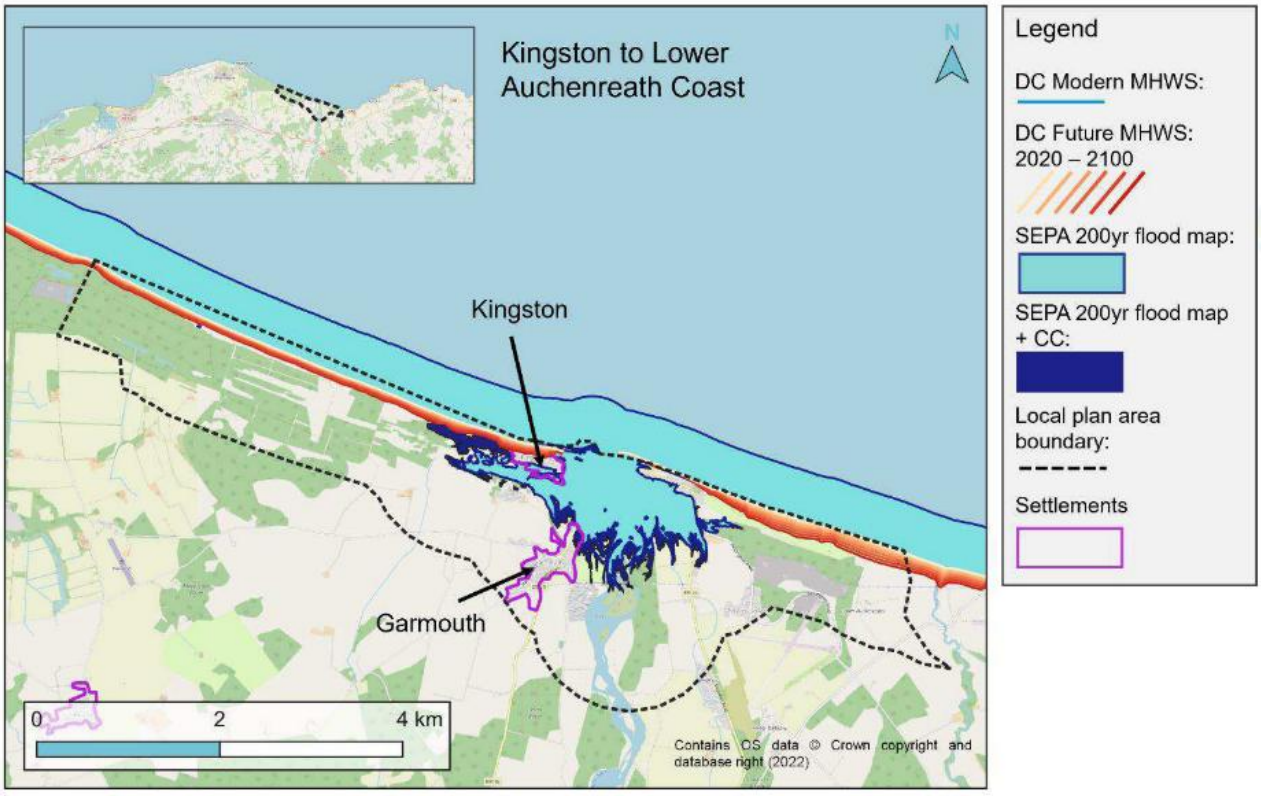


Figure 2-7: Kingston to Lower Auchenreath Coast local plan area showing settlement areas, SEPA flood maps and Dynamic coast present-day and forecast shorelines.

2.8 Portgordon to Buckpool Coast

The Portgordon to Buckpool Coast CA has low scores for all assets at risk of flooding, but there is a greater risk to assets from coastal erosion. Assets at risk from erosion are located west of Portgordon, where a rising main water supply is located; north of the A990 (Gordon Street); and further along the A990: the Great Western Road and Main Street north of Buckpool (Figure 2-8).

The development, demographic and economic Influence Factor scores are mid-range for the CA. It has substantial artificial defences in place.

Overall, the CA is ranked 3rd in the first iteration of the prioritisation calculation and a local adaptation plan will therefore be developed for this area.

Table 2-8 summarises influence factor results for Portgordon to Buckpool Coast.

Table 2-8: Portgordon to Buckpool Coast influence factor results for prioritisation calculation.

Influence Factor	Description and Unit	Details	Value
Risk	Properties at risk (count)	1 in 200-year flood present day	0
		1 in 200-year flood climate change	0
		DC 2100	149
	Roads at risk (length per unit area (m/km^2))	1 in 200-year flood present day	5.3
		1 in 200-year flood climate change	5.3
		DC 2100	586.3
	Utilities at risk (count)	1 in 200-year flood present day	0
		1 in 200-year flood climate change	0
		Erosion climate change	513
	Historical Coastal Change Rate (m/year)	Maximum in CA	-1.5
		Average in CA	-0.24
Management	Length of hard Defences (m)	Formal defences under Moray Council responsibility	707.31
	Natural Defences (Yes/No)	Do natural features form a flood defence	0
Demographics	SMID (score)	Average SIMD (Inverse corrected)	268
Development	Area of coastal greenspace and identified development (m^2/km^2)	Summation of areas divided by CA area	238050
Economics	Non-residential Properties (count)	Total number of non-res properties in CA	43.43

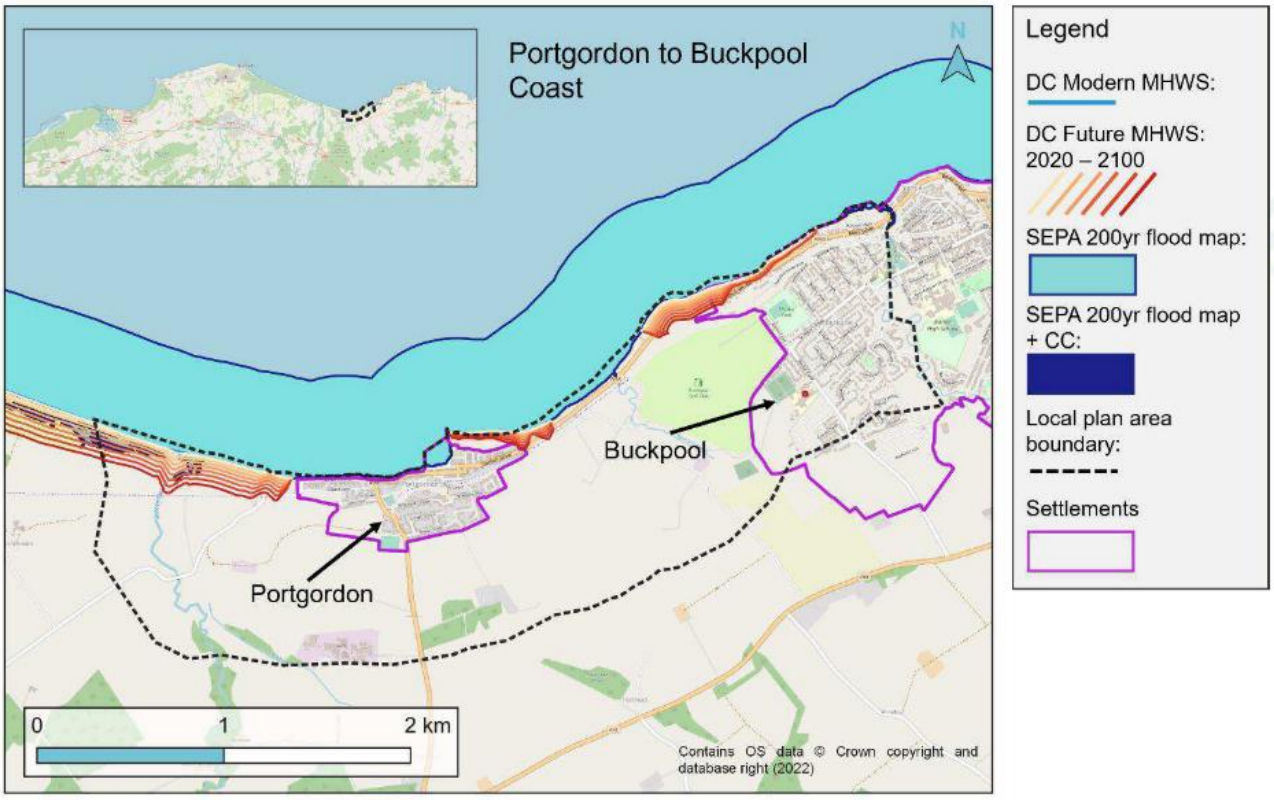


Figure 2-8: Portgordon to Buckpool Coast local plan area showing settlement areas, SEPA flood maps and Dynamic coast present-day and forecast shorelines.

2.9 Buckie to Portessie Coast

The Buckie to Portessie Coast CA has low to mid-range scores for assets at risk from flooding and erosion. There has historically been minimal coastal erosion at Buckie to Portessie Coast. Assets at risk from flooding are located in Gordonsburgh (Figure 2-9). Assets at risk from erosion are located along the Great Eastern Road at Portessie Bay.

The CA has the largest length of artificial defence and ranks highest for all demographic, development and economic Influence Factor scores.

Overall, the CA is ranked 1st in the first iteration of the prioritisation calculation and a local adaptation plan will therefore be developed for this area.

Table 2-9 summarises influence factor results for Buckie to Portessie Coast.

Table 2-9: Buckie to Portessie Coast influence factor results for prioritisation calculation.

Influence Factor	Description and Unit	Details	Value
Risk	Properties at risk (count)	1 in 200-year flood present day	5
		1 in 200-year flood climate change	10
		DC 2100	0
	Roads at risk (length per unit area (m/km^2))	1 in 200-year flood present day	65.1
		1 in 200-year flood climate change	119.1
		DC 2100	0
	Utilities at risk (count)	1 in 200-year flood present day	0
		1 in 200-year flood climate change	0
		Erosion climate change	0
	Historical Coastal Change Rate (m/year)	Maximum in CA	0
		Average in CA	-0.02
Management	Length of hard Defences (m)	Formal defences under Moray Council responsibility	0
	Natural Defences (Yes/No)	Do natural features form a flood defence	No
Demographics	SMID (score)	Average SIMD (Inverse corrected)	233
Development	Area of coastal greenspace and identified development (m^2/km^2)	Summation of areas divided by CA area	32,731
Economics	Non-residential Properties (count)	Total number of non-res properties in CA	5.02

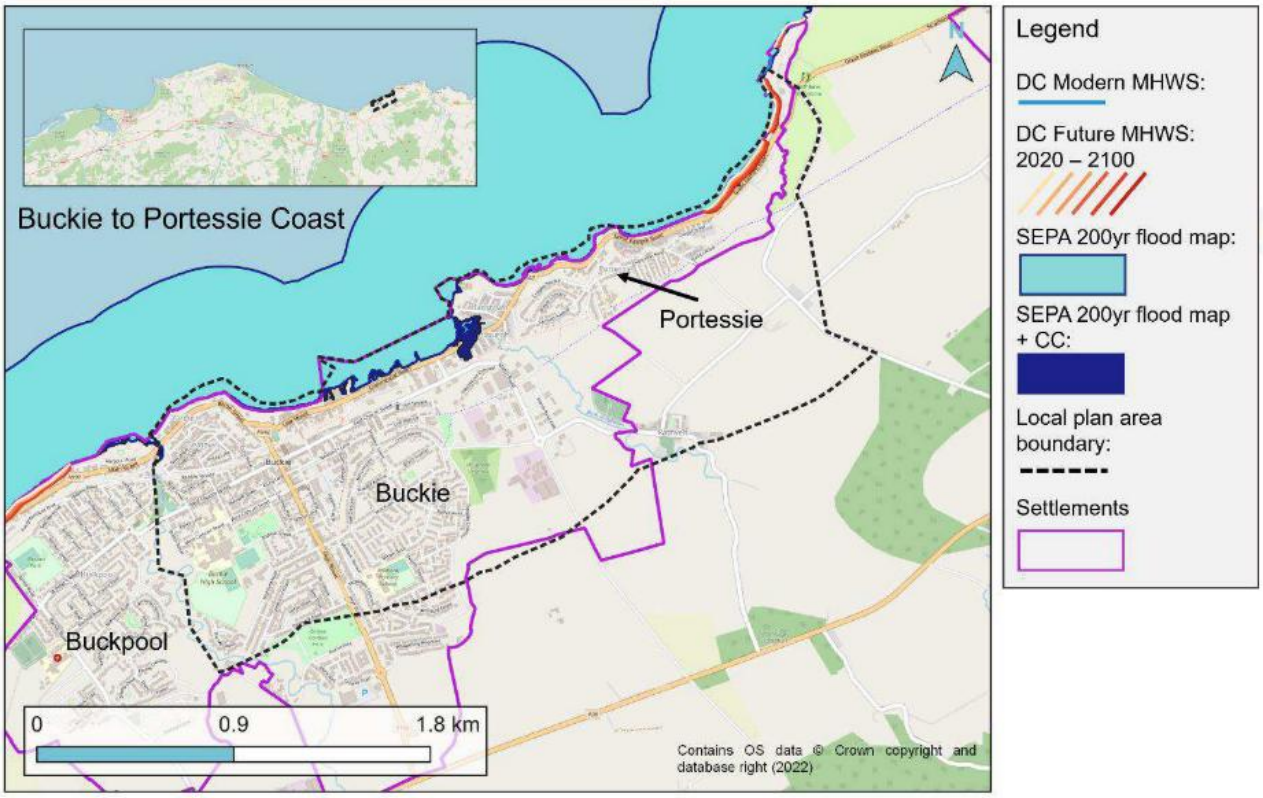


Figure 2-9: Buckie to Portessie Coast local plan area showing settlement areas, SEPA flood maps and Dynamic coast present-day and forecast shorelines.

2.10 Findochty to Portknockie Coast

The Findochty to Portknockie Coast CA has low influence factor scores for assets at risk from both flooding and erosion owing to its dominant cliffed coastline. There are some assets at risk from flooding and erosion near the Findochty harbour and Findochty Bay (Figure 2-10). There has been little coastal erosion historically within the CA.

It has no natural or formal artificial defences and mid-range scores for demographic, development, and economic Influence Factors.

Overall, the CA, is ranked 9th in the first iteration of the prioritisation calculation.

Table 2-10 summarises influence factor results for Findochty to Portknockie Coast.

Table 2-10: Findochty to Portknockie Coast influence factor results for prioritisation calculation.

Influence Factor	Description and Unit	Details	Value
Risk	Properties at risk (count)	1 in 200-year flood present day	1
		1 in 200-year flood climate change	1
		DC 2100	0
	Roads at risk (length per unit area (m/km^2))	1 in 200-year flood present day	3.1
		1 in 200-year flood climate change	3.4
		DC 2100	0
	Utilities at risk (count)	1 in 200-year flood present day	1
		1 in 200-year flood climate change	1
		Erosion climate change	15
	Historical Coastal Change Rate (m/year)	Maximum in CA	-1.7
		Average in CA	+0.01
Management	Length of hard Defences (m)	Formal defences under Moray Council responsibility	0
	Natural Defences (Yes/No)	Do natural features form a flood defence	No
Demographics	SMID (score)	Average SIMD (Inverse corrected)	246
Development	Area of coastal greenspace and identified development (m^2/km^2)	Summation of areas divided by CA area	173,612
Economics	Non-residential Properties (count)	Total number of non-res properties in CA	38.34

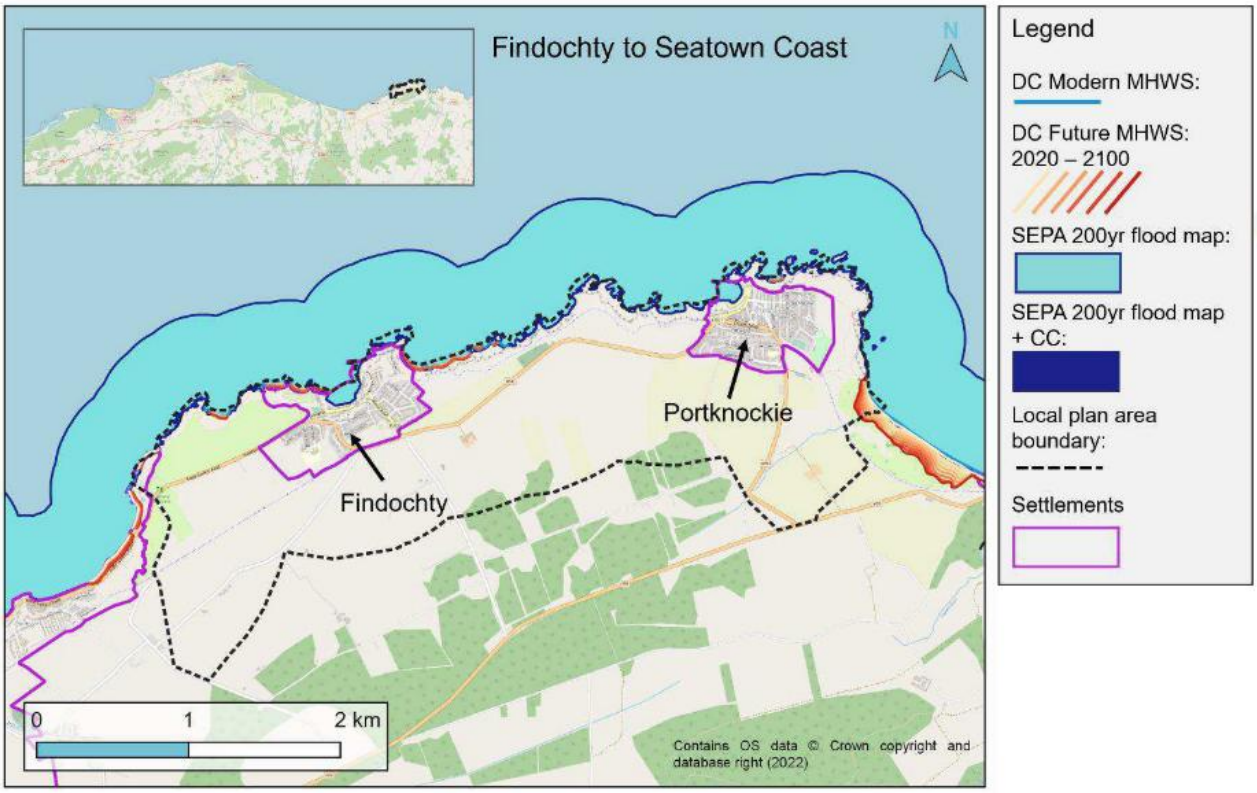


Figure 2-10: Findochty to Portknockie Coast local plan area showing settlement areas, SEPA flood maps and Dynamic coast present-day and forecast shorelines.

2.11 Moray Coastal Trail

As well as the defined assets (e.g. properties, utilities etc.) within each CA, the Moray Coastal Trail (MCT)[41] is a considerable asset that spans the entire region. This is an 80 km waymarked route that runs from Findhorn to Cullen, providing substantial amenity and tourism benefits to the region.

Impact of flooding and erosion on the MCT is yet to be quantified but it will likely become badly affected by coastal change and flooding in both the short and long-term.

As part of delivery of the Regional Plan a more detailed assessment will be undertaken to understand the impacts of climate change on the MCT (Proactive Action 9). This will provide opportunities for investigation options to enhance and retain the amenity.

[41] https://www.morayways.org.uk/routes/the-moray-coast-trail/

2.12 Cullen to Muckle Hythe Coast CA

The Cullen to Muckle Hythe Coast CA has minimal assets at risk from flooding, but a significant number of assets at risk from coastal erosion and ranks highest for properties, roads, and utilities at risk from future erosion from Dynamic Coast data. The highest rates of historical erosion are located along Cullen Golf Course (Figure 2-11).

There are a substantial number of assets predicted to be at risk from coastal erosion at Seatown in Cullen. There are also assets at risk from erosion located west of the harbour along Port Long Road seawards from the prehistoric coastal cliffs.

The CA has artificial coastal defences in place and ranks mid-range for demographic, development, and economic Influence Factors.

Overall, the CA is ranked 4th in the first iteration of the prioritisation calculation; therefore, a local adaptation plan will be developed for this CA.

Table 2-11 summarises influence factor results for Cullen to Muckle Hythe Coast.

Table 2-11: Cullen to Muckle Hythe Coast influence factor results for prioritisation calculation.

Influence Factor	Description and Unit	Details	Value
Risk	Properties at risk (count)	1 in 200-year flood present day	0
		1 in 200-year flood climate change	1
		DC 2100	261
	Roads at risk (length per unit area (m/km^2))	1 in 200-year flood present day	1.1
		1 in 200-year flood climate change	2.5
		DC 2100	631.0
	Utilities at risk (count)	1 in 200-year flood present day	0
		1 in 200-year flood climate change	0
		Erosion climate change	817
	Historical Coastal Change Rate (m/year)	Maximum in CA	-2.7
		Average in CA	-0.66
Management	Length of hard Defences (m)	Formal defences under Moray Council responsibility	329.79
	Natural Defences (Yes/No)	Do natural features form a flood defence	0
Demographics	SMID (score)	Average SIMD (Inverse corrected)	213
Development	Area of coastal greenspace and identified development (m^2/km^2)	Summation of areas divided by CA area	151,686
Economics	Non-residential Properties (count)	Total number of non-res properties in CA	64.82

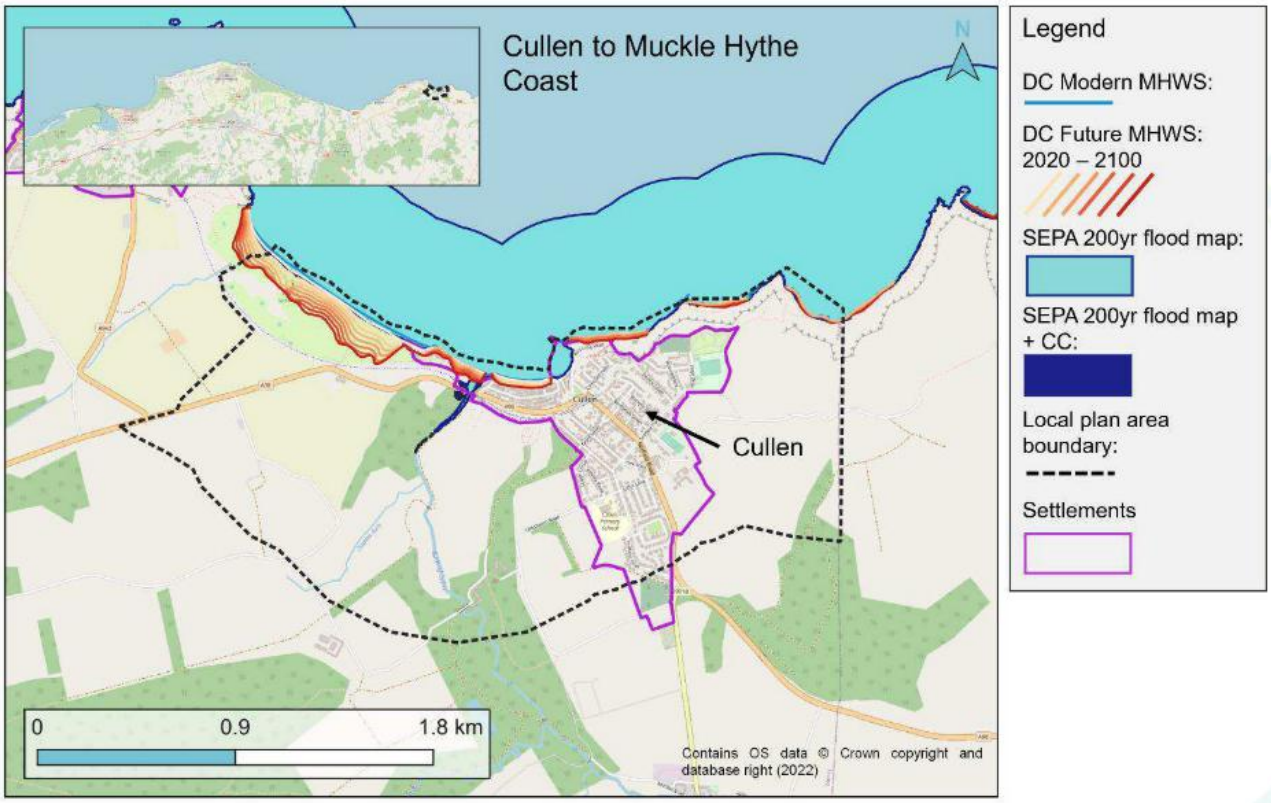


Figure 2-11: Cullen to Muckle Hythe Coast local plan area showing settlement areas, SEPA flood maps and Dynamic coast present-day and forecast shorelines.

3. Methodology

For each Indicator a total score for each CA was determined based on the unit of the data that underpins it. To avoid bias towards datasets with larger values, a min-max normalisation was calculated to allow effective relative comparison. This normalised (0-1) value then presents the basis for which CAs were compared to prioritise the local CCAPs.

However, with adaptation it is important that local decisions from Moray Council and other stakeholders can be incorporated to make sure decisions are being made that account for unquantifiable factors. Here a weighing is therefore assigned to Indicators deemed of higher importance. These aim to align with the four key pillars of adaptation and place emphasis on aspects associated with these.

Three different weightings were applied to the scoring. The highest is allocated to the following Indicators:

- **Risk Indicator** – *Average historical coastal erosion rates* –most reflective of how the coast is changing now.
- **Management Indicator** – *CAs where formal and natural coastal defences exist*.

A medium weighting is allocated to the following indicators emphasise the placemaking approach being championed by SEPA and Scottish Government:

- **Demographics Indicator**
- **Nature-based Development Indicator**
- **Economic Indicator**

The overall prioritisation score was then determined using the sum product for each CA based on the normalised scores and their associated weighting.

The scores for each CA area were ranked, where a rank of 1 has highest prioritisation score. CAs with rankings 1–5 are taken forward to develop specific Local Plans as part of this initial iteration.

3.1 Outcomes

A comparison summary of the overall Indicator rankings provided in with Appendix A.2 providing information on the full processes.

Table 3-1: Summary of prioritisation outcome. CAs are ranked across each Indicator, with the overall score also provided.

CA	Unit Area (km^2)	Risk	Management	Demographic	Development	Economic	Overall
Buckie to Portessie Coast	3.69	7	1	1	1	1	1
Lossiemouth to Binn Hill Coast	70.02	2	1	5	7	8	2
Portgordon to Buckpool Coast	4.95	5	1	2	2	4	3
Cullen to Muckle Hythe Coast	3.61	3	5	5	5	2	4
Kingston to Lower Auchenreath Coast	14.62	4	1	8	7	8	5
Culbin to Netherton Coast	32.08	5	6	4	10	8	6
Kinloss to Hatton Coast	19.26	1	6	8	7	5	7
Burghead to Cummingston Coast	2.60	8	6	5	5	2	8
Findochty to Portknockie Coast	6.13	8	6	3	3	5	9
Hopeman to Covesea Coast	6.65	8	6	11	3	7	10
Roseisle to Burghead (South) Coast	8.28	11	6	10	11	11	11

The results in Table 3-1 show how each CA ranks relative to the others on each of the prioritisation Indicators. A low value in the score indicates the highest priority in the region (i.e. greatest risk, highest deprivation etc.).

It is important to understand here that priority does not necessarily mean greatest risk (i.e. Kinloss to Hatton Coast). This must be balanced by the other indicators defined by the four key pillars of adaptation. Adaptation planning must also be used to create and maximise additional opportunities and help realise multiple benefits for both current and future generations.

The results from the prioritisation were used to schedule the development of Local CCAPs with five CCAPs being developed in September 2023 and the remaining six following in April 2024.

Part D – Regional Plan

1. Regional Plan Overview

1.1 Plan Area

The Moray coastline is located on the north coast of Scotland, east of Inverness, stretching approximately 190 km from just east of Nairn to the east of Cullen. It constitutes a mix of sandy and cliffed coast, as well as some sections with built coastal defences. There are several towns, villages, and features such as harbours, beaches, golf courses, coastal trails and agricultural land that are vulnerable to both coastal flooding and erosion.

The location and extent of Moray coastline, and the associated Community Council Areas are shown in Figure 1-1.

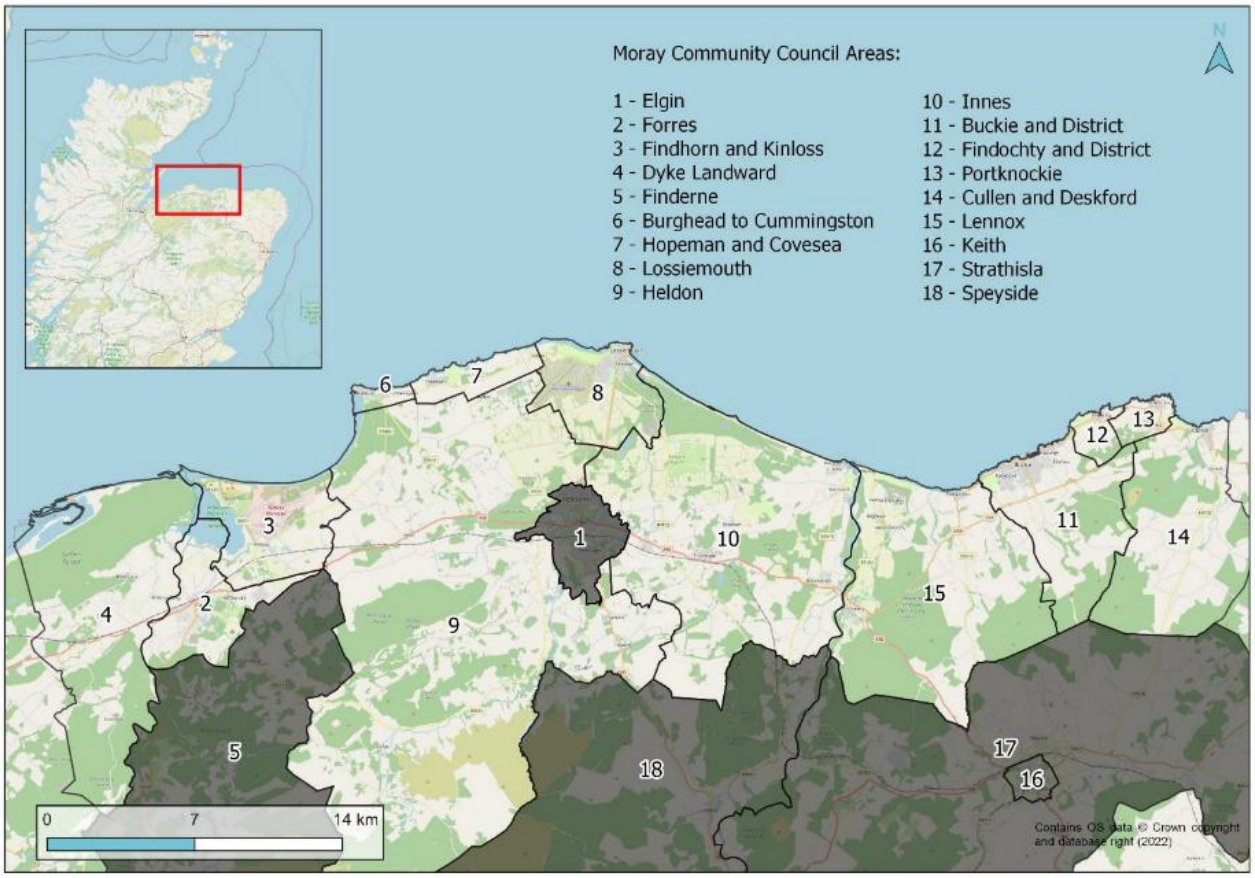


Figure 1-1: Moray coastline with Moray Community Council Areas shown. Greyed areas include no coastal extents.

1.2 Plan Structure and Development

The structure of the Plan is simple in content but can be complex in underlying subject matter. It is defined by three input criteria which can lead to two types of outcomes (Figure 1-2).

Figure 1-2: Regional plan structure concept.

This is summarised as:

Inputs

- **Influence Factors**

Elements which define the direction, requirements, and vision for adaptation. These have been developed to reflect that, unlike more traditional coastal management, risk reduction should not be, and is not, the only metric to define adaptation. We have identified the following indicators as being critical to Plan implementation:

  - **Hazards** – Flooding and Erosion
  - **Climate change** – Sea level rise and storminess
  - **Demographics** – Population, deprivation, and vulnerability
  - **Development** – Opportunities for development and land use change
  - **Economics** – Opportunities to support economic growth and tourism

- **Triggers**

Changes in the data or other external factors that influence Plan implementation and actions. At Regional level, these are pre-defined through:

  - Changes to the data sources that underpin the Influence Factors;
  - Changes to key policy, guidance (internal or external) that impact Plan content.

- **Stakeholders**

CCAPs are collaborative and should promote a shared vision for the future of the Moray coast. Stakeholder engagement is therefore important for successful development and implementation. For development of this Plan this has been led by a Cross-Council Action Group (CCAG) consisting of:

  - Flood Risk Officers
  - Open Spaces Officers
  - Strategic Development Officers
  - Climate Change Officers
  - Transportation Officers

Moving forward, delivery of the Plan will rely on wider engagement and partnership working. This will be delivered through **Priority External Stakeholders** potentially including:

  - SEPA.

- Scottish Water.
- Offshore wind/energy companies.
- Nature Scot.
- Transport Scotland.
- Moray Council Councillors.

Outcomes

Outcomes are a defined set of activities that Moray Council will deliver in response to the realisation of the identified Triggers. These are in the form of **Direct or Indirect Actions** summarised as:

- **Direct Actions**

Those which Moray Council own and can deliver independently of any third part inputs or support.

- **Indirect Actions**

Those which Moray Council are responsible for initiating and coordinating third party involvement necessary to support the adaptation vision.

In short, Direct Actions will result in a tangible short-term outcome or product, and Indirect Actions will initiate necessary supporting processes to maximise the adaptation opportunities.

Adaptation planning is an ongoing and continuous process that requires regular review, updating and implementation of additional actions and measures. The Regional CCAP is circular with Outcomes driving future Inputs through a feedback loop. Direct Actions may also lead to follow on Local CCAP activities (Figure 1-3).

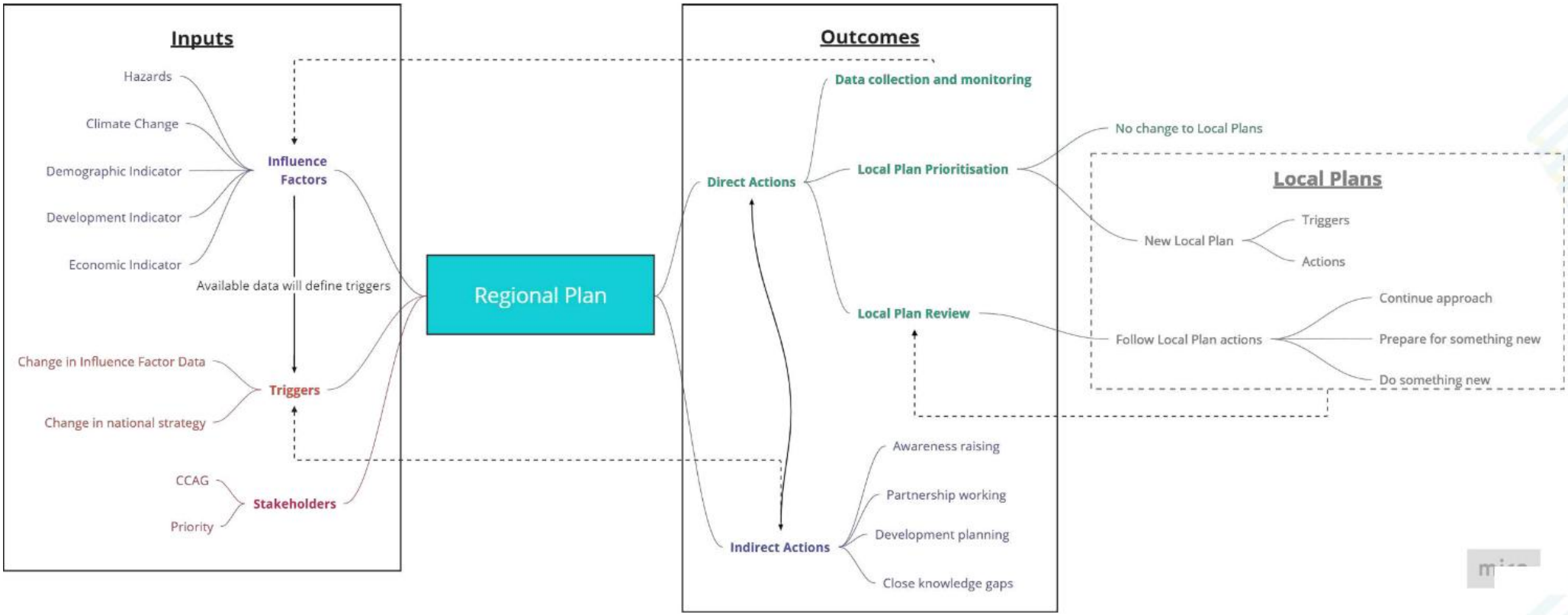


Figure 1-3: Schematisation of Regional CCAP, feedback loops and linkage with Local Plans.

2. Regional Coastal Change Adaptation Process

This Regional Plan provides an overview of the approach to coastal adaptation for Moray. It is a live document and will be subject to updates and review. This process will follow the adaption planning concept, set out in the draft Scottish Government guidance, through defining **Triggers** and **Actions**.

Actions, depending on their outcome, will not result in a definitive end point, but rather **determine the future route for the adaptation process in Moray.** Each of these are summarised below.

2.1 Triggers

Triggers are predefined commitments that specify when actions are required to be taken by Moray Council. These are identified through monitoring and, if implemented, will increase confidence that the associated actions will support sustainable adaptation.

In the case of the regional adaptation process, triggers are defined by the information that has underpinned this Plan. Regional triggers can be grouped into two components. Both will require monitoring by Moray Council going forward to enable associated actions to be taken should any be updated.

The following are defined as regional triggers for Moray, for each component.

1) Data for CA Local Plan prioritisation

a. SEPA Flood map updates
b. SEPA NFRA updates
c. Dynamic Coast updates

2) Guidance and supporting documentation

a. Scottish Government CCAP guidance updates
b. LFRMP updates
c. Moray LDP updates
d. UKCP climate change updates

2.2 Actions

Actions are predefined commitments that Moray Council will undertake to support and enable adaptation. They are associated with individual triggers and, depending on the outcomes, will result in different Adaptation Pathways potentially being followed.

For the Regional CCAP actions take two forms:

1) Direct actions

- actions as a response to Triggers Moray Council are responsible for.

2) Indirect actions

- actions as a response to Triggers third parties are responsible for.

Actions will only occur once the associated trigger is met. Depending on the outcome, these may lead to additional regional actions, local adaptation actions or no further action being taken. In this scenario the Plan will revert to monitoring of the currently defined regional triggers.

As well as understanding possible action outcomes, it is important to distinguish between those that are Direct and Indirect.

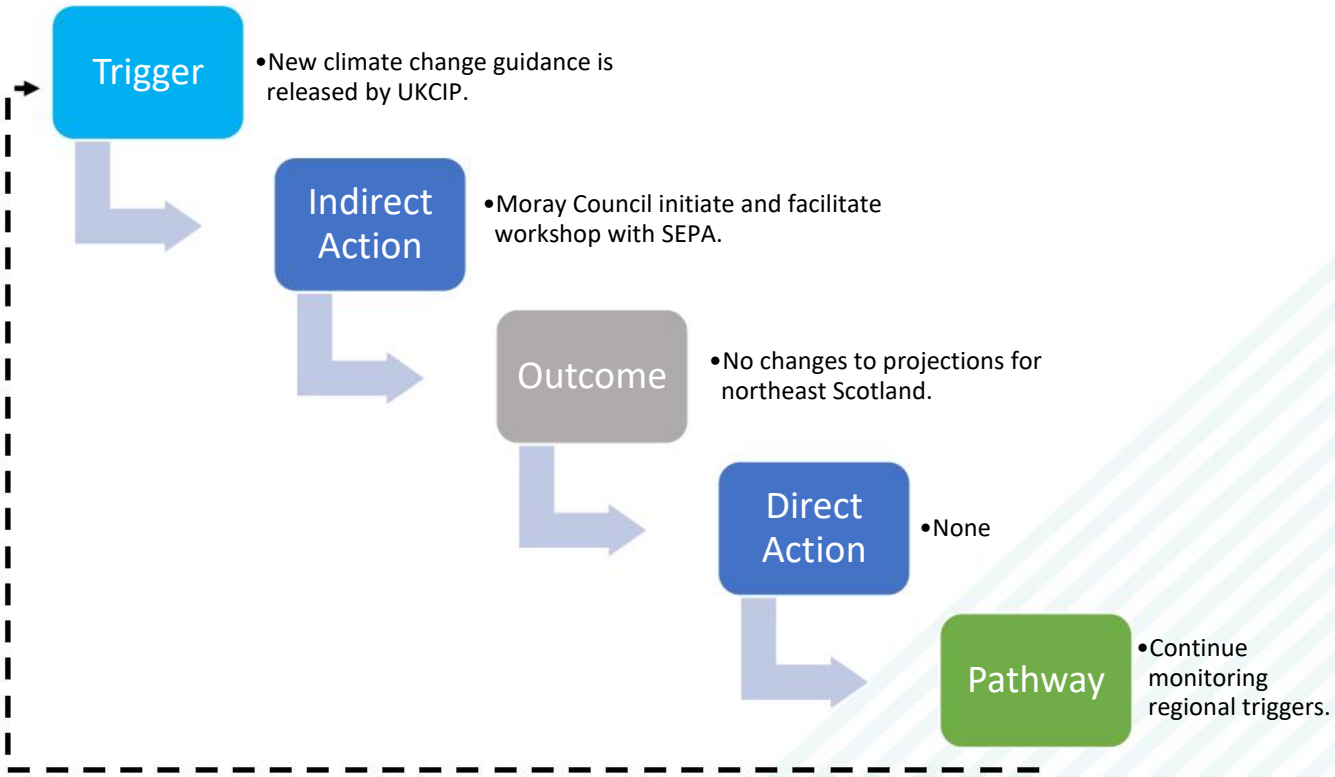
Direct actions will result in:

- A new or updated adaptation document.
- Publication of a new, regional, adaptation initiative or assessment.

These are activities that Moray Council take direct responsibility for delivering and disseminating as part of an agreed ongoing engagement plan.

In contrast, Indirect actions involve collaborations with third parties. Moray Council are responsible for initiating and facilitating, but these may or may not lead to further Direct actions being taken.

An example of this process could be:



The following are defined as regional actions for Moray.

1) Direct actions

a. Re-prioritisation of CA Local Plans.
b. Undertake new CA Local Plan.
c. Update Regional CCAP (this document).
d. Undertake regional Proactive Actions.

2) Indirect actions

a. Initiate and facilitate third party engagement activities.

2.3 Supporting steps and Proactive Actions

The nature of adaptation means that future decisions and directions are unknown and will be affected by external changes not necessarily under Moray Council's influence. It is critical that proactive supporting steps and Proactive Actions are undertaken to enable effective decision making in the future. This is especially the case where land needs to be safeguarded now, in statutory planning and/or via purchase arrangements, to provide capacity for accommodation space on land for landforms (natural and nature-based risk alleviation options) and where required, assets to migrate landwards to accommodate coastal change.

Proactive Actions, at this initial stage, are defined as those whereby there is only benefit to building resilience. Undertaking these can therefore only have a positive impact on supporting adaptation or increasing resilience.

At this stage in the adaptation planning process, seven such actions have been identified. These have been developed focusing on the key pillars identified previously and through review and understanding of key knowledge gaps. They therefore aim to close these knowledge gaps at this stage and support alignment with wider aspects of the adaptation plan for the region.

A summary of these actions is provided in Table 2-1 with further details on each included in Appendix B.

Table 2-1: Regional Proactive Actions

Action	Details	Primary Pillar	Multi Benefits
1	Undertaken NBS opportunities mapping exercise at the coast and land adjacent to the current coast-land boundary	Working with Natural Processes 	• Community and Engagement • Placemaking
2	Establish coordinated and consistent coastal change monitoring plan for Moray Region.	Monitoring Change 	• Community and Engagement • Working with Natural Processes
3	Establish and standardise defence asset condition database, including a mechanism for updating this and for identifying triggers in advance.	Monitoring Change 	• Working with Natural Processes
4	Coastal adaptation workshop with Moray Coastal Partnership	Community and Engagement 	• Community and Engagement • Placemaking

5	Engagement workshop with key third-party stakeholders. Utilities companies, private marinas, coastal asset owners, gold clubs etc.	Community and Engagement 	• Placemaking
6	Coastal flood forecasting refresher workshop with SEPA	Community and Engagement 	
7	Undertake land use opportunities mapping exercise	Placemaking 	• Working with Natural Processes
8	Undertake economic opportunities exercise	Placemaking 	
9	Undertake regional risk assessment to determine impact on Moray Coastal Trail.	Placemaking 	

2.4 Regional Pathway Process

Implementation of the Regional CCAP will follow a pathway process that is determined through the monitoring of the regional triggers and implementation of agreed predefined actions. The pathway process is presented in completeness in Figure 2-1 and summarised below.

Phase 0 Actions

- What will be implemented upon completion of the Regional CCAP (this document)
- Identified Proactive Actions
- A monitoring programme for regional triggers

Triggers

- Review of identified triggers
- Decision point if trigger is realised
    - Determine type of trigger if realised
    - Continue monitoring if not

Phase 1 Actions

- When regional trigger is realised

- Initial steps to review, update or evaluate the existing Regional CCAP
- Local CCAPs should be re-prioritised
- Existing Local CCAPs should be reviewed
- Necessary third-party engagement (e.g. SEPA or Dynamic Coast) should be initiated

Phase 2 Actions

- Dependent on Phase 1 Action outcomes
- Regional CCAPs may be updated

Phase 3 Actions

- Dependent on Phase 2 Action outcomes
- Further Regional Proactive Actions should be implemented

Local Actions

- Dependent on Phase 2 Action outcomes
- Further Local CCAPs may be developed.

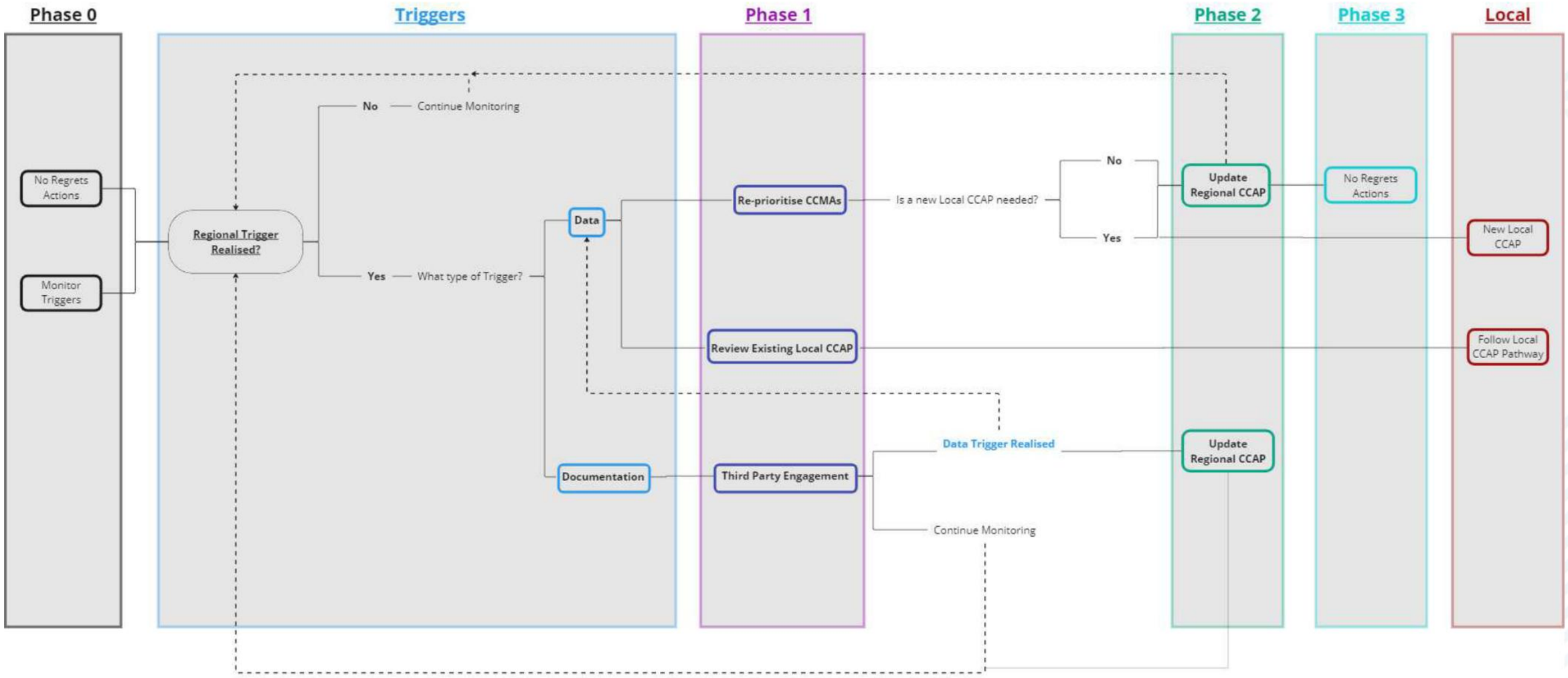


Figure 2-1: Regional Coastal Change Adaptation Pathway for Moray

3. Summary and Next Steps

3.1 Regional Plan

This document presents the Regional Coastal Change Adaptation Plan for Moray Council. It is the first iteration and will be subject to ongoing review and update to effectively guide the adaptation process across Moray. The approach for developing the Plan makes use of available, national information, on coastal flood and erosion risk, and combines these with relevant local datasets.

It has been steered by relevant published documentation and Scottish Government's draft guidance on CCAPs. To reflect the stage that Moray Council are at in the adaptation planning process this has been simplified into four key pillars of adaptation:

1) **Working with Natural Processes**
2) **Monitoring Change**
3) **Community and Engagement**
4) **Placemaking**

The Plan focuses on these pillars, undertaking assessments and setting Actions that, at this stage, aim to close knowledge gaps and make sure that Moray Council can effectively prepare for adapting to the impact climate change will have on the coast.

The following sections provide summaries of the key findings of this initial stage of the adaptation planning process.

3.2 Local CA Prioritisation

Planning for adapting to coastal change in Moray follows Regional (this document) and Local scale processes. Using available data to understand the coastal processes and characteristics, the Moray coastal region has been subdivided into eleven independent Community Areas (CA). Through a structured prioritisation exercise these were assessed against a series of indicators from national and local datasets. Again, these focused on the four key pillars of adaptation.

Using these data, a relative comparison was made across the CAs to prioritise development of Local CCAPs.

3.3 Regional Pathway Process

The regional pathway process was developed by defining regional triggers and setting future actions against these. These were then combined into a process to support future adaptation.

While the adaptation planning process was used as a guide, at a regional level, the pathway does not result in definitive end points. Triggers, while tangible, provide stages whereby Moray Council will undertake further adaptation actions. The outcomes of these however, are unknown and the direction of the pathway in the future therefore cannot be defined.

Triggers focus on the updates to the data and documentation that has underpinned the development of the plan. Should this change, Actions are set for Moray Council to implement.

Actions are split into those that are Direct (Moray Council will deliver a new or updated document) and Indirect (Moray Council will initiate but rely on third parties).

As well as actions that rely on triggers being realised. This initial stage of the adaptation process has identified several knowledge gaps and opportunities for region wide actions to be delivered upfront.

These are defined as Proactive Actions, whereby undertaking these will only benefit and support Moray's adaptation to coastal change. As with the overall regional pathway process,

these focus on the four key pillars of adaptation. In total, nine Proactive Actions have been set, with at least one associated to each pillar.

3.4 Next Steps

Adaptation to coastal change will be a continual journey and it is therefore important that the process is ongoing. Here, the following key steps require implementing by Moray Council to support this journey and follow the initial regional pathway:

- Implement internal governance processes to review and monitor defined regional triggers.
- Facilitate regular collaboration between the CCAG members to make sure that additional plans in Moray (e.g. LDP, strategic development, economic growth etc.).
- Develop and deliver the Local CCAPs in priority order.
- Deliver the regional Proactive Actions.
- Assess asset condition and draw up plans for financing adaptation of these and the assets they currently protect/alleviate risk for before they come to the end of their design life.
- Create mechanisms to proactively plan for storm-induced triggering of points on the adaptation pathway. i.e., have "advanced" planning agreed for key assets such as at-risk roads, so that storms can be used as catalysts to adapt rather than to hastily "rebuild".

Appendices

A. CA Prioritisation

A.1 CA Prioritisation Data Sources

Indicator	Description	Data Layer name	Source
Risk	Present day 1 in 200-year coastal flood extents	LPD_5_FRM_FH_COASTAL_EXTENT_M_v2_0	SEPA
	Future 1 in 200-year coastal flood extents	LPD_5_FRM_FH_COASTAL_EXTENT_M_CC_v2_0	SEPA
	Non-residential properties at risk of flooding and erosion	PDS_2017_NRP_Polygon_PP_20190523_Point_Coastal	SEPA NFRA
		Coastal_NRPs_Poly_1km_LA_Cells_Eroded	Dynamic Coast
	Residential properties at risk or flooding and erosion	PDS_2017_RP_Polygon_PP_20190523_Point_Coastal	SEPA NFRA
		Coastal_RPs_Poly_1km_LA_Cells_Eroded (RCP_8_95th)	Dynamic Coast
	Roads at risk of erosion	Roads_pp_13102017_coastal	SEPA NFRA
		OS_Open_Roads_LA_Cells_Eroded (RCP_8_95th)	DC
	Utilities at risk of erosion	Utilities	SEPA NFRA
		SW_RisingMains_LA_Cells_Eroded (RCP_8_95th)	Dynamic Coast
		SW_Outfalls_LA_Cells_Eroded (RCP_8_95th)	
		SW_OperationalSewerWAMS_LA_Cells_Eroded (RCP_8_95th)	
		SW_GravityPipes_LA_Cells_Eroded (RCP_8_95th)	
		SG_CleanWater_LA_Cells_Eroded (RCP_8_95th)	
		SEPA_Utilities_LA_Cells_Eroded (RCP_8_95th)	
	Coastal Change	DC-HES-MHWS-FUT_SCOTLAND	DC
Management	Formal defences	Coastal Defence coordinates	Moray Council
Demographic	Deprivation value	SG_SIMD_2020 (Overall SIMD Rank)	Scottish Government
Development	Coastal greenspace	GB_GreenspaceSite_LA_Cells	Dynamic Coast
	Planned development	Moray_20220831_LDP2020DESIG	Moray Council
Economic	Non-residential property counts	Coastal_NRPs_Polygon_PP_20190523_Point_Coastal	SEPA NFRA

A.2 CA Prioritisation Results

CA Prioritisation																			
CA		Unit Area (km^2)	Risks Indicators										Management Indicators		Demographic Indicator	Development Indicator	Economic Indicator	Weighted Score	Rank
			Properties at risk			Roads at risk			Utilities			Coastal change							
			Flooding	Future Flooding	Future Erosion	Flooding	Future Flooding	Future Erosion	Flooding	Future Flooding	Future Erosion	Maximum Change	Average Change	Hard Defences	Natural Defences					
1	Culbin to Netherton Coast	32.08	0.13	0.13	0.00	0.28	0.32	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.42	0.05	0.02	14.31	6
2	Kinloss to Hatton Coast	19.26	1.00	1.00	0.30	1.00	1.00	0.06	1.00	1.00	0.30	0.31	0.22	0.00	0.00	0.27	0.12	0.18	12.03	7
3	Roseisle to Burghead (South) Coast	8.28	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.08	0.02	0.00	0.00	0.10	0.00	0.00	0.83	11
4	Burghead to Cummingston Coast	2.6	0.03	0.05	0.02	0.05	0.11	0.04	0.00	0.25	0.28	0.08	0.08	0.00	0.00	0.31	0.26	0.39	6.45	8
5	Hopeman to Covesea Coast	6.65	0.05	0.04	0.06	0.00	0.00	0.16	0.25	0.25	0.23	0.14	0.00	0.00	0.00	0.00	0.32	0.17	3.63	10
6	Lossiemouth to Binn Hill Coast	70.02	0.82	0.60	0.23	0.80	0.68	0.02	0.75	1.00	0.10	0.61	0.27	0.00	1.00	0.29	0.12	0.08	20.79	2
7	Kingston to Lower Auchenreath Coast	14.62	0.13	0.09	0.17	0.65	0.59	0.07	0.25	1.00	0.12	0.20	0.13	0.00	1.00	0.21	0.09	0.08	16.53	5
8	Portgordon to Buckpool Coast	4.95	0.00	0.00	0.57	0.02	0.01	0.93	0.00	0.00	0.63	0.29	0.21	0.92	0.00	0.69	0.38	0.28	20.47	3
9	Buckie to Portessie Coast	3.69	0.03	0.10	0.08	0.43	0.33	0.52	0.00	0.00	0.30	0.00	0.02	1.00	0.00	1.00	1.00	1.00	27.00	1
10	Findochty to Portknockie Coast	6.13	0.03	0.01	0.00	0.01	0.01	0.00	0.25	0.25	0.02	0.33	0.03	0.00	0.00	0.52	0.27	0.24	6.41	9
11	Cullen to Muckle Hythe Coast	3.61	0.00	0.01	1.00	0.00	0.01	1.00	0.00	0.00	1.00	0.53	0.50	0.43	0.00	0.27	0.24	0.42	17.58	4

B. Proactive Actions

Action 1 – Nature Based Solutions Opportunities Mapping

A sustainable approach to adaptation is essential. At the forefront of this is making sure that opportunities for nature-based approaches to coastal management are maximised. These should focus, not only on using natural processes to reduce risk, but also where such practices can improve the overall resilience of the Moray Coast.

This could include:

- Habitat creation
- Biodiversity improvement
- Blue bio-economy opportunities

A holistic opportunity mapping exercise should be undertaken that to understand where and how regional activities or initiative can be implemented to improve the natural resilience. The exercise should develop a set of proactive steps to implement nature-based coastal management at appropriate locations.

Action 2 – Establish coordinated and consistent beach monitoring plan

Only by monitoring the changes to the coast effectively can Adaptation Pathways be effectively developed. To enable these opportunities for a strategic beach/coastal monitoring programme should be explore. This should focus not only on data collection but all about how that information is stored, managed, and assimilated to allow for robust and efficient decision making. The current survey programme at Kingston should be used as a benchmark with a review as to the usage, frequency, and ability to scale this across the region. For CA areas of lower priority, low coast methods (e.g., remote sensing) should be explored to provide seamless coverage at relevant levels of detail.

Action 3 – Establish and standardise defence asset condition database

Understanding the condition and performance of existing (or new) coastal defence assets is critical when planning adaptation. The nature of adaptation means that defence performance and life must be maximised. To enable this effectively a standardised defence condition database should be developed. As with the beach/coastal monitoring focus should be given to the usage of the information within the adaptation framework to allow for proactive and robust decision making.

Action 4 – Coastal adaptation workshop with Moray Coastal Partnership

Engage and develop a relationship with Moray Coastal Partnership. This could be used to secure funding and opportunities to delivery region-wide community initiatives that support adaptation objectives. Areas such as engagement, community monitoring, community nature enhancement should be explored.

Action 5 – Engagement workshop with key third party stakeholders

Key individuals (landowners), public bodies (SEPA), utility providers (Scottish Water) and private asset owners (e.g. marina's golf courses etc) should be engaged directly. The aim of this is to develop efficient mechanisms for monitoring changes and enabling decisions and actions to be taken quickly when triggers are realised. Clear guidelines around ownership, responsibility and communication chains should be developed.

Action 6 – Coastal flood forecasting refresher workshop with SEPA

Adaptation to coastal change is not solely about physical interventions in coastal communities. Community and individual responsibility to increase resilience and adapt to coastal hazards is of paramount importance. Since 2015 the Moray Coast has been covered by a bespoke Coastal Flood Forecasting System that is manage by SEPA through the statutory obligations for flood warning. Such early warning systems are critical non-structural options for improving resilience to communities. It is therefore important that it becomes more integrated into the approach for adaptation for the Moray coast.

To achieve this a collaborative workshop should be undertaken between Moray Council and SEPA to review the system usage and identify opportunities for improvement. As well as a technical focus, this should consider wider community engagement activities to improve public awareness and integrate into the community pathways.

Action 7 – Land use constraints and opportunities mapping

To adapt while working with natural processes it is critical that the space required for coastlines to evolve is considered in the planning process. Where possible, systems should be allowed to respond naturally to climate change. This however may put pressure on land use and communities through the loss of land. Proactive actions such as safeguarding land for relocation or roll back should be considered to offset or compensate for losses or where land may no longer been deemed to be safe from erosion risks. As well as losses there may be opportunities to align mitigation and adaptation actions through enhancing habitat function and connectivity and assessing the adaptive capacity of land for alternative uses such as solar farms. To incorporate this proactively into the adaptive pathway for Moray, a regional assessment of land use constraints and opportunities should be undertaken to ensure that future opportunities are not unintentionally limited. This should be in conjunction with the LDP and aim to identify areas where land use changes should be planned and integrated early to Moray future development objectives.

Action 8 – Economic growth potential

Economic potential of communities is key to make sure that a robust placemaking approach to adaptation can be followed. Here, while this has been accounted for using the number of commercial properties as a surrogate, a more comprehensive economic growth potential assessment should be developed. Focus here should lie on understanding the potential Gross Value Added of commercial businesses and serve to form a baseline against which Adaptation Pathways can be tested.

A baseline review could be supplemented by a review of longer growth potential through a review of housing need and housing strategies, regional spatial strategies, harbour strategies, renewable opportunities, and other readily available information. Similar to the land use constraint and opportunity assessment, by understanding the economic baseline and growth potential within the framework of adaptation, potential losses can be offset or growth opportunities relocated to maximise the potential.

Action 9 – Undertake regional risk assessment for Moray Coastal Trail

A full risk assessment of the impacts and timescales of coastal change on the MCT should be delivered. This should form the evidence based to set actions for any future planning or realignment works with the aim of continuing to realise the amenity benefit in the future.

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