

# Moray Coastal Change Adaptation Plan

**Culbin to Netherton Coast**

**Final Report**

**April 2024**

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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. William Mortimer, Katie Corbett, and Doug Pender of JBA Consulting carried out this work.

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## Purpose

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## Acknowledgements

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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 previous reports.

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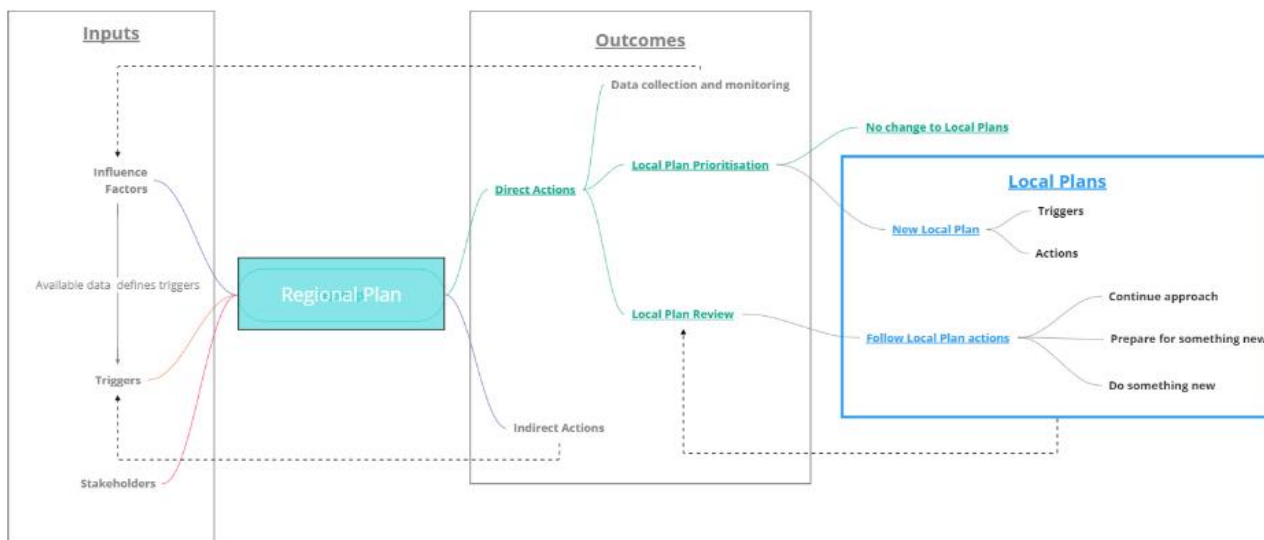
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## Executive summary

The report documents the Coastal Change Adaptation Plan (CCAP) for the Culbin to Netherton Coast Community Area (CA) in Moray. It forms one of the eleven Local Plans, for the Moray Council region. It aligns with the wider Regional Plan<sup>1</sup> and forms the highest level of detail of the overall Coastal Change Adaptation Planning process adopted by Moray Council.



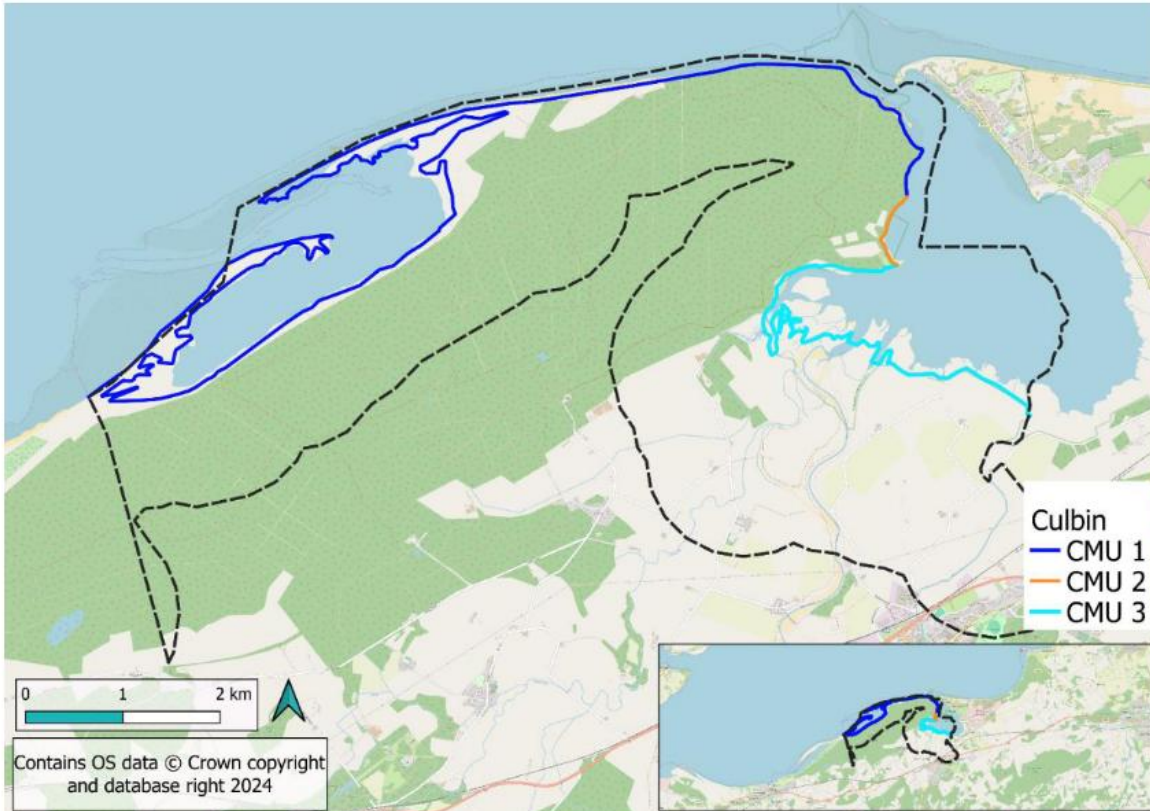
The CCAP provides an overview of the coastal flood and erosion risks to Culbin to Netherton Coast CA, which are used to underpin development of possible Adaptation Pathways for this community. These are presented, along with a framework to support proactive coastal risk management, enable implementation of climate change adaptation actions, and link with climate resilient development planning along Moray’s coast.

The Plan has been developed using available datasets from Moray Council, SEPA, and the Dynamic Coast Project. It aims to directly support statutory and non-statutory Moray Council policies, plans, and strategies and aligns with key coastal climate change adaptation guidance and resources within and beyond Moray Council.

This Plan documents the Phase 0 starting point of adaptation, meaning that no definitive preferred Adaptation Pathway and associated Action Plan have been developed. Rather this Plan sets out a framework and process for Moray Council to implement to effectively plan and support sustainable adaptation.

To develop Adaptation Pathways, the coast of the CA was classified into Coastal Management Units (CMUs) defined by 1) classification of coastal landform type, and 2) risk associated with coastal flooding and erosion. A total of three CMUs were identified, and associated Adaptation Pathways were developed for each.

<sup>1</sup> Moray Coastal Change Adaptation Plan: Regional Plan - IRR-JBAU-XX-XX-RP-MO-0001-S4-P03-Regional\_Plan



The framework is to be delivered through the defined Implementation Plan by defining Triggers and setting associated Actions against these. A single Implementation Plan is applied to the entire CA, where the outcome of the process determines what direction will be followed within the Adaptation Pathway. The Implementation Plan has three key stages:

- 1) Monitoring and Triggers
- 2) Actions
- 3) Outcomes

Trigger points are identified, and set following a risk-based approach and will be identified through repeat monitoring of available data that informs coastal flood and erosion risk.

Realisation of Triggers signal a need for review or change of the Adaptation Pathway. Actions bridge the gap between Triggers and Outcomes and define what processes need to be implemented before an appropriate Outcome is identified. Adaptation interventions are potential measures that can be applied. There are four possible categories:

- 1) No intervention
- 2) Enhance natural features
- 3) Protect
- 4) Create Space

A set of Phase 0 Actions have been identified that require immediate attention because of Triggers being met in this iteration of the Culbin to Netherton Coast CCAP. Furthermore, this initial stage of the adaptation planning process has identified several knowledge gaps and opportunities for activities to be undertaken upfront to support coastal change adaptation at Culbin to Netherton Coast.

The current iteration of the Culbin to Netherton Coast CCAP is at Phase 0. Triggers met in Phase 0 and associated Actions for each CMU are summarised in the table below. These will be delivered during the first cycle.

Full details of the Phase 0 Actions are included in Appendix C and documented in Section 4.4.

CMU	Trigger	Action
1	No current Triggers	No current Actions
2	No current Triggers	No current Actions
3	Flood Trigger Exceeded	Undertake assessment and plan for intervention

As well as Triggers and Actions that correspond directly to the Adaptation Pathway and specified CMUs, Proactive Actions that support the whole of the Culbin to Netherton Coast are summarised below:

- 1 Work with landowners to ensure responsible management of Culbin Forest.
- 2 Develop remote sensing monitoring techniques to support future assessments of remote coastlines.
- 3 Develop modelling framework to understand combined risk of fluvial and coastal flooding within CMU 3.
- 4 Conduct an adaptation and resilience workshop with local community and stakeholders.
- 5 Identify landownership and safeguarding space. This should link with the Regional Plan Proactive Action 7 to identify and define local opportunities.

Again, these will be delivered during this first cycle.

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## Abbreviations

CCAP	Coastal Change Adaptation plan
CA	Community Area
CMU	Coastal Management Unit
DC	Dynamic Coast
mAOD	meters Above Ordinance Datum
MHWS	Mean High Water Spring
NFRA	National Flood Risk Assessment
NRP	Non-residential Property
RCP	Representative Concentration Pathways
RP	Residential Property
SEPA	Scottish Environment Protection Agency
SLR	Sea Level Rise



## Glossary

Accretion*	The build-up of sediment resulting in the seaward movement of the coast/ 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 coast (Mean High Water Springs)
Hard coast*	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 determine the current path of the Adaptation Pathway.
Soft coast*	A coast 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<sup>2</sup>.

<sup>2</sup> [https://www.dynamiccoast.com/files/ccapg\\_2023feb.pdf](https://www.dynamiccoast.com/files/ccapg_2023feb.pdf)

# 1 Introduction

## 1.1 Coastal Change Adaptation Planning in Moray

Our climate is changing and throughout history, our coast has responded to changes in sea level, storms, and other climate parameters. This means that the current position of Moray's coast is not fixed but is dynamic and will continue to evolve as our climate changes.

We can no longer use traditional, engineered, coastal risk management approaches in isolation to protect society against these risks. Instead, we must, as a society, become more resilient and adapt to our changing coast through combined coastal risk management with climate resilient development planning on land near the coast. To enable this, we must be proactive in making combined coastal risk and land management decisions which provide long-term space for the coast to naturally respond to coastal climate change risks.

Developing and implementing an Adaptive Framework now to address how society responds to the current and future risks can help to reduce costs and negative impacts such as assets eroding into the sea or suffering repeat, frequency flooding. More positively, a proactive approach to adaptation and climate resilient development planning now can generate wider benefits and opportunities for coastal communities and the ecosystems which sustain and support them.

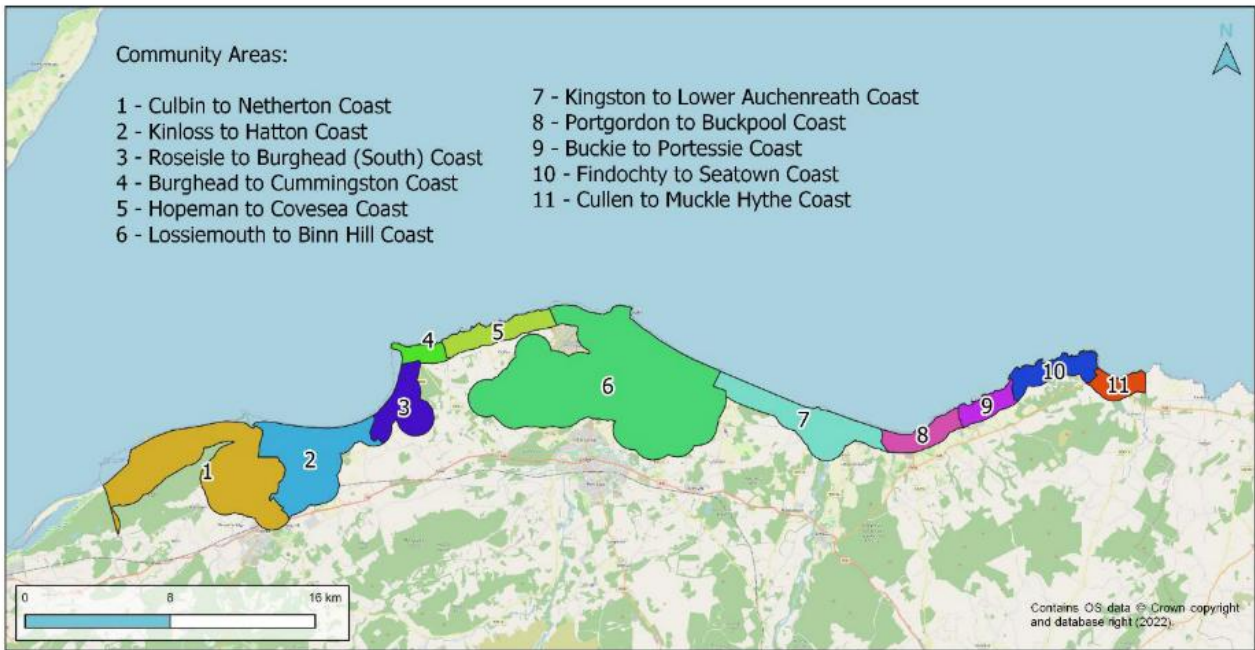
The Coastal Change Adaptation Plans (CCAPs) provide a key first step in this process; they are a practical mechanism to enable proactive engagement with and involvement of communities to co-develop a shared vision for long-term societal resilience to coastal climate change risk and impacts.

To support this adaptation journey in Moray the coast has been subdivided into Community Areas (CAs) (Figure 1-1). Culbin to Netherton Coast is one of eleven CAs recognised in the Regional Coastal Change Adaptation Plan (CCAP). The Culbin to Netherton Coast CA comprises an expansive natural coastline made up of sandy beaches and spits. This nature of this coast is susceptible to erosion. Into the future, the Dynamic Coast has, for example, projected as much as 700 m of shoreline retreat could be realised by 2100 at CMU 1.

This provides the justification for a more detailed, local, CCAP which is contained in this document.

The entire Coastal Change Adaptation Plan for Moray is contained within a series of documents, the following should be consulted alongside this CCAP to provide context on the overall process.

- IRR-JBAU-XX-XX-RP-MO-0001-S4-P03-Regional\_Plan
  - Provides the region wide plan and process to deliver coastal adaptation across Moray.
- IRR-JBAU-XX-XX-RP-MO-0007-S4-P03-Coastal\_Change\_Adaptation
  - Provides information on the concept of coastal change adaptation and how this has been applied to the Moray Coastal Change Adaption Plan.



**Figure 1-1: Extent and location of CAs within Moray**

### 1.2 What is a Local CCAP?

A Local CCAP follows the same principle as the Regional CCAP but is assessed and developed at a finer level of detail for a specified CA. A local CCAP is developed where a CA has been identified as a high priority, based on risk, development, management, and socio-economic Influence Factors (see Regional Plan for more details). It divides the coast of the CA into individual Coastal Management Units (CMUs) and presents Adaptation Pathways for each. See section 2.2 for more details on CMUs and CMU classification.

### 1.3 What are adaptation pathways?

Adaptation Pathways are flexible tools that can be used by local authorities, politicians, local businesses, and residents to make current and future decisions across all involved sectors to accommodate coastal change and associated uncertainty.

As well as the traditional management, they should identify opportunities to work with natural processes, enhance the environment and include necessary supportive steps to **create space** (e.g. accommodate erosion through land safeguarding) in preparation for inevitable future sea level rise and associated increases in erosion and flooding.

### 1.4 What do adaptation pathways do?

Adaptation Pathways aim to identify climate resilient risk management and development pathways for each or CMU; the phases in the pathways, provide flexibility for decisions at various points on the pathway to be modified dynamically through time.

Triggers are used in Adaptation Pathways to signal when the current management approach should be reviewed, and possibly changed, in response to updated information or change of circumstance i.e., risk has increased.

### 1.5 What is the focus of the Local CCAP?

Adapting to coastal and climate change requires two parallel streams:

1. Land-based initiatives to **prevent** new future risk.
2. Management initiatives to **reduce** current and future risk.

The Local CCAP presented here **focuses only the management initiatives** but, only by considering these in parallel with those that are land-based will result in a sustainable adaptation journey for Moray. This should identify both the need and practical steps required to safeguard land to support where areas of retreat may be considered in the future.

### 1.6 Where are we on the adaptation journey?

The Local CCAP presented here focuses only the management initiatives but, only by considering these in parallel with those land-based will result in a sustainable adaptation journey for Moray. This should identify both the need and practical steps required to safeguard land to support where areas of retreat may be considered in the future.

The aim of this first 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 for Culbin to Netherton Coast. It then identifies and promotes a process that, when implemented by Moray Council, will support community adaptation to coastal change.

The adaptation journey is a multiphase, multiyear process and aims to transition communities into a more sustainable and resilient future. We are currently at **Phase 0**, meaning that no definitive preferred Adaptation Pathway and associated Action Plan have been developed.

### 1.7 What is the Phase 0 Adaptation Framework?

The overall aim of the framework set out in this Local CCAPs is to:

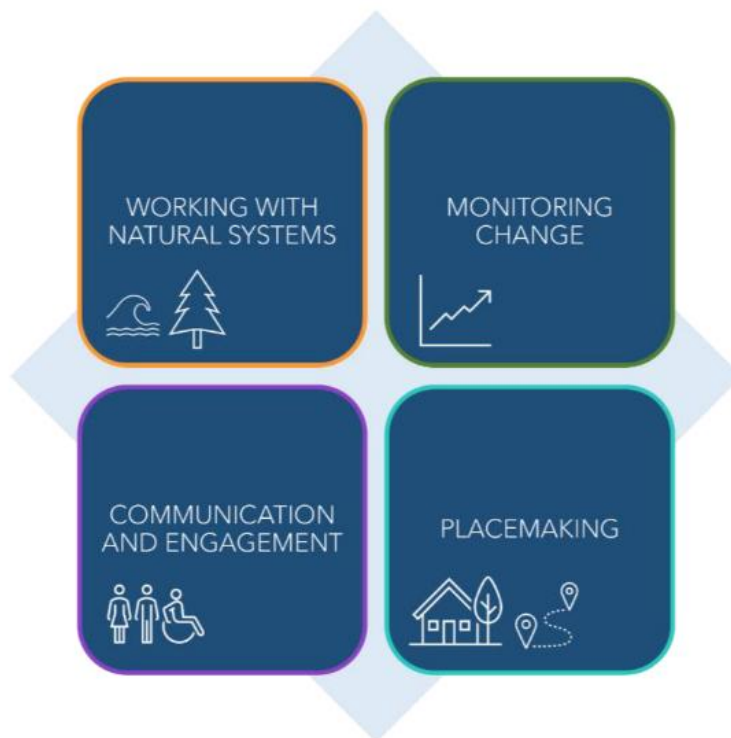
*Guide Moray Council towards development of detailed Adaptation Pathways and associated Action Plans for the Culbin to Netherton Coast CA.*

To achieve this goal the following objectives have been set for Phase 0:

- Identify and characterise local CMUs within the CA suitable for development of future Adaptation Pathways.
- Present coastal flood and erosion risk for each CMU.
- Develop an Implementation Plan to be used by Moray Council to support adaptive decision making, future action planning and evaluation of adaptation options.
- Identify CA and CMU specific Triggers that will influence adaptation decision making.
- Identify and set Proactive Actions that will support delivery of the CCAP in each CMU.
- Inform and support the Local Development Plan<sup>5</sup> and Local Planning Policy. These should be implemented in parallel to avoid future risk by making space for change.

## 1.8 How has this framework been developed?

The approach to coastal change adaptation in Moray is presented in the Regional Plan which distils the Scottish Government guidance<sup>3</sup> into **four key pillars of adaptation** (Figure 1-2). Development and implementation of the CCAP Implementation Plan should align with these principles.



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

## 1.9 How does the Local CCAP link to the Regional CCAP?

The Regional CCAP links to the Local CCAP in the following ways:

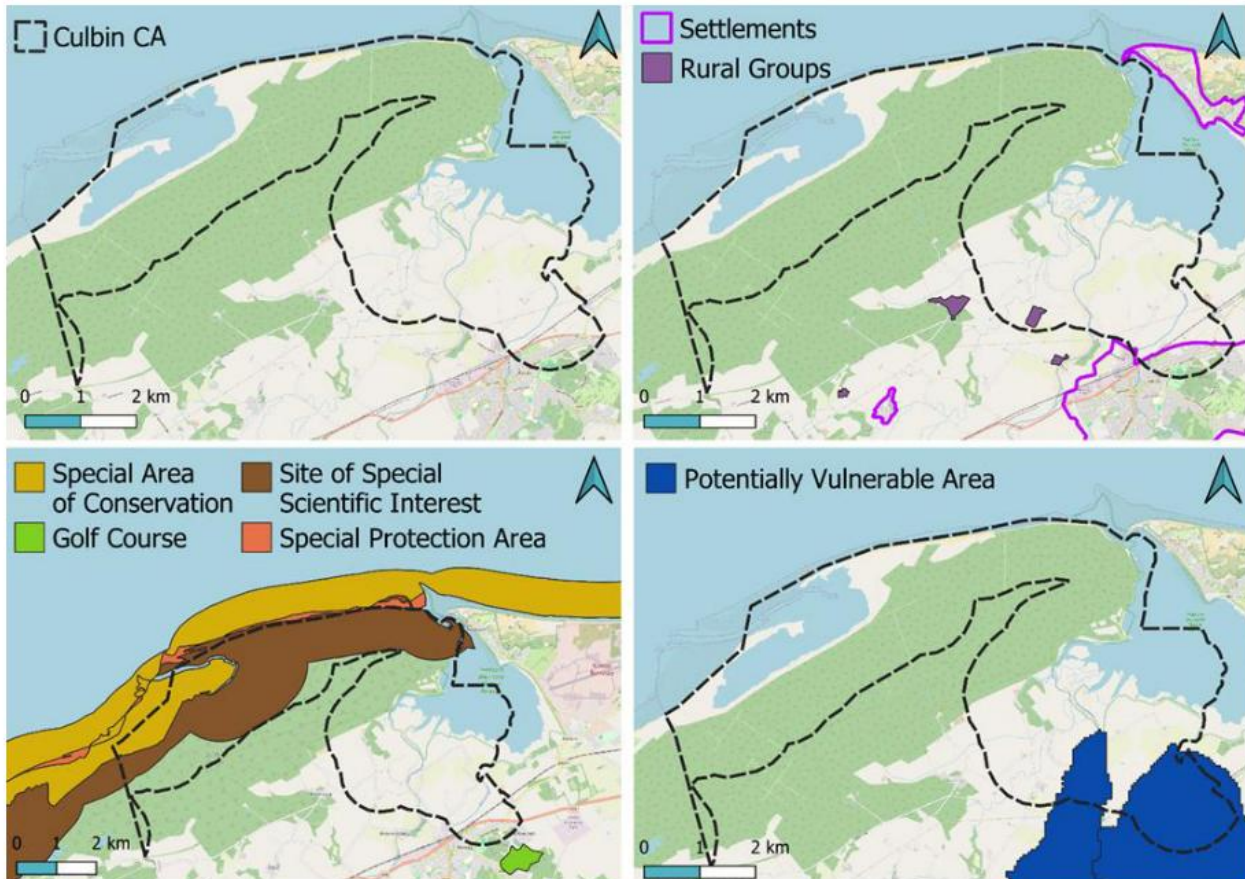
1. Defines the **prioritisation** of Local CCAP with risk, development, management, and socio-economic Influence Factors (see Regional Plan for more details).
2. Sets wide **Proactive Actions** that, when implemented, should be used to support Local CCAP Action Plans.
3. Provides the links between the **land-based** components of the Adaptation Planning process. This includes links with the LDP and delivery of necessary regional actions required to effectively support and plan for adaptation at a local level e.g. land safeguarding.

<sup>3</sup> Scottish Government (2023) Coastal Change Adaptation Plan Guidance – Interim  
[https://www.dynamiccoast.com/files/ccapg\\_2023feb.pdf](https://www.dynamiccoast.com/files/ccapg_2023feb.pdf)

## 2 Plan Overview

### 2.1 Plan Area and Characteristics

The Culbin to Netherton Coast CA covers an area of ca. 32.1 km<sup>2</sup> and is immediately west of the Kinloss to Hatton CA (Figure 2-1). The CA includes a range of coastal environments and land use types. The southern part of the CA also sits within SEPA Potentially Vulnerable Area (PVA) due to the flood risk identified in the Flood Risk Management Plan<sup>4</sup> (Figure 2-1).



**Figure 2-1: Culbin to Netherton Coast CA, showing settlements, greenspace and environment and special consideration areas.**

#### Settlements:

The Culbin to Netherton Coast CA includes the settlement of Forres in its southern extent (Figure 2-1). Forres has a population of approximately 10,156 with 4,624 households<sup>5</sup>. The Moray Council Local Development Plan<sup>6</sup> has identified designation areas for specific land use in these settlements and rural groups.

4 Moray Council. 2016. Findhorn, Nairn and Speyside Local Flood Risk Management Plan. Section 2.4.4. <http://www.moray.gov.uk/downloads/file105636.pdf>

5 Moray Council. 2020. Moray Local Development Plan. Volume 2: Settlement Statements.

[http://www.moray.gov.uk/moray\\_standard/page\\_133431.html](http://www.moray.gov.uk/moray_standard/page_133431.html)

6 Moray Council. 2020. Moray Local Development Plan. Volume 3: Rural Groupings.

**Greenspace and Environment:**

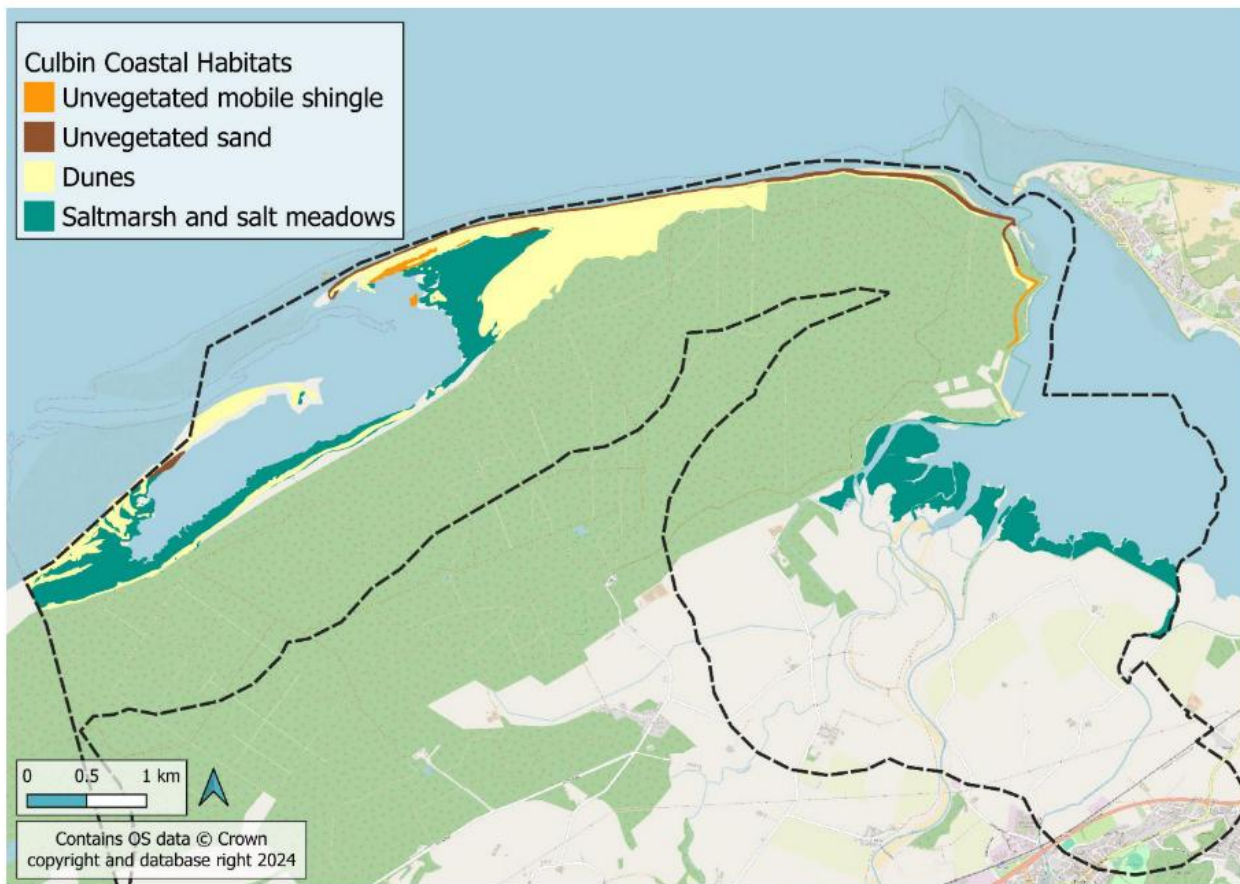
The entire coastline between Culbin to Netherton is a NatureScot designated Site of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC). In addition, there is a NatureScot designated Special Protection Area (SPA) along part of the coastline. There are no formal public or private recreational greenspace areas.

**Special consideration areas:**

The CA contains a small section of the Forres Potentially Vulnerable Area (PVA) as identified in the Nairn and Speyside Local Flood Risk Management Plan (LPD05)<sup>7</sup>. This PVA encompasses most of Forres and is centred around the River Findhorn.

**Habitats:**

There are four key habitats within the CA: Unvegetated mobile shingle, unvegetated sand, sand dunes, and saltmarsh and salt meadows (Figure 2-2).



**Figure 2-2: Coastal habitats at Culbin to Netherton Coast as identified by NatureScot.**

<sup>7</sup> Moray Council. 2016. Findhorn, Nairn and Speyside Local Flood Risk Management Plan. <http://www.moray.gov.uk/downloads/file105636.pdf>

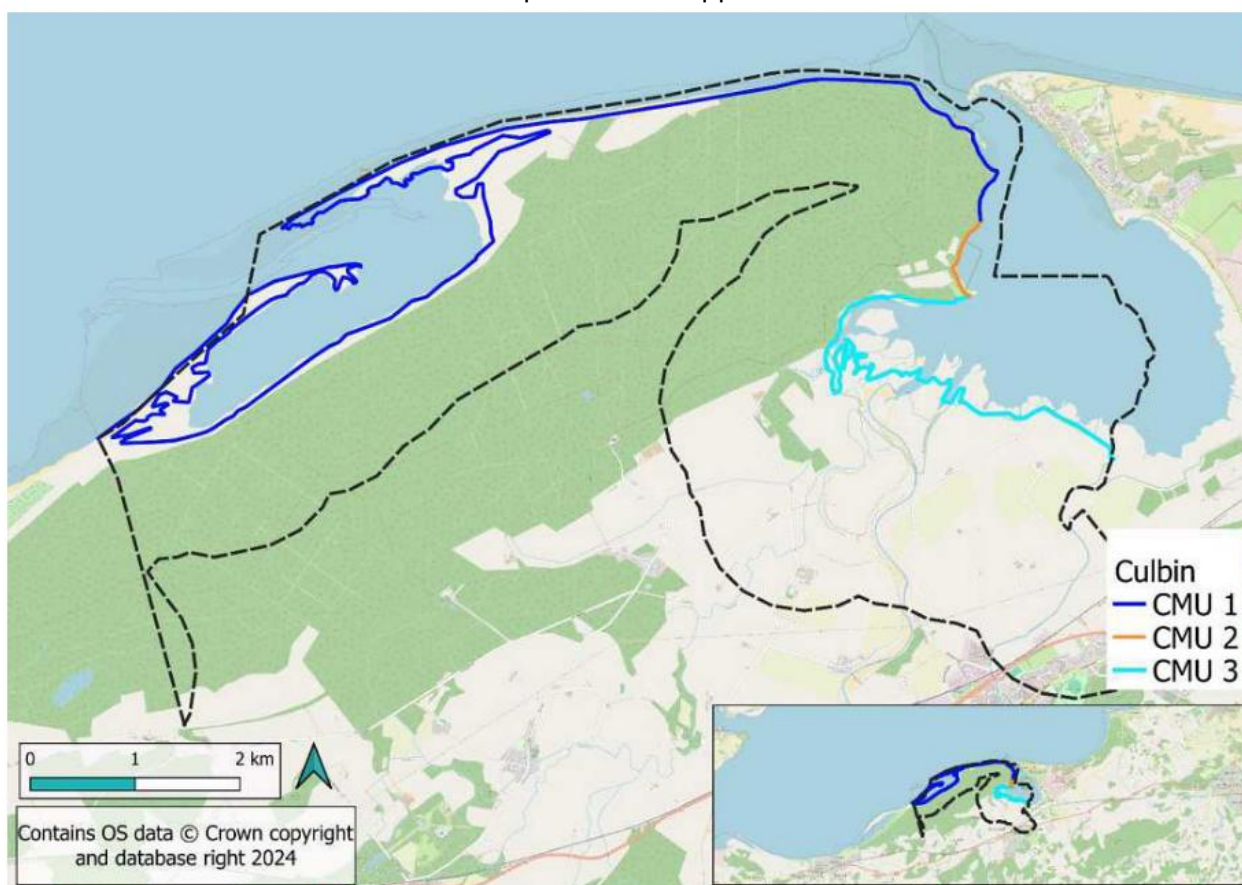
## 2.2 Coastal Management Units

To facilitate the development of this Local CCAP, the coast of the CA is classified into Coastal Management Units (CMUs) defined by:

1. Classification of coast type.
  - a. Natural – beaches, cliffs, dunes, saltmarshes, etc.
  - b. Built Structures – formal engineered structures.
  - c. Hybrid – combination of a and b.
2. Risk associated with coastal flooding and erosion.
  - a. Risk and Hazard  
Assets present in CMU, which are at risk of flooding/erosion hazard.
  - b. Risk and unknown Hazard.  
Assets present in CMU, no data on flood/erosion risk available.
  - c. No Risk and Hazard  
No assets present in CMU, but there is a flooding/erosion hazard.
  - d. No risk and no Hazard  
No assets present in CMU, no flooding/erosion hazard.

Assets referred to in the risk classification include residential properties, key roads and infrastructure.

Following this, the Culbin to Netherton CA coast has been subdivided into three CMUs (Figure 2-3). The CMUs are described below including a summary of the coastal change and flood risk. Full details of with each CMU are provided in Appendix A.



**Figure 2-3: Culbin to Netherton Coast CMU divided coastal extents.**



### 2.2.1 CMU 1: Culbin Forest Beaches - Natural

This CMU is an expansive stretch of natural sandy coastline backed by Culbin Forest. The CMU spans the entire outer coastline of the CA, over 10 km in length, and extends from the middle of Culbin Forest through to the inside of Findhorn Bay. The coastline along this unit is dynamic, dominated by two large spits which wrap around a tidal inlet. From available data sources and aerial imagery review, there is no evidence of engineered coastal defence structures present within this unit. The Duck Island Observatory tourist attraction is located on a small island within the tidal inlet.

SEPA flood maps show there is a limited flood hazard along the coastline, with a slight increase due to climate change, which poses a flood risk to a small section of minor road. Dynamic Coast erosion projections show the coastline of this unit is susceptible to erosion. The coastline here has an estimated historic rate of retreat of 5.1m/yr. This rate is projected to increase up to 6.7 m/yr by 2050 and 12.9 m/yr by 2100 leading to an estimated maximum potential distance of retreat of just over 700 m by 2100. According to available data, there are currently no assets present within the area projected to be lost by 2100.

### 2.2.2 CMU 2: Findhorn Bay - Hybrid

This CMU is a hybrid coastline. It is classified as hybrid as it is a predominantly natural coastline, but there is evidence of small sections of engineered coastal defence structures present. The CMU extends approximately 850 m of the western bank of the Findhorn River, within the wider Findhorn Bay, the unit comprises a long sandy beach, with a tidal mud-flat in front.

SEPA flood maps show that there is risk of flooding from 1-in-200-year and 1-in-200-year plus climate change events within this CMU, however there is no flood hazard to assets according to NFRA data.

There is an unknown hazard from coastal erosion as there is no data available from Dynamic Coast. However, MHWS appears to have remained stable across most of the CMU from 1890 to the present day.

### 2.2.3 CMU 3: River Findhorn - Natural

This CMU is a natural coastline, characterised by a low-lying inter-tidal system fronted by saltmarsh. The unit comprises 4.5 km of the southwestern extent of Findhorn Bay, around the confluence with the River Findhorn. This unit is a delicate and important environment for ecology and bird conservation<sup>8</sup>. There is no coastal erosion projected by Dynamic Coast for the area and MHWS appears to have remained stable from 1890 to the present day. There is no evidence of engineered coastal defences present within this CMU.

SEPA flood maps show that there is a flood risk at this unit in the present day. There are currently six properties at risk from a 1-in-200-year flood event in the present day, and this increases to 13 when factoring for climate change.

## 2.3 CMU categorisation for local adaptation plan

Review of the characteristics and risk associated with each CMU led to the classifications summarised in Table 2-1. These were used to develop initial Adaptation Pathways, Triggers, and an associated Implementation Plan.

<sup>8</sup> <https://fblnr.org/> - accessed on 05/03/2024.

**Table 2-1: Culbin to Netherton Coast CMU categorisation.**

<b>CMU</b>	<b>Coastal Type Classification</b>	<b>Risk Classification</b>
1	Natural	No Risk with Hazard
2	Hybrid	No Risk with Hazard
3	Natural	Risk with Hazard

### 3 Adaptation Pathways

Development of Adaptation Pathways for each CMU are based on the classification presented in Table 2-1. This aims to provide a flexible approach to adaptation that works towards a defined and desirable end outcome for the CMU and CA.

Details of this outcome are however, not defined at this stage, and will ultimately be dependent on monitoring changes to the following factors at the coast and on land adjacent to the coast:

- **Natural systems**
  - Habitat.
  - Greenspace.
- **Climate**
  - Climate change guidance.
  - SEPA flood maps or risk assessments.
  - Coastal flood occurrence.
  - Coastal erosion risk.
- **Risk exposure**
  - Change in defence condition.
  - Update to SEPA flood warning system.
  - Erosion risk buffer exceeded.
  - Flood risk threshold exceeded.
- **Socio-economics**
  - Changes of asset ownership.
  - Changes of land ownership.
  - Community pressures.
  - Tourism.

Adaptation Pathways for each CMU are presented in the following sections.

#### 3.1 CMU 1, 2, and 3 Adaptation Pathways

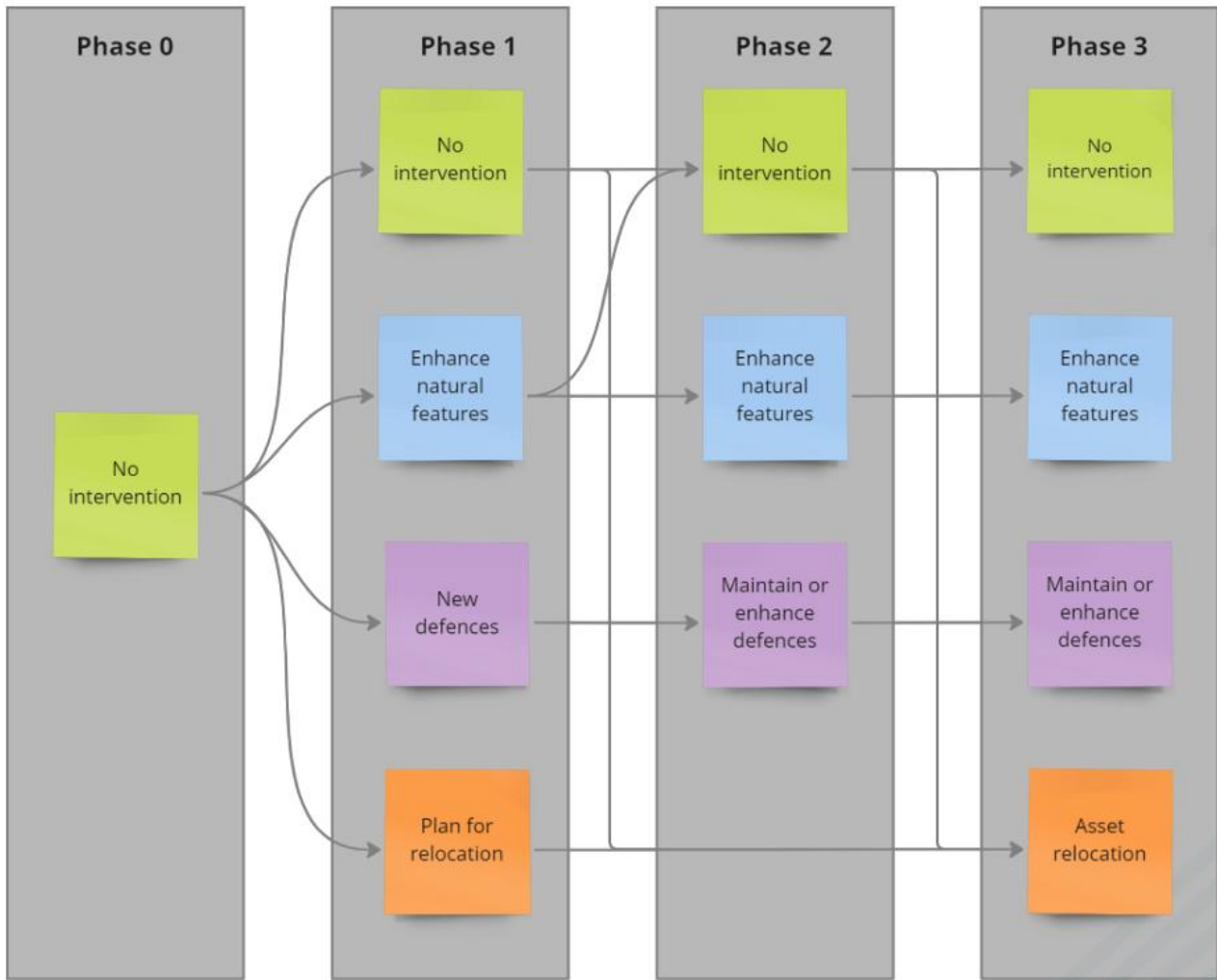
All three CMUs are classified as natural coasts and have been assigned an adaptation pathway for natural coastlines with hazard from erosion, flooding, or both (Figure 3-1):

- **CMU 1 = Natural with no risk with hazard**
- **CMU 2 = Hybrid with no risk with hazard**
- **CMU 3 = Natural with risk and hazard**

Phase 0 of the adaptation pathway (1<sup>st</sup> column) is the current action undertaken by Moray Council in respect to all three CMUs. Here this is **No Intervention**. This means that there will be no coastal and/or erosion risk management interventions during this phase.

For the adaptation pathway to move to Phase 1 (2<sup>nd</sup> column of potential actions) a pre-defined Trigger must be realised. Then, depending on the outcome of any Implementation Plan Actions, this may or may not result in a change to the management approach adopted for the CMU.

Consultation of the CCAP Implementation Plan (Section 4.1) will guide the process and ultimately the pathway to adaptation.



**Figure 3-1: Adaptation Pathway for CMUs 1, 2, and 3 (natural coast). Grey lines represent possible future pathways.**

## 4 Adaptation Process

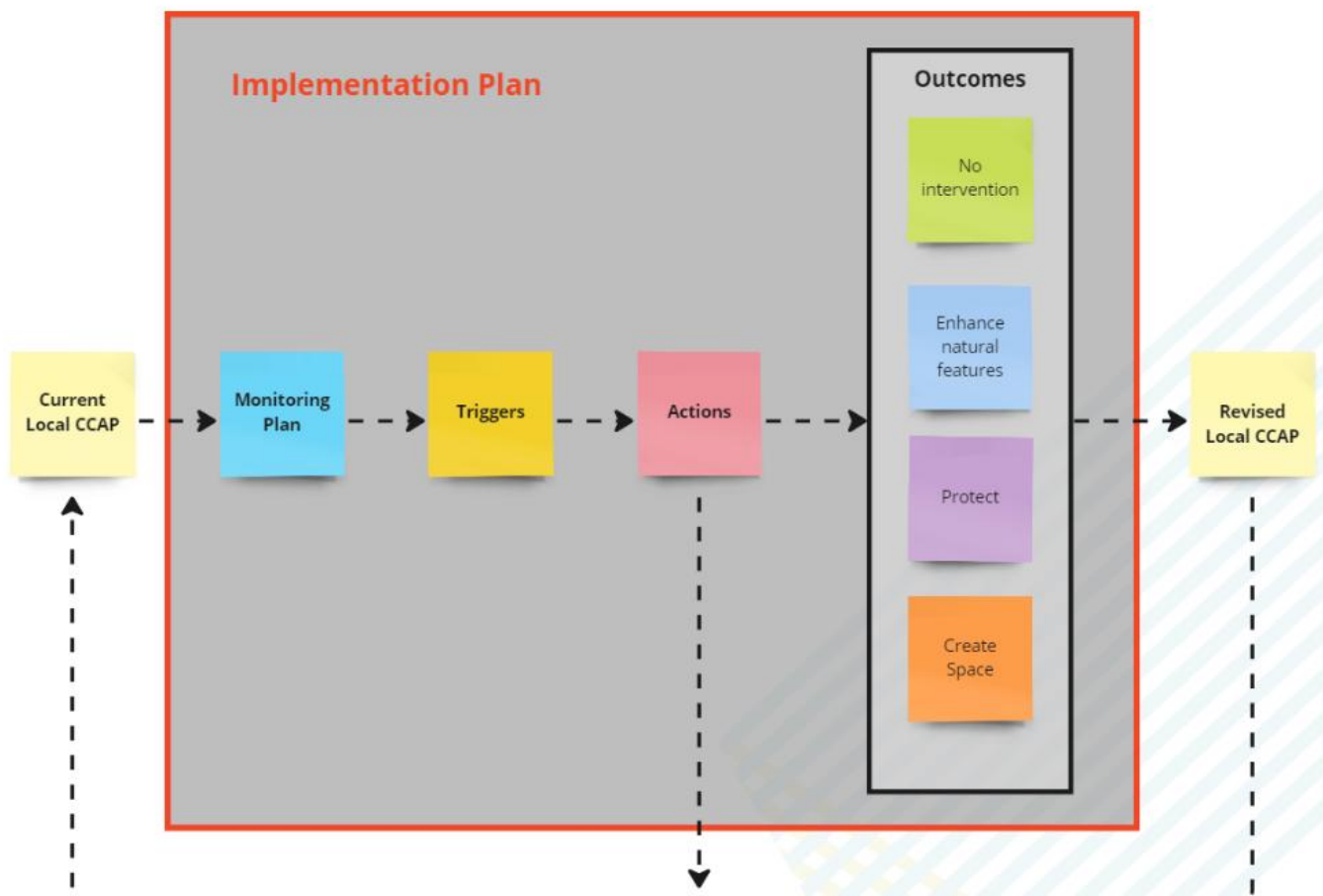
### 4.1 Implementation Plan

To support the delivery of the Adaptation Framework, a single Implementation Plan is applied to the entire Culbin to Netherton Coast CA with generic triggers and actions set that are relevant across the CA. Specific triggers and actions are then assigned to each CMU based on the Risk Assessment. Outcomes of the Implementation Plan link to the Adaptation Pathway specific to each CMU.

Delivery of the Implementation Plan has three stages (Figure 4-1):

- 1) Monitoring and Triggers (Section 4.2)
- 2) Actions (Section 4.3)
- 3) Outcomes (Section 4.6)

The outcome of the Implementation Plan determines what path will be followed within the Adaptation Pathway when moving to a new phase.



**Figure 4-1: High-level Implementation Plan.**

## 4.2 Monitoring and Triggers

### 4.2.1 Monitoring

Triggers are realised through monitoring of available data that informs risk of flooding and erosion. Triggers signal the requirement to deliver the Implementation Plan, which may lead to a review of the Risk Assessment and potential change to the Adaptation Pathway.

Triggers are categorised as:

- Natural systems triggers.
- Climate triggers.
- Risk exposure triggers.
- Socio-economic triggers.

These are subsequently grouped into categories with each requiring a plan for monitoring within the CA:

- Third party data and information.
- Moray Council data and information.
- Moray Council monitoring.
- External pressure.

### 4.2.2 Trigger Classification

Classification of the triggers falls into two parts.

1. Generic triggers applicable to the entire CA.
2. Bespoke triggers applicable to individual CMUs.

Climate, natural systems, and socio-economic triggers are generic for the whole CA, but risk exposure triggers related to physical flooding and erosion thresholds are specific to each CMU. For the Culbin to Netherton Coast CA these are summarised in Table 4-2.

Effective review of these requires development of a monitoring plan of risk for each CMU as follows:

- CMU 1: Monitoring of flood and erosion hazard
- CMU 2: Monitoring of flood hazard
- CMU 3: Monitoring of flood hazard

### 4.2.3 CMU-specific flooding trigger

Based on SEPA’s NFRA data, where there is risk of flooding, the elevation of assets at risk are compared to sea levels taken from the SEPA tide gauge at Buckie. Assets considered at risk from flooding include:

- Residential properties.
- Key roads.
- Coastal defences.

Where flood risk is present in a CMU, the lowest elevation of a residential property (minus 300mm freeboard) or key road is used to determine a frequency of exceedance using the tide gauge levels (Table 4-1).

At Culbin to Netherton Coast, current SEPA maps indicate a flood risk at CMU 1 and CMU 3.

**Exceedance Frequency is the number of events that exceed the asset threshold in a 10-year period.**

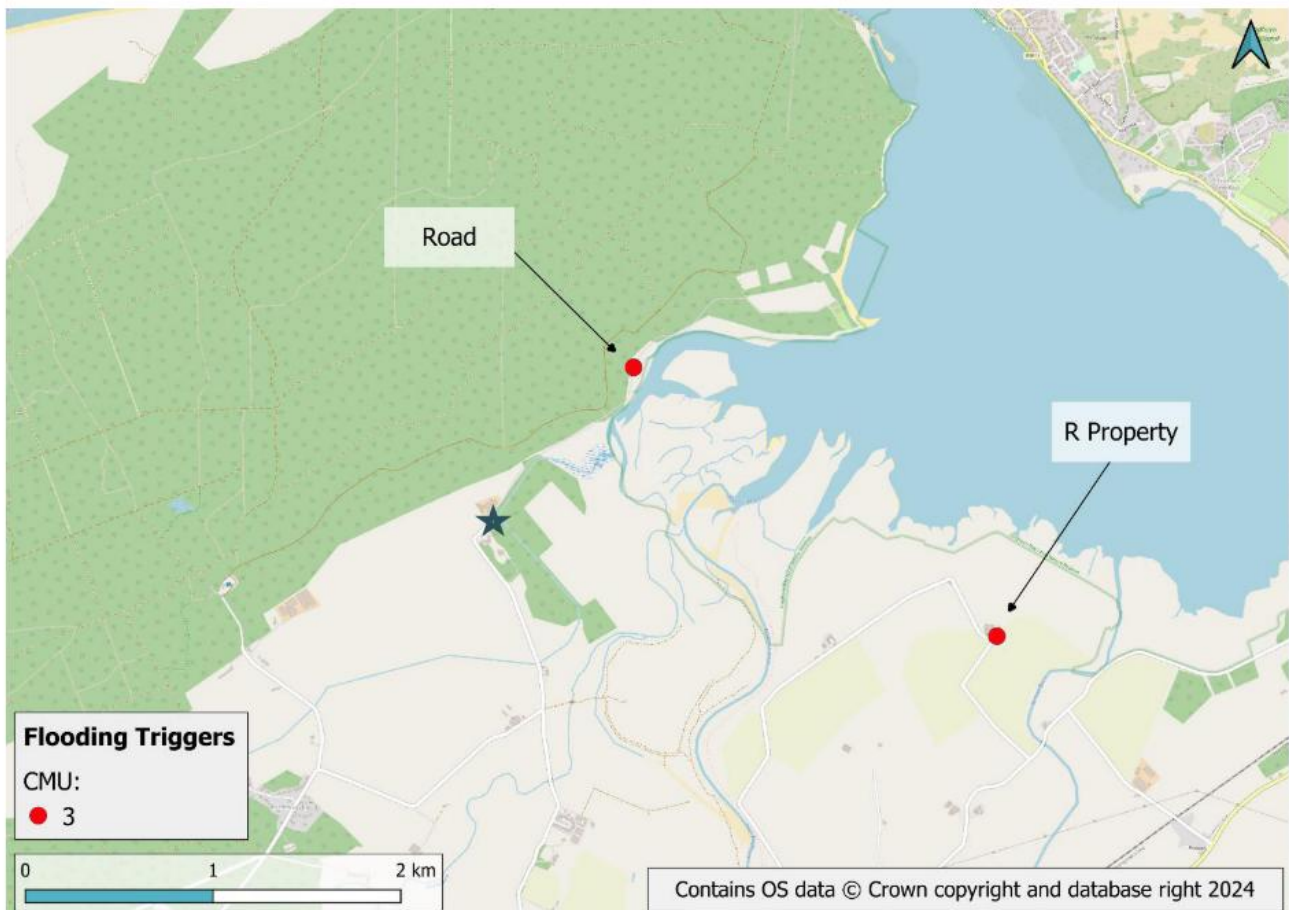
The CMU-specific flooding trigger is realised if the exceedance frequency increases beyond specified criteria. There are two levels to this Trigger realisation that result in different actions. These also vary depending on the type of asset at risk of flooding:

- **Residential properties**
  1. Exceedance frequency of **two** or more in a **ten-year window**.
    - Increase monitoring and plan for assessment.
  2. Exceedance frequency of **five** or more in a **ten-year window**.
    - Undertake assessment and plan for intervention.
- **Key Roads**
  1. Exceedance frequency of **five** or more in a **ten-year window**.
    - Increase monitoring and plan for assessment.
  2. Exceedance frequency of **ten** or more in a **ten-year window**.
    - Undertake assessment and plan for intervention.

Locations of these assets used to define the flooding triggers are shown in Figure 4-2. Currently, flooding trigger levels 1 and 2 have been met at CMU 3 (Table 4-1).

**Table 4-1: CMU-specific flooding triggers. Cells shaded red indicate that the flooding trigger has already been met.**

CMU	Lowest level of Property (mOD)		Property – Freeboard (mOD)	Current 10-year frequency	Flooding trigger level 1 Exceedance Frequency:	Flooding trigger level 2 Exceedance Frequency:
3	Property	3.0	2.7	7.8	2.0	5.0



**Figure 4-2: Culbin to Netherton Coast flooding trigger locations.**

#### 4.2.4 CMU-specific erosion trigger

Where there is risk of erosion, the distance from the asset at risk to the coast is used to define the Trigger. Assets considered at risk from erosion include:

- Residential properties.
- Key roads.
- Other features, such as car parks and golf courses.

As there are no assets currently predicted to be at risk of erosion, based on available data from Dynamic Coast, erosion triggers have not been set for Culbin to Netherton Coast.

#### 4.2.5 CMU-specific condition triggers

Where a coastal defence is present in a CMU, a CMU-specific trigger will be applied to the condition of the coastal defence. Currently, there are no coastal defences present in any CMU.



#### 4.2.6 New information trigger

New information on hazards, vulnerability, built structure and infrastructure assets etc. may become available at any time as the CCAP is implemented. The new information trigger acknowledges this and accounts for changes to properties, roads, key features, or assets available from Dynamic Coast or the NFRA.

This new information may be provided by a Council or stakeholder member, or local resident of the CA, and would trigger a review of the relevant part of the CCAP.

- **New Information trigger:**
  1. New information received of asset at risk:
    - Understand risk and, if relevant, set adaptation triggers and actions.
    - Incorporate into monitoring plan.
  2. New information received regarding a change in hazard (CMU 2 and 3):
    - Understand risk and, if relevant, set adaptation triggers and actions.
    - Incorporate into monitoring plan.

#### 4.3 Actions

Actions, like Triggers, are also applied to the entire CA, or to specific CMUs where the risk of flooding and/or erosion is identified. Actions will be specific to CMUs where, for example, a coastal defence is present; a natural protective feature is present; the risk of flooding/erosion is localised; assets are at risk of flooding/erosion.

Actions applicable to all and specific CMUs in Culbin to Netherton Coast CA have been identified in Table 4-4. These are based on the Phase 0 Triggers only and it is possible that more will be required as a reactive response to change. Delivery of the Regional Plan<sup>9</sup> Proactive actions are also required to support. The types of Actions are summarised below:

##### Review risk assessment:

- Involves a review of available data and associated risk assessment. Increased monitoring, planning, and implementing an assessment, and planning for intervention because of the erosion and flooding triggers are included in the review risk assessment action.

##### Community engagement:

- **Places:** Involves local groups, such as Councillors and community groups.
- **Practice:** Involves third party stakeholders, such as SEPA, Scot Gov, Nature Scot, and the Forestry Commission etc.
- **Asset:** Includes utilities specific to each built structures or hybrid CMUs.

##### Post flood data collection:

- Involve community engagement, surveys, photographs etc.

##### New risk assessment:

- Following a review of the current risk assessment and/or community engagement, a new risk assessment may be required. Should a new assessment be deemed necessary this should follow appropriate guidance<sup>10</sup> and include all necessary components to develop a preferred Adaptation Pathway and associated Action Plan for delivery. E.g. risk, economics, social, environment, engineering, land use planning etc.

<sup>9</sup> Moray Coastal Change Adaptation Plan: Regional Plan - IRR-JBAU-XX-XX-RP-MO-0001-S4-P03-Regional\_Plan  
<sup>10</sup> Scottish Government. 2016. Flood protection appraisals: guidance for SEPA and responsible authorities  
<https://www.gov.scot/publications/guidance-support-sepa-responsible-authorities/pages/2/>

Actions bridge the gap between Triggers and Outcomes and define what processes need to be implemented before the most appropriate Outcome is recognised and delivered for each CMU. Actions linked to specific triggers and relevant to Culbin to Netherton Coast CMU is included in Table 4-2. These highlight what may be delivered during the Phase 0 cycle and are dependent on the associated Trigger being realised.

**Table 4-2: Triggers, trigger categories and associated actions for each CMU.**

Category	Trigger	Action	CMU
<b>Natural Systems</b>	Changes to habitat	Community engagement (places)	All
	Changes to greenspace	Community engagement (places)	All
<b>Climate</b>	Update to climate guidance	Review risk assessment Community engagement (practice)	All
	Update to SEPA flood maps	Review risk assessment Community engagement (practice)	All
	Coastal flood occurrence	Review risk assessment Community engagement (places, asset) Post flood survey	All
<b>Risk exposure</b>	Update to SEPA flood warning	Review risk assessment Community engagement (places, practice)	All
	Flood risk threshold exceeded	Review risk assessment Community engagement (places)	CMU 3
	Update to Dynamic Coast	Review risk assessment Community engagement (practice)	All
<b>Socio-economic</b>	Changes of asset use	Community engagement (asset)	All
	Community pressure	Review risk assessment Community engagement (places)	All

#### 4.4 Phase 0 Actions

Phase 0 Actions require immediate attention and have been identified by triggers realised through the development process of this initial CCAP for Culbin to Netherton Coast. These are outlined below:

- CMU 3:
  - Trigger: Flooding risk threshold of property exceeded (level 2)
    - **Action 2:** Undertake assessment and plan for intervention.

An overall summary of all CMUs, Triggers, buffers and Phase 0 Actions is provided as a standalone record in Appendix C for clarity.

#### 4.5 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.

Proactive Actions are defined as those whereby there should only be benefit. Undertaking these can therefore only have a positive impact on supporting adaptation or increasing resilience.

At this stage in the adaptation planning process five such actions have been identified. These have been developed focusing on the key pillar 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 4-3, with further details on each included in Appendix C. These are designed to complement the wider Proactive Actions identified in the Regional CCAP.

**Table 4-3: Local Proactive Actions.**

Action	Details	Pillars
1	Work with landowners to ensure responsible management of Culbin Forest	Working with Natural Processes 
2	Conduct an adaptation and resilience workshop with local community and stakeholders.	Community and Engagement 
3	Develop remote monitoring techniques to support future assessments of remote coastline	Monitoring Change 
4	Develop modelling framework to understand combined risk of fluvial and coastal flooding within CMU 3	Working with Natural Processes 
5	Identify landownership and safeguarding space. This should link with the Regional Plan Proactive Action 7 to identify and define local opportunities.	Place Making 

## 4.6 Outcomes

Outcomes are the potential intervention measures that will be implemented after a trigger is realised and the associated actions, defined in the Implementation Plan, have been undertaken. There are four possible outcome categories:

- 1) No intervention.
- 2) Enhance natural features.
- 3) Protect.
- 4) Create Space.

These categories however are general, and nuances and variations may result upon completion of any more detailed study.

As the Implementation Plan is applied at CMU level, the ultimate outcome is dependent on the CMU and the associated Adaptation Pathway. Table 4-4 summarises the general and specific CMU outcomes for the Culbin to Netherton Coast CA.

**Table 4-4: Culbin to Netherton Coast CA possible outcomes.**

Category	Outcome	Culbin to Netherton Coast CMU
No intervention	No intervention	All
Enhance natural features	Enhance natural features	All
Protect	Maintain defences	N/A
	Sustain* defences	N/A
	Improve** defences	N/A
Create space	Remove defences	N/A
	Set back defences	N/A
	Relocate assets	CMU 3
*standard of performance is sustained into the future in response to climate change		
**standard of performance is improved beyond the current and then maintained in response to climate change		

The complete Implementation Plan for Culbin to Netherton Coast is shown in (Figure 4-5); structured using the three stages: 1) Monitoring and Triggers, 2) Actions, and 3) Outcomes.

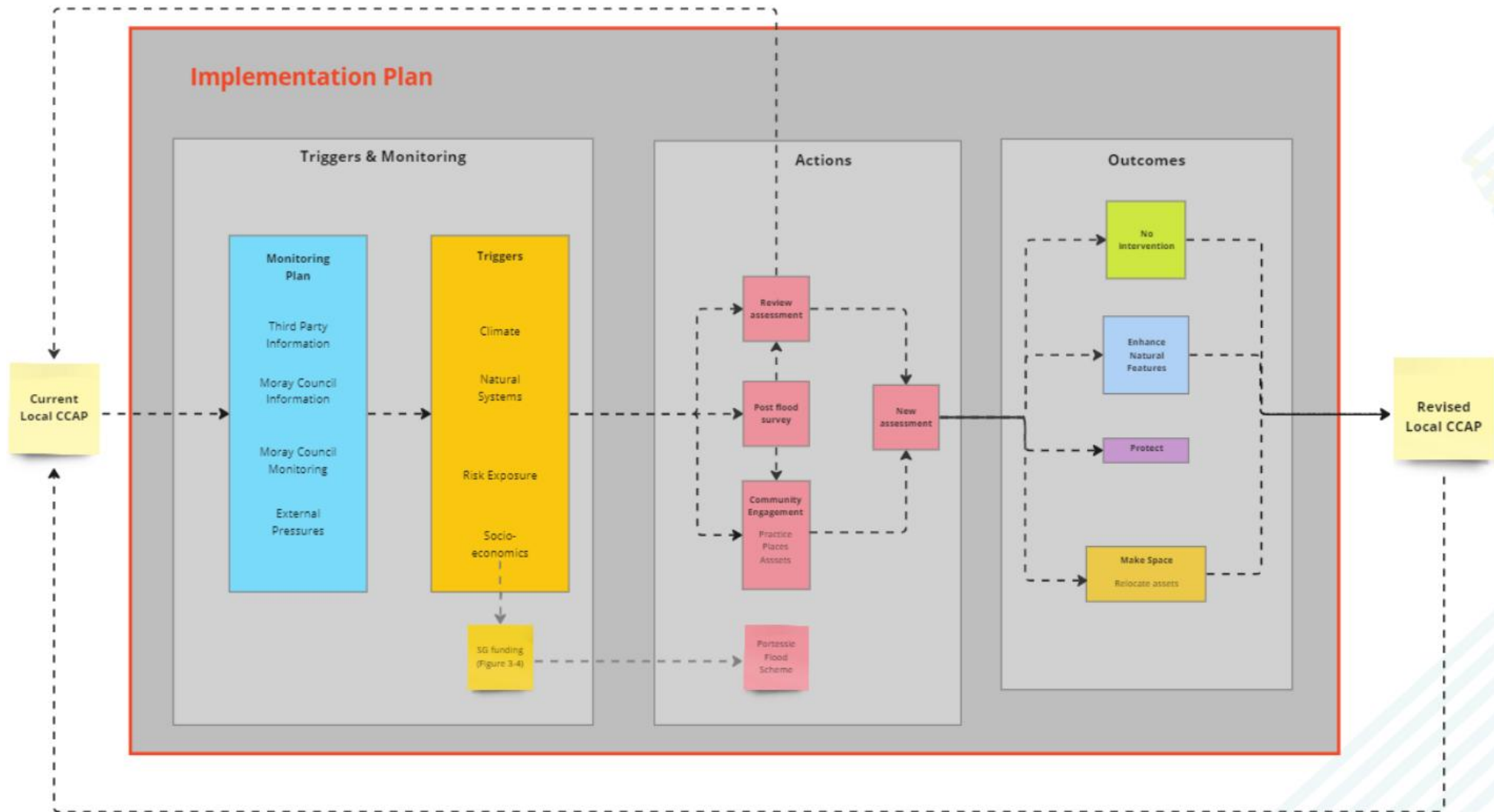
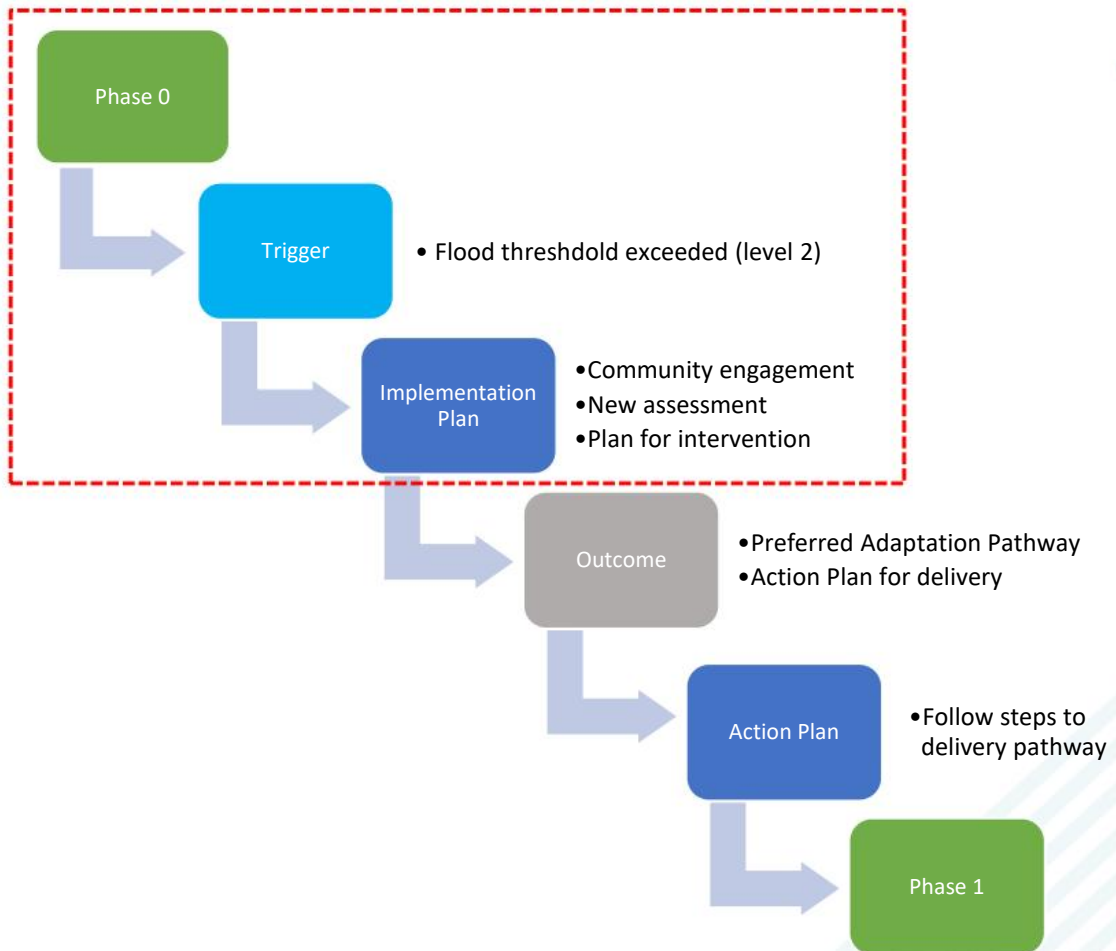


Figure 4-3: Complete Implementation Plan for Culbin to Netherton Coast CA.

#### 4.7 Example application

Figure 4-4 provides a schematic describing an example application of the Implementation Plan and how it fits in with the wider Adaptation Framework for Culbin to Nethererton Coast. The red box highlights the processes described in this iteration of the CCAP.



**Figure 4-4: Example application of Phase 0 to Phase 1 of the adaptation process and how the Implementation Plan works with Adaptation Pathways and Action Plans.**

## 5 Summary and Next Steps

### 5.1 Approach

This document presents the local CCAP for Culbin to Netherton Coast. It is the first iteration and will be subject to ongoing review and update to effectively guide the adaptation process. 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.

Adaptation in Moray has been steered by relevant published documentation and the Scottish Governments interim guidance on CCAPs. These have been used to develop a CCAP. This has been simplified into four key pillars of adaptation:

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

This local Plan builds on the Regional Plan by focusing on these pillars to develop an Adaptation Framework that can effectively support Culbin to Netherton Coast preparing for the impact that climate change will have on the coast. This will be delivered by following the Implementation Plan, presented here, that outlines Triggers and associated actions to develop detailed Adaptation Pathways and an action Plan for the Culbin to Netherton Coast CA. This will happen when the process moves into Phase 1.

### 5.2 Coastal Management Units and Risks

The Culbin to Netherton Coast CA was subdivided into three CMUs. For each of these a refined assessment was undertaken to determine coastal type and associated current and future flood and erosion risk. These are summarised as:

- CMU1 – Natural with No Risk with Hazard
- CMU2 – Hybrid with No Risk with Hazard
- CMU3 – Natural with Risk and Hazard

These were then taken forward to develop Adaptation Pathways and an Implementation Plan with Triggers and Actions associated with each CMU.

### 5.3 Adaptation Pathways

To enable effective implementation of this CCAP across the Culbin to Netherton Coast CA, each CMU has been assigned a generic Adaptation Pathway. This is specific to the CMU classification.

The adaptation journey is a multiphase, multiyear process and aims to transition communities into a more sustainable and resilient future. We are currently at **Phase 0**, meaning that no definitive preferred Adaptation Pathway and associated Action Plan have been developed. To move to Phase 1 of the Adaptation Pathway, a trigger must be realised that results in New Assessment and a preferred pathway and associated Action Plan must be identified:

1. **Phase 0:**
  - Development of the Implementation Plan
  - Delivery of Phase 0 Actions (Appendix C)
  - Delivery of Phase 0 Proactive Actions (Appendix B)
2. **Phase 1:**
  - Implementation Plan outcomes:
    - Preferred Adaptation Pathway
    - Action Plan for delivery
  - Delivery of Phase 1 No Regrets Actions
3. **Phase 2+:**
  - Implementation Plan outcomes:
    - Preferred Adaptation Pathway (Continue or revise Phase 1)
    - Action Plan for delivery (Continue or revise Phase 1)
  - Delivery of Phase 2 No Regrets Actions

While ultimately the Adaptation Pathways have a desired outcome, what that looks like and how it will be reached cannot be defined at this stage. Effective monitoring against the set triggers will enable the CCAP to evolve through Phases and support Moray Council decision making to aim to achieve this end-outcome.

A detailed summary of Phase 0 Actions is included in Appendix C.

#### 5.4 Implementation Plan

The Implementation Plan was developed by defining Triggers and setting Actions against these. Implementation of the Plan will result in end outcomes that will ultimately influence the direction of the Adaptation Pathways in the Culbin to Netherton Coast CA.

At this stage the pathways do not result in definitive end points. Triggers, while tangible, provide markers whereby Moray Council will undertake actions, guided by the Action Plan. 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, and bespoke flooding or erosion thresholds being exceeded, through monitoring of physical processes.

As well as Actions that rely on Triggers being realised. This initial stage of the adaptation planning process has identified several knowledge gaps and opportunities for activities to be undertaken upfront. These are defined as Proactive Actions, whereby undertaking these will only benefit and support Moray's adaptation to coastal change.

In total, four Proactive Actions have been set.

#### 5.5 Next Steps

Adapting 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 CCAP:

- Implement internal governance processes to review and monitor Triggers.
- Deliver local Phase 0 Actions.
- Deliver local Proactive Actions.



# Appendices

## A CMU Risk Assessment

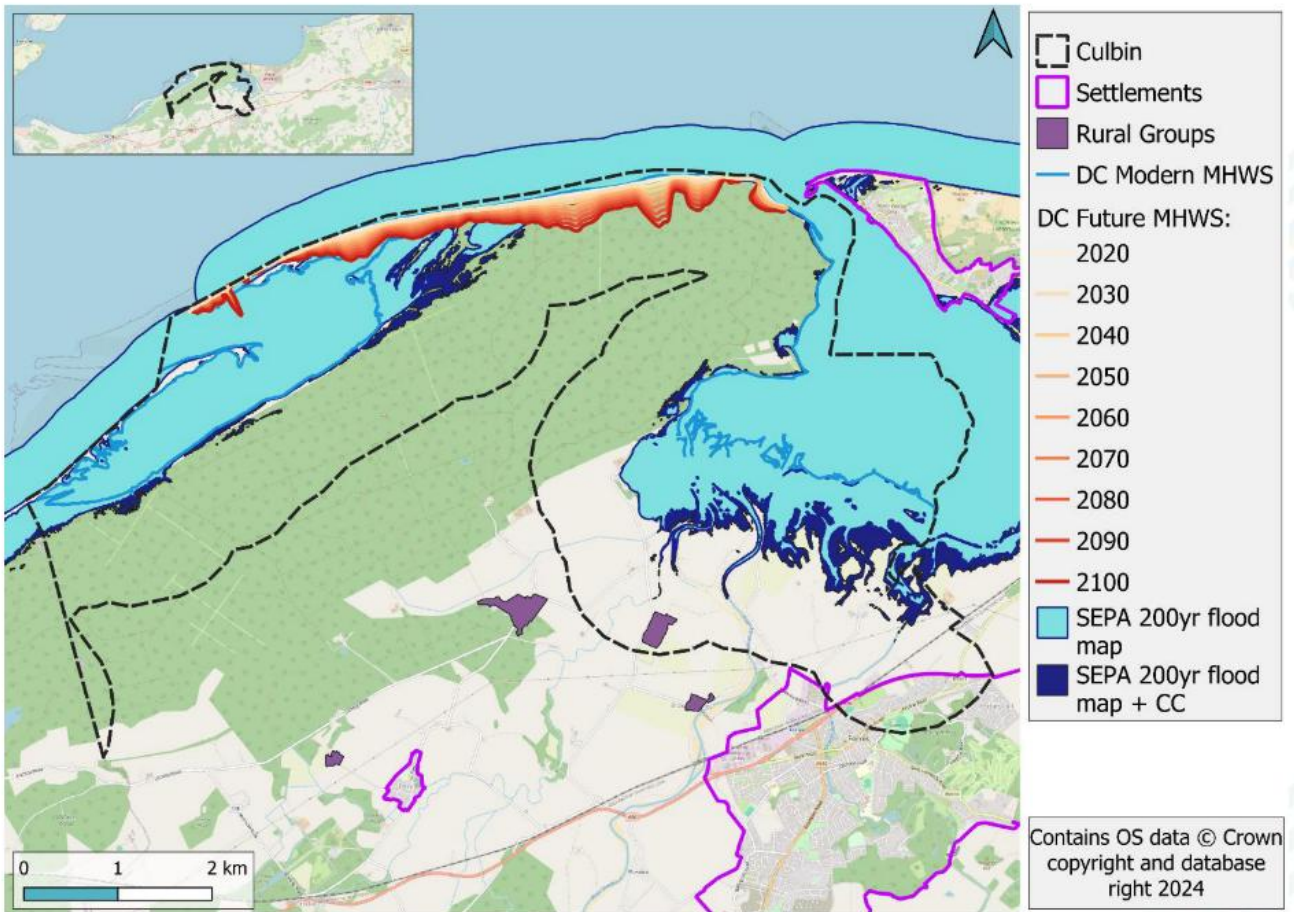
### A.1 Data and overview

Coastal parameters and associated datasets summarising wave, tide, and sea level conditions for Culbin to Netherton Coast are summarised in Table A-1.

**Table A-1: Coastal dataset summary for Culbin to Netherton Coast CA.**

Coastal Data		Details	Data source
Hindcast wave height	0.62 m	50th percentile	CMEMS
	0.96 m	75th percentile	
	2.69 m	99th percentile	
Tide levels	HAT	2.5 mOD	TotalTide
	MHWS	2.0 mOD	
	MHWN	1.1 mOD	
	MSL	0.1 mOD	
	MLWN	-0.5 mOD	
	MLWS	-1.5 mOD	
	LAT	-2.1 mOD	
Extreme Sea Levels	2.17 mOD	MHWS	CFB (3034)
	2.88 mOD	2-year	
	3.17 mOD	50-year	
	3.23 mOD	100-year	
	3.29 mOD	200-year	
	3.45 mOD	1000-year	
Sea level rise projections	0.14 m	2050 70th percentile	UKCP18
	0.19 m	2050 95th percentile	
	0.58 m	2100 70th percentile	
	0.82 m	2100 95th percentile	

An overview of coastal flood and erosion hazards is provided for the Culbin to Netherton Coast CA (Figure A-1). This has been produced using SEPA flood mapping for 1 in 200-year and 1 in 200-year plus climate change flood events as well as Dynamic Coast erosion projections from present day to 2100. The data has been analysed for each CMU individually and has been used to identify receptors at risk.



**Figure A-1: Culbin to Netherton Coast CA coastal flood and erosion hazard overview.**

### A.2 CMU 1:

This CMU is a natural coastline, with no engineered structures present. The CMU spans the entire coastline of the CA, over 10 km in length, from the middle of Culbin Forest through to just inside of the Findhorn Bay in the east. The coastline along this CMU is dynamic, dominated by two large spits which wrap around a tidal inlet.

SEPA flood maps show that there is risk of flooding from 1-in-200-year and 1-in-200-year plus climate change events within this CMU. Assets at risk from a 1 in 200-year flood event, according to NFRA data, are summarised below:

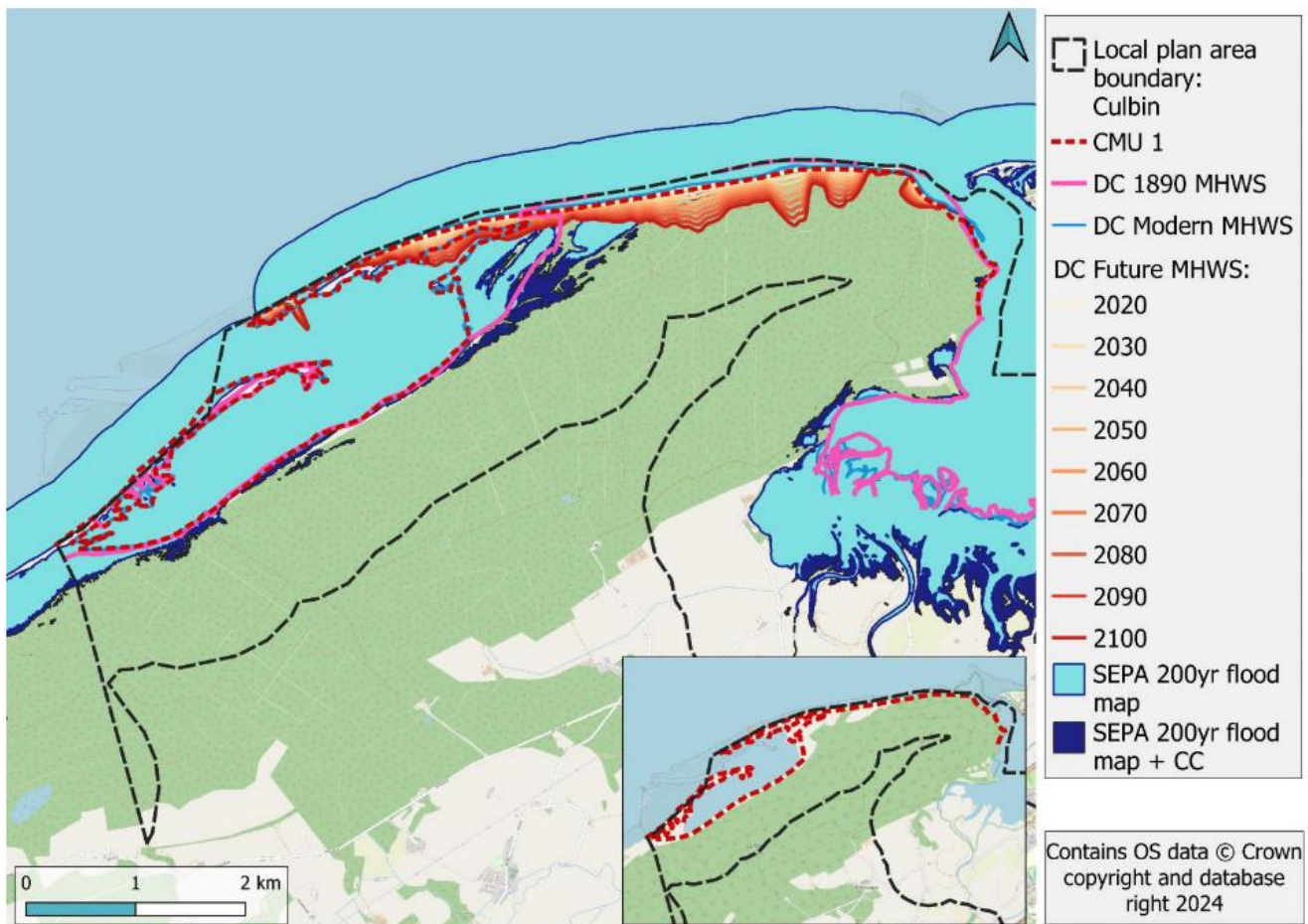
- Unnamed minor roads: (~430 m in total)

Assets at risk from a 1 in 200-year plus climate change flood event include assets at risk from a 1 in 200-year flooding event (shown above) plus assets summarised below:

- Unnamed minor roads (~650 m in total)

Erosion data from Dynamic Coast show the shoreline in CMU 1 has retreated at a maximum rate of 5.1 m/yr. Maximum future erosion rates are expected to increase to 6.7 m/yr by 2050 and to 12.9 m/yr by 2100. This would result in a maximum potential of 700 m land loss caused by shoreline retreat by 2100.

Table A-2 summarises the Dynamic Coast data for CMU 1. There are no assets currently predicted to be at risk of erosion according to the Dynamic Coast dataset.



**Figure A-2: CMU 1 coastal hazards map showing SEPA flood extents and Dynamic Coast (DC) past and future erosion. Inset shows unit without coastal hazards.**

**Table A-2: CMU 1 Dynamic Coast erosion summary.**

Dynamic Coast calculation	Results
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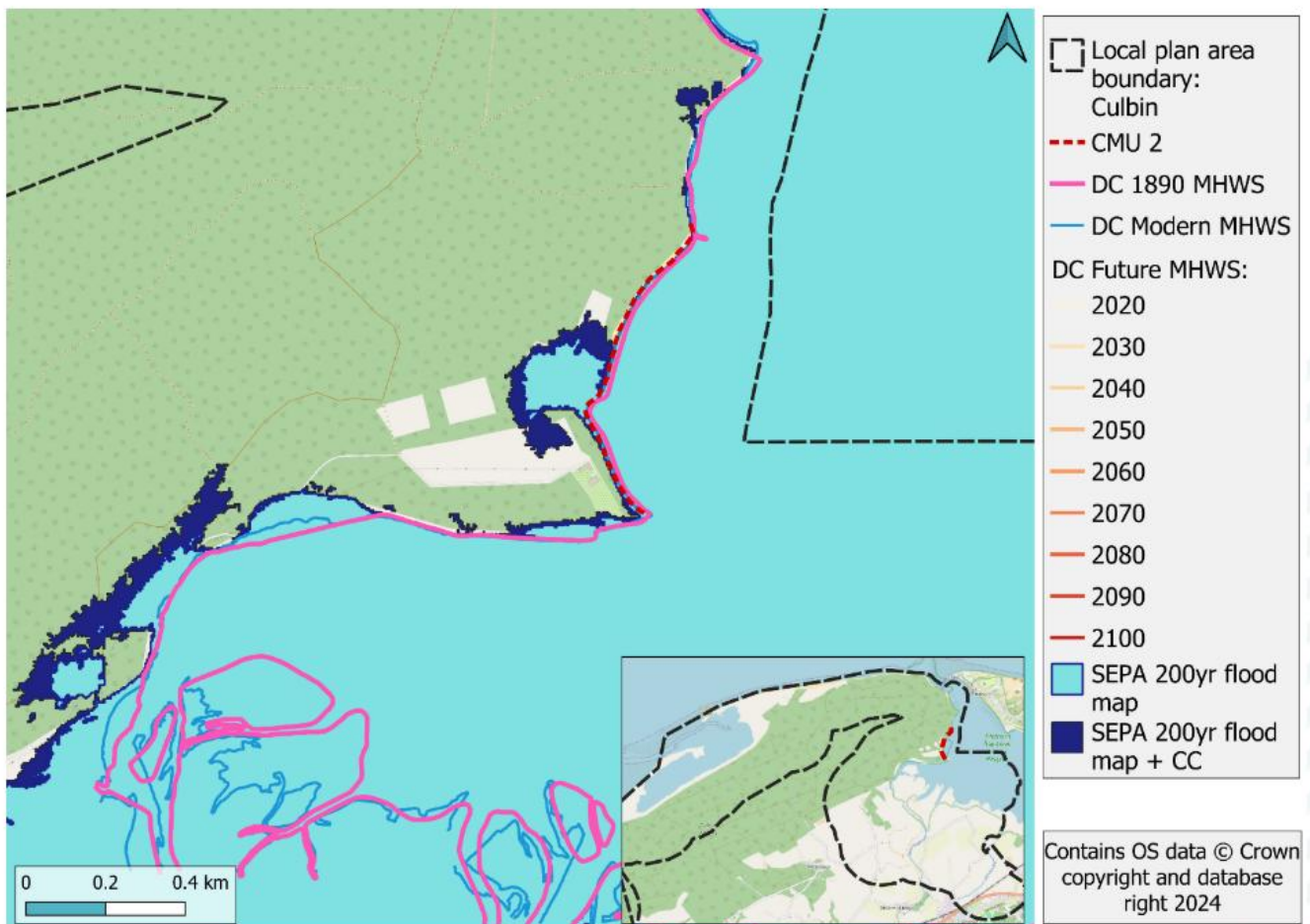
Historical rate	5.1 m / yr	Maximum
	1.4 m / yr	Median
2050 rate	6.7 m / yr	Maximum
	1.8 m / yr	Median
2050 distance	164.6 m	Maximum
	49.5 m	Median
2100 rate	12.9 m / yr	Maximum
	2.6 m / yr	Median
2100 distance	702.9 m	Maximum
	164.9 m	Median

### A.3 CMU 2:

This CMU is a hybrid coastline. It is classified as hybrid as it is a predominantly natural coastline, but there is evidence of small sections of engineered coastal defence structures present. It extends approximately 850 m of the western bank of the Findhorn River, within the wider Findhorn Bay, the unit comprises a long sandy beach, with a tidal mud-flat in front.

SEPA flood maps show that there is risk of flooding from 1-in-200-year and 1-in-200-year plus climate change events within this CMU, however there is negligible flood risk to assets according to NFRA data (Figure A-3).

There is an unknown hazard from coastal erosion as there is no data available from Dynamic Coast. MHS appears to have remained stable across most of the CMU from 1890 to the present day.



**Figure A-3: CMU 2 coastal hazards map showing SEPA flood extents and Dynamic Coast (DC) past and future erosion. Inset shows unit without coastal hazards.**

#### A.4 CMU 3:

This CMU is a natural coastline and characterised by a low-lying inter-tidal estuary fronted by saltmarsh. The unit comprises 4.5 km of the southwestern extent of Findhorn Bay, around the outfall for the River Findhorn. This unit is a delicate and important environment for ecology and bird conservation.

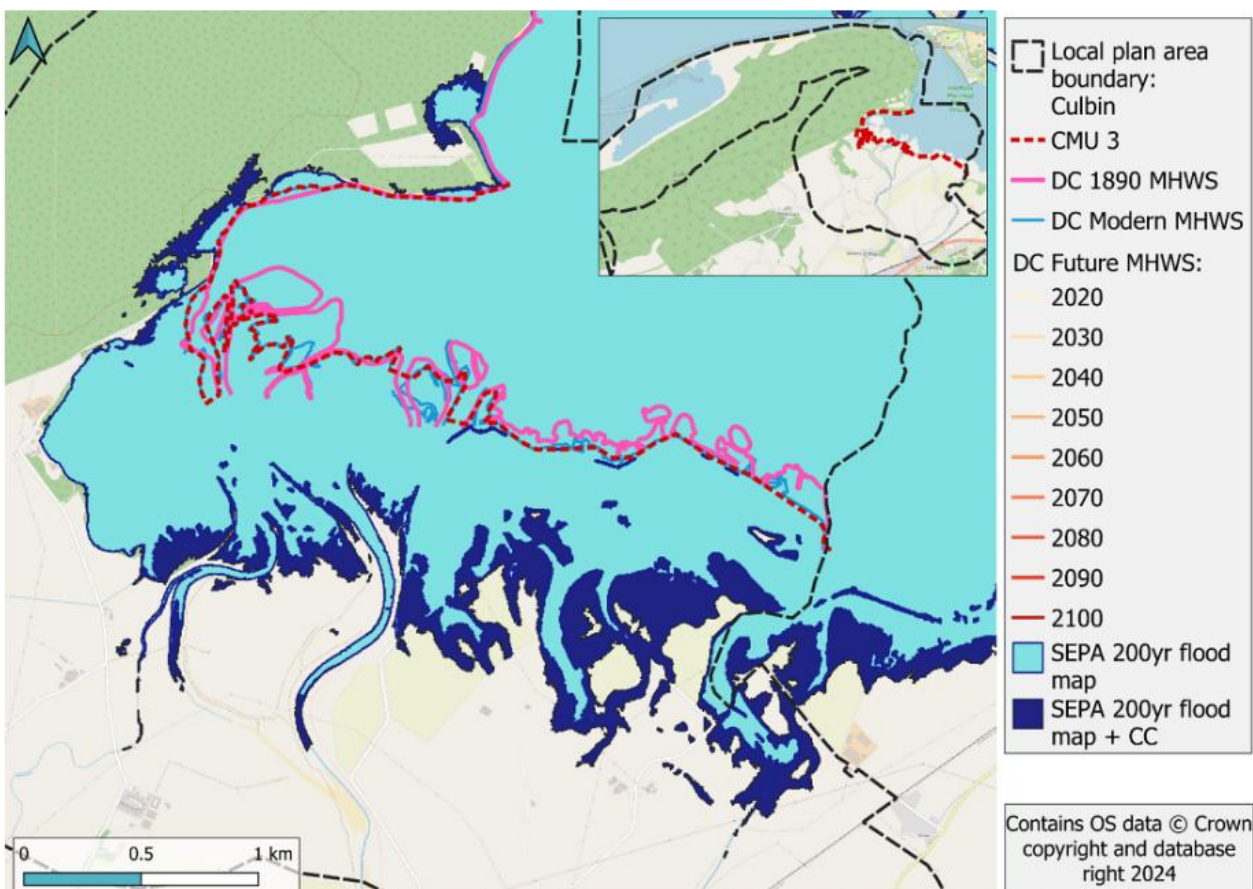
There is an unknown hazard from coastal erosion as there is no data available from Dynamic Coast. MHWS appears to have remained generally stable across most of the CMU from 1890 to the present day.

SEPA flood maps show that there is risk of flooding from 1-in-200-year and 1-in-200-year plus climate change events within this CMU. Assets at risk from a 1 in 200-year flood event, according to NFRA data, are summarised below:

- One RP (residential property)
- Five NRPs (non-residential property)
- Unnamed roads (~1.6 km in total)

Assets at risk from a 1 in 200-year plus climate change flood event include assets at risk from a 1 in 200-year flooding event (shown above) plus assets summarised below:

- Two RPs
- Five NRPs
- Unnamed roads (~1.2 km in total)



**Figure A-4: CMU 3 coastal hazards map showing SEPA flood extents and Dynamic Coast past and future erosion. Inset shows unit without coastal hazards.**

## B Proactive Actions

### Action 1 – Work with landowners to ensure responsible management of Culbin Forest

The coastline between Culbin and Netherton is natural, with a large proportion backed by Culbin Forest. This forest is a significantly important ecological, environmental, and recreational resource, which has multiple benefits for local wildlife as well as the local economy.

Culbin Forest will become increasingly important in years to come at mitigating coastal retreat. Whilst coastal retreat, particularly in CMU 1, is unavoidable. The forest may help consolidate sands and soils at the coast, as well help reduce aeolian erosion of the beaches and dunes by casting wind shadows at the coastline.

A proactive action that will help maintain resilience at the Culbin to Netherton Coast will be to work with the forest managers to maintain the forest cover in a sustainable way. This can be achieved through avoiding de-forestation immediately at the coast, limiting pollutants and invasive diseases/fungi, controlling tourist pathways, and mitigating potential causes of fires.



### Action 2 – Conduct a new adaptation and resilience workshop with local community and stakeholders.

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.

The outcomes of this initial phase should be presented to the community and stakeholders alongside consideration for wider support and education around climate awareness and flood resilience.



### Action 3 – Develop remote monitoring techniques to support future assessments of remote coastline.

The nature of the coastline between Culbin and Netherton is dynamic. The expansive beaches and attached spits that make up the coastline are continuously moving in response to tidal dynamics and responses to storms. It would be beneficial to understand the nature of this coastline to project coastal change more accurately within this locality, particularly in CMU 1.



<p>To understand the dynamics of the coastline here will require an effective monitoring strategy. Due to the size and remoteness of the coastline a remote sensing technique, such as LiDAR, aerial imagery, or satellite derived shorelines, could provide an efficient method to monitor coastal change in the longer-term.</p>	
<p><b>Action 4 – Develop modelling framework to understand combined risk of fluvial and coastal flooding within CMU 3</b></p> <p>The flooding triggers have been set in CMU 3 based on the SEPA flood projections. The flood maps consider the tidal flood component within Findhorn Bay; however, flood risk may be greater than projected as the fluvial component is not accounted for. A combined fluvial-tidal model could provide greater accuracy for flood risk within CMU 3.</p>	
<p><b>Action 5 – Identify landownership and safeguarding space. This should link with Regional Proactive Action 6 to identify and define local opportunities.</b></p> <p>To work with natural processes and make space for coastal change it is inevitable that existing land will be lost. To adapt effectively it is therefore important that land and asset ownership within the CA is fully understood to enable safeguarding of areas. This should feed into revisions of the wider Moray Council Local Development Plan.</p>	



## C Trigger and Action Database

**Table C- 1: Phase 0 Trigger and Action database for Culbin to Netherton Coast.**

Community Area (CA)	CMU	Coast Type	Trigger Type	Asset Affected	Asset Description	Trigger Level	Trigger Exceeded?	Trigger Buffer Flooding (Freq/10 yr)	Trigger Buffer Erosion (m)	Action	Owner	Delivery Partners	Timescale	Cost
Culbin to Netherton Coast	1	Natural	Flooding	Other	Culbin Forest	1	N			None	NA	NA	NA	NA
						2	N			None	NA	NA	NA	NA
			Erosion	Other	Culbin Forest	1	N			None	NA	NA	NA	NA
						2	N			None	NA	NA	NA	NA
	2	Natural	Flooding	Propoerty	B&B	1	N			None	NA	NA	NA	NA
						2	N			None	NA	NA	NA	NA
	3	Natural	Flooding	Property	Private Property	1	Y	7.8		Increase monitoring and plan for assessment.	Moray Council	None	Short	Low
						2	Y			Undertake assessment and plan for intervention.	Moray Council	Scot. Gov.	Medium	Medium
				Road	Waterford Road	1	Y	345.2		Increase monitoring and plan for assessment.	Moray Council	None	Short	Low
						2	Y			Undertake assessment and plan for intervention.	Moray Council	Scot. Gov.	Medium	Medium

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