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Coastal Infrastructure Investment Framework

Department of Environment, Land, Water and Planning

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Contents

Glossary

Acronym	Definition
CBA	Cost benefit analysis
CIIF	Coastal Infrastructure Investment Framework
CoM	Committees of Management
DDA	Disability Discrimination Act
DELWP	Department of Environment, Land, Water and Planning
GIS	Geographic information system
GORCAPA	Great Ocean Road Coast and Parks Authority
MCA	Multi-criteria analysis

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1. Context and Purpose

The Coastal Infrastructure Investment Framework is driven by a desire to enable local government and Committees of Management to manage their coastal infrastructure in a strategic manner.

CIIF Background and Purpose

Project context

The Coastal Infrastructure Investment Framework (CIIF) sits within a $4.8 million package of works overseen by DELWP, named “Preparing the Barwon Region for Climate change”.

The projects within the package were suggested at the Barwon South West Regional Partnership Assembly and shortlisted by the Barwon Regional Partnership to apply for funding. These three climate change adaptation projects within the package approved for funding include:

- Emergency Management and Local Government
- **Investing in Coastal Infrastructure**
- Landscape scale adaptation.

DELWP’s project drivers for the CIIF stem from a desire to enable local government and Committees of Management (CoM) to manage their coastal infrastructure in a strategic manner. Conscious that often political drivers dictate infrastructure requirements, sometimes leading to poor outcomes, the objective of the CIIF was to provide coastal asset managers with a transparent and defendable methodology for making investment decisions.

Consultation with land managers highlighted the following list of key issues and concerns for managing coastal assets. The CIIF was designed to consider these concerns:

- Data uncertainty and a lack of data communication – lack of understanding of what best practice looks like in relation to coastal infrastructure data capture, storage, management and use.
- Lack of community needs assessments to identify community values and service needs.
- Climate change impacts - concern regarding inundation or loss of assets.
- Lack of knowledge on frequency of asset use, lack of confidence in asset condition and consistency of condition assessments.
- Lack of consistency with wider plans and management including lack of dynamic and ongoing mapping of coastal assets.

The CIIF has been developed to a concept level, defining its key purpose, outputs and process to produce outputs. Further development is required in the next stages of work to build a digital tool to house the CIIF, to ensure it can integrate with existing asset management software. Longer pilot testing with land managers are also needed to test that benefits are achieved. This scope will be the area of focus in the next Phase of the project.

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1. Context and Purpose

The Coastal Infrastructure Investment Framework assists land managers in making strategic investment decisions for coastal assets, as a transparent and robust methodology that promotes holistic decision making.

CIIF Background and Purpose

Purpose of the CIIF

The coastal infrastructure investment framework assists land managers to embody holistic thinking into their initial strategic planning to assess what assets require investment. The CIIF encourages land managers to consider a range of criteria that cover social, environmental, heritage and economic aspects.

The local governments, CoMs, and Great Ocean Road Coast and Parks Authority (GORCAPA) play an important role in managing, maintaining and improving coastal assets. The purpose of the CIIF is to provide a clear pathway for land managers in identifying a prioritised list of coastal assets that require investment in the near future. The CIIF sets out a range of criteria for the land managers to use, which enables all land managers in the Barwon South West coastal area to apply consistently.

The type of coastal assets that are to be considered as part of the framework include but are not limited to jetties/piers/wharves, BBQs, bollards, seating, bins, signs, lighting, tables and other amenities.

As shown by Figure 1, the CIIF would be applied during the initial strategic planning stage of an investment lifecycle. The CIIP will help land managers identify what assets require attention and start considering what the high-level management response should be. The outputs of the CIIF will then become the driver and key input into the strategic plans and capital works budgeting program that are collated by land managers. This will then be followed by the business case process where more detailed analysis is undertaken.

The CIIF will become the driver of the strategic plan, where land managers will run the CIIF to identify what assets require investment and create a strategic plan or capital works program based around it.

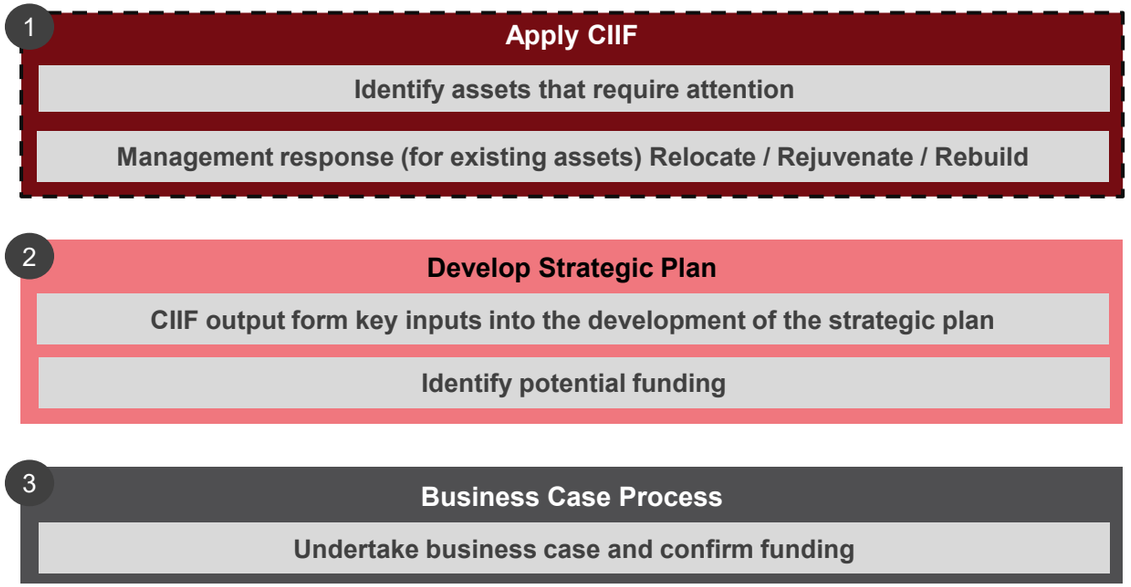

Figure 1: Application of CIIF in the planning stage

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1. Context and Purpose

Use of the Coastal Infrastructure Investment Framework will benefit land managers by various means such a reduction in costs and disruptions from asset deteriorations, alignment of decisions with community needs and by strengthening the strategic planning process.

CIIF Background and Purpose

CIIF overview

The CIIF is a three-phase framework, which steps coastal assets of the Barwon South West region through several criteria filters within each phase to produce a list of assets in order of investment priority.

The CIIF is currently a first iteration concept that articulates the process, key outputs and value to be gained. In order to effectively roll out the CIIF across land managers, further testing and development of additional value-adds is required. The next steps are listed on Page 17.

The CIIF process is detailed on Page 7. This outlines the three phases of work and the criteria used to produce the prioritised asset list.

Benefits of the CIIF to land managers

1. **Reduction in costs and social disruptions from asset deterioration –** coastal infrastructure investment decisions are often unplanned and reactionary. Planning informed by the CIIF would mitigate costs of urgent repair work, ensure assets provide value for money and reduce the number of unplanned repairs to ensure the community can access key assets.
2. **Better informed investment decisions that align with community needs –** the CIIF will help ensure that the needs of the broader community are captured in decisions, with a multi-criteria assessment to consider the needs of community as well as economic and tourism drivers.
3. **Strengthens the strategic planning/budgeting/business case process –** the CIIF will provide a prioritized list of assets requiring attention which can be used to develop the strategic plan for investments and support the business case process for upgrades.
4. **A preventative approach rather than reactive –** the CIIF encourages asset intervention and upgrade before the condition deteriorates and requires an urgent solution.

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2. Overview of the CIIF

The CIIF has been informed by stakeholder engagement and pilot testing with specific land managers, and a GIS map of the coastal assets was created to better understand the assets present in the region.

CIIF Introduction

Steps undertaken to inform the CIIF

Stakeholder engagement

Stakeholder engagement with land managers in the Barwon South area was crucial for understanding:

- Current processes used for determining high priority investments
- Important criteria used to prioritise assets
- Views on what makes tools more usable.

The engagement process included the Great Ocean Road Coast and Parks Authority, Barwon Coast Committee of Management, Bellarine Bayside Committee of Management, Colac Otway Shire, Surf Coast Shire and Borough of Queenscliff.

The findings from these discussions underpinned the development of the CIIF. The key takeaways included:

- Condition, asset utilisation, environmental significance and economic significance are important factors
- Revenue generation potential is integral and return on investment is a key driver for alterations or expansions
- The service need of an asset needs to be considered early in the CIIF, as assets that are no longer used should not be considered for future investment

Pilot testing

The Great Ocean Road Coast and Parks Authority (GORCAPA) was selected to undertake pilot testing of the CIIF. The Authority was selected as a result of its diverse range of asset types. During this collaborative testing process, real asset data was run through the CIIF to identify any issues and ensure the outputs were in line with expectations.

The pilot testing process was valuable in fine-tuning the CIIF and gaining direct feedback from GORCAPA. Pilot testing was essential to understand what additional value-adds can be undertaken to further develop the CIIF into a user friendly digital tool.

GIS Mapping

GIS mapping was undertaken to map coastal assets and hazards within the region. This exercise plotted inundation levels for the future based on rising global mean sea levels, storm surge and astronomical tides and potential ranges for these levels in the region. This was a key task as no comprehensive mapping had been produced before in the study region. The GIS mapping produced a consolidated view of the location of coastal assets and the land manager responsible.

The GIS map is interactive and was based on coastal asset data collected by Assetic, an external asset management firm appointed by DELWP. As the data was collected in 2020, the GIS map only reflects that point in time. It is important to note that the data collected by Assetic did not accurately capture the ownership of assets by land managers, as GORCAPA had been newly formed, and transition of responsibilities had not been complete.

Expanding the GIS mapping to reflect live and accurate data, as assets and its ownership change is a priority in the next Phase of CIIF.

Figure 2: GIS Mapping study area

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2. Overview of the CIIF

The CIIF has three phases which produce a prioritised list of assets for investment.

CIIF

An overview of the CIIF is shown in Figure 3. The framework has three phases, which steps coastal assets of the Barwon South West region through several criteria filters within each phase to produce a list of assets in order of investment priority.

Phase 1 starts with the complete list of assets. It eliminates assets from the lists that no longer have a service need and then groups the remaining assets into priority categories based on the asset compliance, condition and asset revenue generating status.

Phase 2 then seeks to sort the assets within the prioritised categories using a multi-criteria analysis. The criteria covers social, economic and environmental factors.

Phase 3 is for the land managers to identify high-level management response on the prioritised asset list from Phase 2.

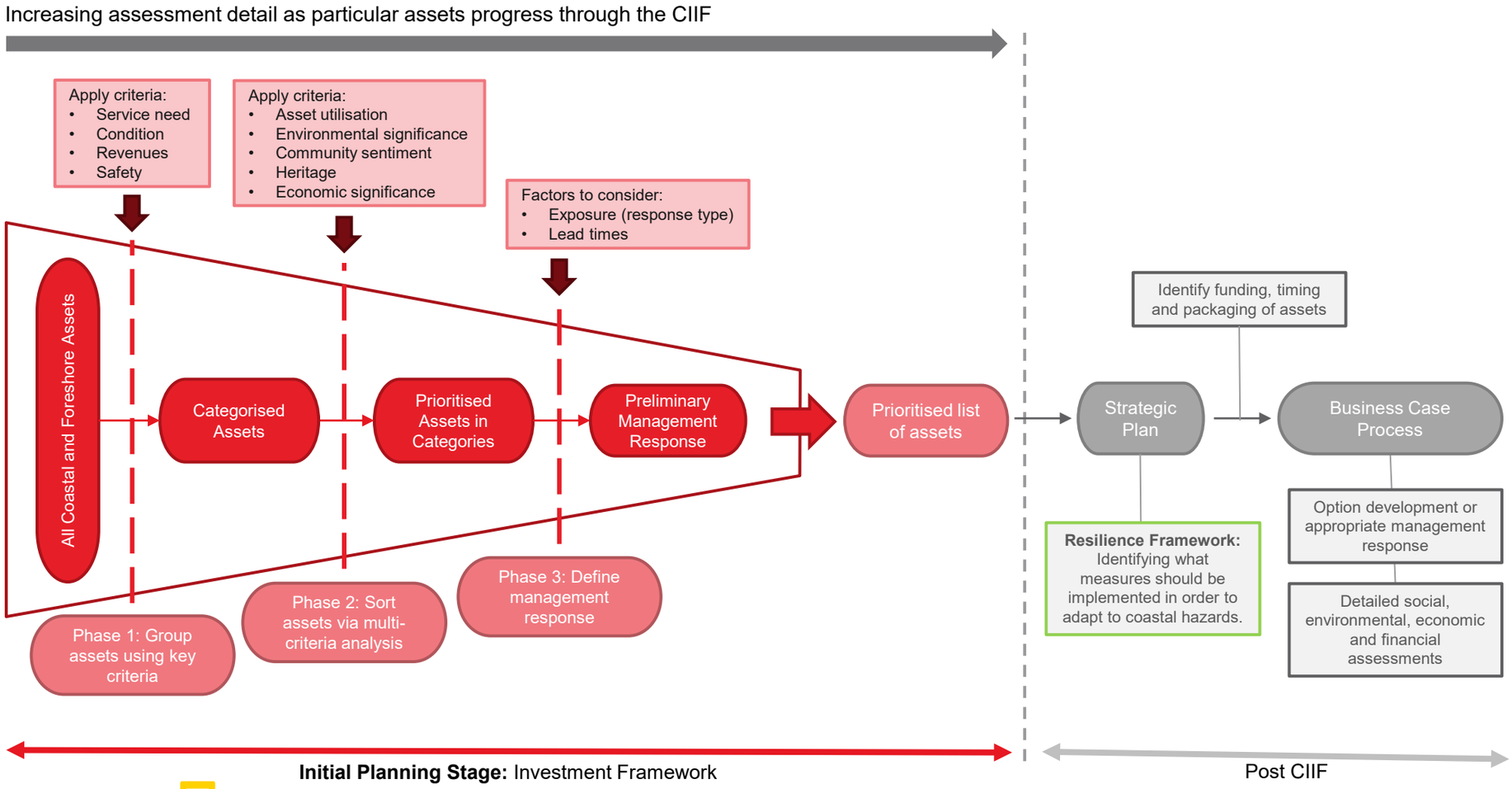

Figure 3: Overview of CIIF

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2.1 CIIF Phase 1

Phase 1 seeks to place assets into prioritised categories based on condition, safety and whether the asset generates revenue.

Phase 1 – Categorised Assets

Overview

The steps involved in Phase 1 are outlined in Figure 5. This diagram shows the order of criteria applied and progression through Phase 1.

Phase 1 starts with the complete list of assets and applies two key steps:

1. Eliminates assets from the list which are not needed in service
2. Groups the remaining assets into five priority categories which separate assets into the highest priority category A to lowest priority category E.

After the assets with no service need are removed, the following criteria are applied to the list of assets:

- Asset compliance status / safety
- Asset condition
- Asset revenue generating status

Detailed definitions for these criteria and how they are applied are included in Table 1. The application of these criteria separate the remaining assets into the priority categories.

Priority categories

Priority A and B assets are the highest priority as these assets are non-compliant with regards to safety risk (Priority A) or regulation and legislation (Priority B).

Following this, assets that have poor condition (4 or 5) are prioritised, the assets amongst these that generate revenue are Priority C and those that do not – Priority D.

The remaining assets which are condition 3 are split between Priority E and Priority F, where Priority E are revenue generating and Priority F are not.

Assets with condition 1 or 2 do not progress to Phase 2 and are placed as lowest priority, external to the prioritisation system due to their good asset condition.

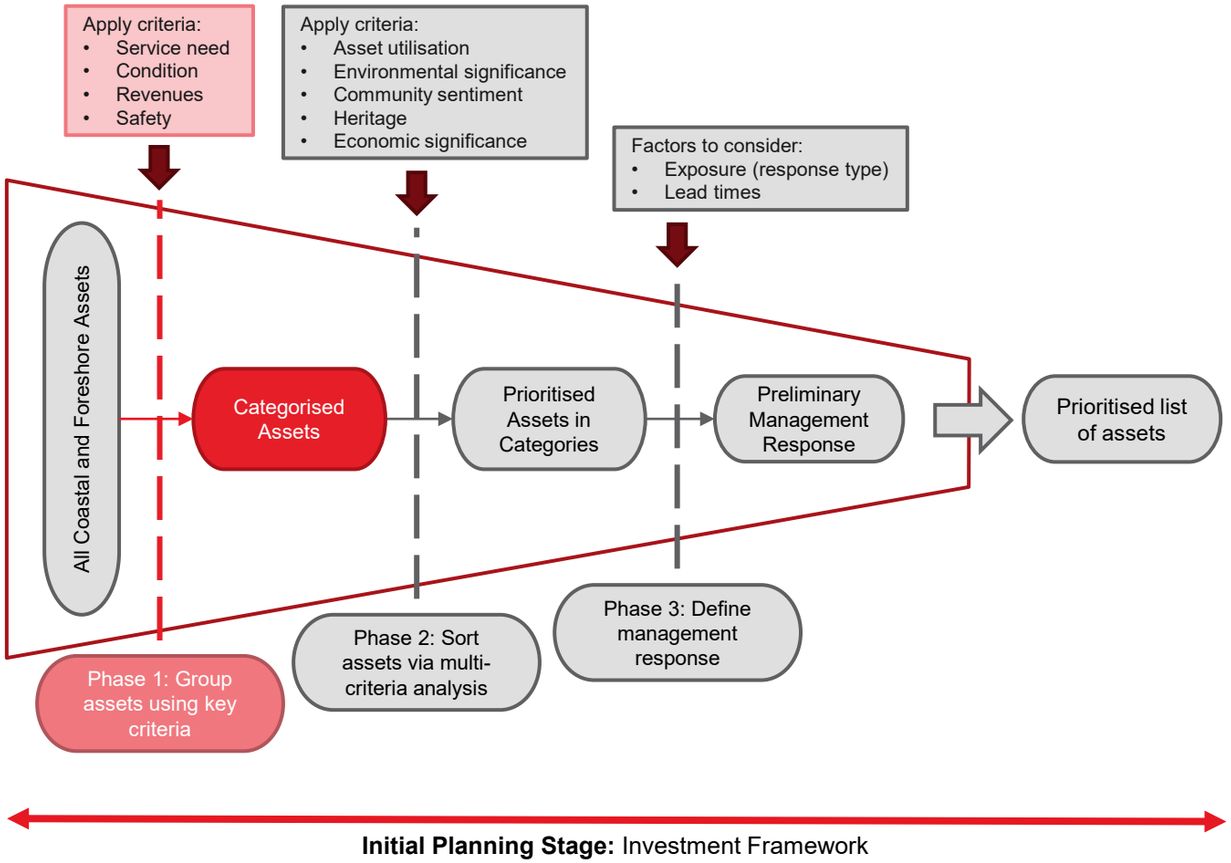

Figure 4: Overview of CIIF – Phase 1 Steps

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2.1 CIIF Phase 1

Phase 1 seeks to place assets into prioritised categories based on compliance, condition, safety and whether the asset generates revenue.

Phase 1 Categorised Assets Flow Chart

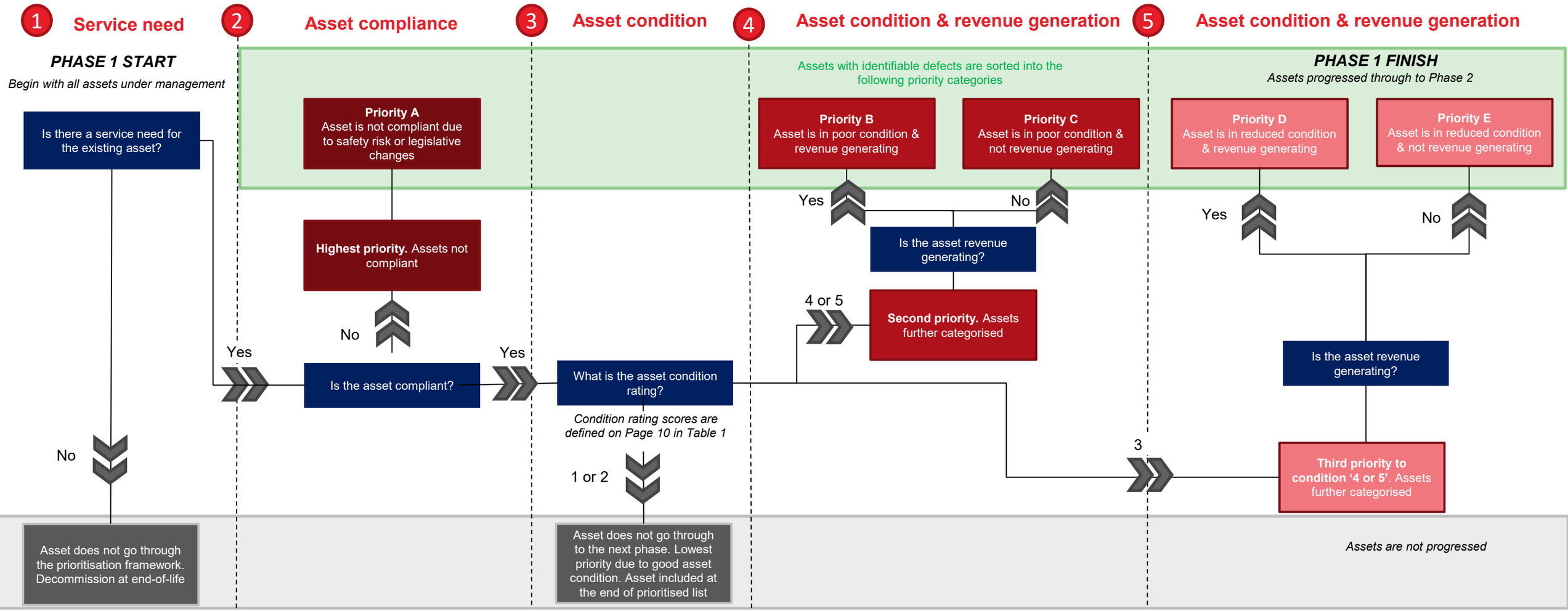

Figure 5: Phase 1 CIIF Process

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2.1 CIIF Phase 1

The key terms of Phase 1 are defined below to ensure that interpretation of the framework is consistent amongst land managers.

Phase 1 – Key Terms and Definitions

Key Term	Definition
Compliance - legislative risk	Where an asset is non-compliant in relation to legislative requirements such as DDA and buildings codes.
Compliance - public risk	Where an asset is non-compliant in relation to safety standards and represents a safety risk to the public.
Condition	Based on the scores of 1 to 5 from Assetic: Condition 1 - no observable defects or deterioration. Condition 2 - Minor defects and deterioration within expected design rates. Condition 3 - Identified defects and deterioration that may reduce service life or asset performance, risk failure before the next inspection. Condition 4 - Identified defects and deterioration that lead to an unacceptable risk of failure within 10 years. Condition 5 - Defects indicating actual failure or unacceptable risk of imminent failure.
Revenue generating	The asset directly creates revenue e.g. a public swimming pool with admission fees, a paid car parking lot, a caravan park.
Service need	The need for this asset to be in continued service i.e.. is it still utilised by the public; does it perform a function that benefits the public?

Table 1: Phase 1 Key Terms and Definitions

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2.2 CIIF Phase 2

Phase 2 seeks to sort assets within prioritised categories via multi-criteria analysis.

Phase 2 – Prioritised Assets

Overview

Phase 2 seeks to sort assets within prioritised categories via multi-criteria analysis. Using the five priority categories of assets defined in Phase 1, Phase 2 keeps assets within these groups and sorts them into an ordered priority list for each priority category.

Assets are assessed against multiple criteria to prioritise assets within a given priority category. The criteria are defined clearly in Table 2 and include:

- Asset utilisation – whether the asset can cope with existing demand
- Environmental significance – contribution to environmental protection
- Community sentiment – local emotional attachment to the asset
- Heritage and culture – contribution to society, knowledge or culture
- Economic significance – contribution indirectly or directly to local and regional economies vie expenditure

As land managers do not have widely available quantitative data and resources to easily evaluate assets at the initial strategic planning stage, the definition and scoring of each criteria has been designed to allow for the land managers' qualitative understanding of assets.

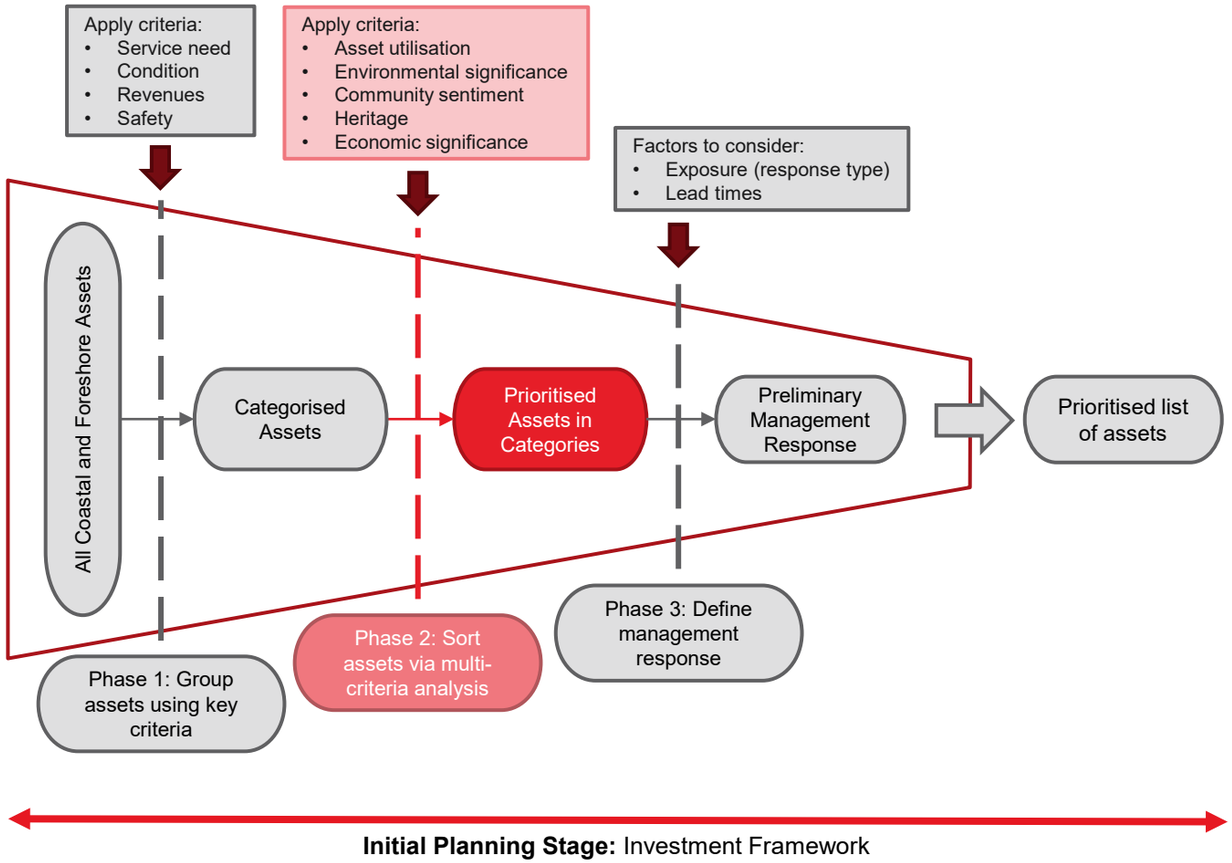

Figure 6: Overview of CIIF – Phase 2 Steps

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2.2 CIIF Phase 2

Phase 2 seeks to sort assets within prioritised categories via multi-criteria analysis.

Phase 2 – Prioritised Assets

Multi-criteria analysis

To apply the criteria, the land manager using the CIIF will undertake a Matched Pairs Analysis to determine weightings for each criteria and then apply scoring to each criteria for each asset. To remove subjectivity to some extent, closed ended questions are used to define each criteria and a 3-point scale has been developed to score each criteria.

Scoring for each criteria for each asset is based on a 1-3 system, whereby ‘1’ indicates a lower priority, and ‘3’ indicates a higher priority.

Weighting of criteria is determined via a matched-pairs analysis, whereby each criteria is individually assessed against all others, generating unique weightings which sum to 100%.

Both the scoring of criteria and the criteria weightings are used to feed prioritised assets through to Phase 3. After scoring and weighting are complete, each asset is given a score out of 100 used to produce the prioritised list in Phase 3.

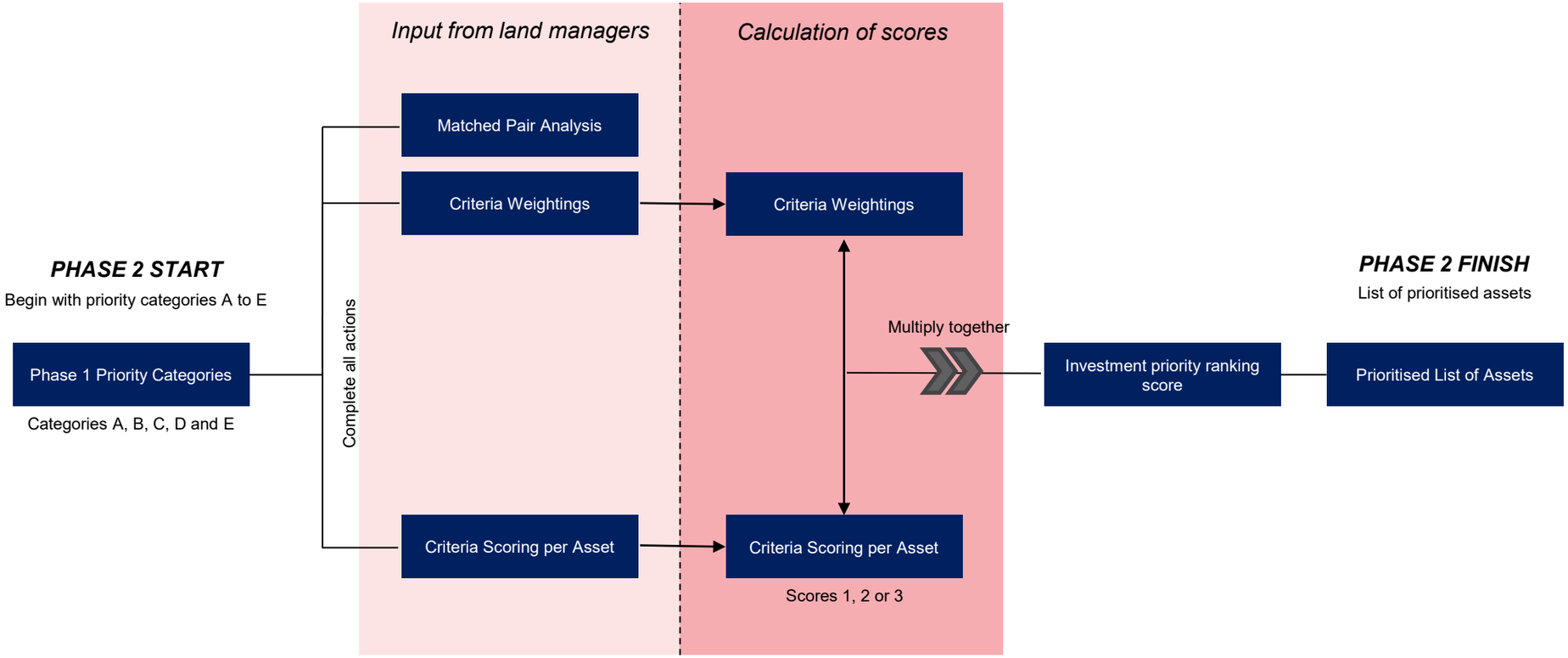

Figure 7: Phase 2 CIIF Process

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2.2 CIIF Phase 2

The definition and scoring for each criteria is defined in the following table.

Phase 2 - Asset scoring criteria definitions

	Criteria	Definition	Scoring
	**Asset utilisation**	The extent to which an asset is being used presently and whether it can cope with existing demand. *i.e. are current needs being met and are there capacity issues?*	1. Excess capacity at peak periods currently 2. At capacity at peak periods currently 3. Over capacity at peak periods currently
	**Environmental significance**	The extent to which an asset protects foreshore land, coastal habitats and physical assets from climate change impacts. *i.e. is the purpose of the asset to mitigate against coastal erosion, extreme weather event impacts, inundation etc.?*	1. Does not contribute to environmental protection 2. Contributes to environmental protection (but this is not the primary purpose of the asset) 3. Contributes significantly to environmental protection (as is the primary purpose of the asset
	**Community sentiment**	The extent to which local residents and businesses have an emotional attachment to the asset. *i.e. is the asset socially significant in that it provides a sense of belonging and community to locals?*	1. No social significance 2. Some emotional attachment from locals 3. Part of the community's identity
	**Heritage and culture**	The extent to which an asset contributes (tangibly or intangibly) to society, knowledge and culture locally or more broadly. *i.e. is the asset heritage-listed or does it have significance?*	1. Is not heritage listed and is not culturally significant 2. Is not heritage listed but is culturally significant 3. Is heritage listed and has major cultural significance
	**Economic significance**	The extent to which an asset contributes (indirectly) to local and regional economies via expenditure. *i.e. does the asset draw visitors into the region and/or support the tourism sector?*	1. No direct relationship to tourism 2. Has an ancillary role in supporting tourism and/or a destination 3. Is a destination or directly serves tourism and/or a destination

Table 2: Phase 2 Asset Scoring Criteria Definitions 

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2.2 CIIF Phase 2

The matched pair analysis calculates the weighting of each criteria, to show which criteria are most important for each land manager.

Phase 2 – Multi-Criteria Analysis

The matched pair analysis and criteria weightings exercise are undertaken together. The matched pairs analysis determine the priority of the different criterion, which results in the percentage weightings.

Matched Pair Analysis

A Matched Pairs Analysis is a method to determine criteria weightings.

The process requires the Project Team to compare two criteria – a 'matched pair' – to determine which is more impactful when considering asset importance.

Upon the completion of all 'matched pairs', final weightings (adding to 100%) are established.

Example

Each criteria will undergo a matched pair analysis with the competing criteria.

One round of matched pair analysis consists of assessing if criteria 1 is *less/same/more* important as an investment driver than criteria 2.

Matched pair definitions

Less (0) - indicates the criteria to be less important than that shown in the respective row

Same (1) - indicates a neutral position, no differentiator between the two

More (2) - indicates the criteria to be more important than that shown in the respective row

Project Team to agree each 'relative importance' ↓

Resulting 'importance' for weighting ↓

Criteria you are comparing the performance of	Relative importance (Less, Same, More)	Criteria you are comparing against	Relative importance score
Criteria 5			
Economic Significance	Less	Asset utilisation	0
Economic Significance	Same	Environmental significance	1
Economic Significance	More	Community sentiment	2
Economic Significance	More	Heritage and culture	2

Table 3: Matched Pair Analysis Example

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2.2 CIIF Phase 2

The asset scoring and asset weighting values are used to determine an investment priority ranking number. This determines the position of each asset in the priority list.

Phase 2 – Multi-Criteria Analysis

Weightings of Criteria

Once all matched pairs are complete, criteria weightings are illustrated as in Figure 8.

Through the stakeholder engagement with land managers, it became clear that each land manager required bespoke criteria weightings for each area. This capability was built into the CIIF to include weightings that reflect the priorities of each land manager.

There are two sets of MCA weighting, full and reduced, where reduced excludes asset utilisation. For assets where asset utilisation is not applicable, such as public art, the reduced MCA weighting is applied to scoring.

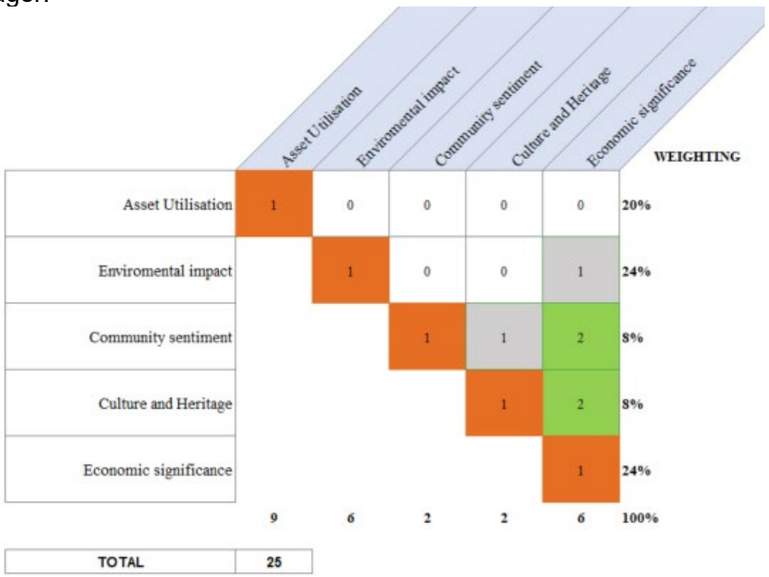

Figure 8: Criteria Weighting Example

Scoring

For each asset, a score from 1 – 3 is given to each criteria based on its relative importance, as agreed by the land manager. 3 is the highest importance and 1 is the lowest.

MCA Criteria	Asset utilisation	Environmental impact	Community sentiment	Culture and heritage	Economic significance
Artefact	1	1	3	3	1
BBQ	3	1	2	1	3
Carpark	3	1	2	1	3

Table 4: Criteria Scoring Example

Urgency rating and prioritised list

The scores for each criteria are multiplied by the criteria weightings as outlined on the previous page, and then added together. The resulting number is an urgency rating for each asset, which determines its place in the list of prioritised assets. The higher the urgency rating, the higher the asset is on the final prioritised list.

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2.3 CIIF Phase 3

The purpose of Phase 3 is to identify the high-level management response on the prioritised asset list from Phase 2.

Phase 3

Overview

Phase 3 focuses on the actions taken by the land manager, using the information gained by the list of prioritised assets generated in Phase 2. The role of the land manager is critical in investment decisions, as the CIIF acts as only a tool to filter mass data and recommend a priority list. The onus remains on the land manager to identify appropriate responses for the assets and process and understand nuanced decision drivers, which the CIIF cannot.

Please note that the steps in this phase are proposed as guidance only and provides a preliminary idea of what the management response might entail. Detailed analysis such as CBA and financial analysis would need to be undertaken in the next stage of the project lifecycle to assess different options.

Factors to be considered by the land managers during this phase include:

- **Hazard exposure** – the level of exposure to existing or future climate or other hazards will drive responses. For example, management response will range between relocating the asset where there may be high hazard exposure, to asset replacement in its current location if condition is poor and exposure is low.
- **Interdependencies of other known projects** – awareness of projects or works occurring within the locality or that have the potential to impact the use of the asset will affect management responses. For example, if there is a new investment to increase visitation to a landmark, this may impact on the priority of upgrades to associated amenities.
- **Lead times** – depending on the lead times required for parts, labour, replacement or maintenance, land managers may escalate or deprioritise an asset based on these factors.
- **Packaging of assets** - this drives how efficiently a land manager can complete works (or multiple works) within the same local area, i.e. if several high priority assets exist at the same location, they should all be completed within the same project.

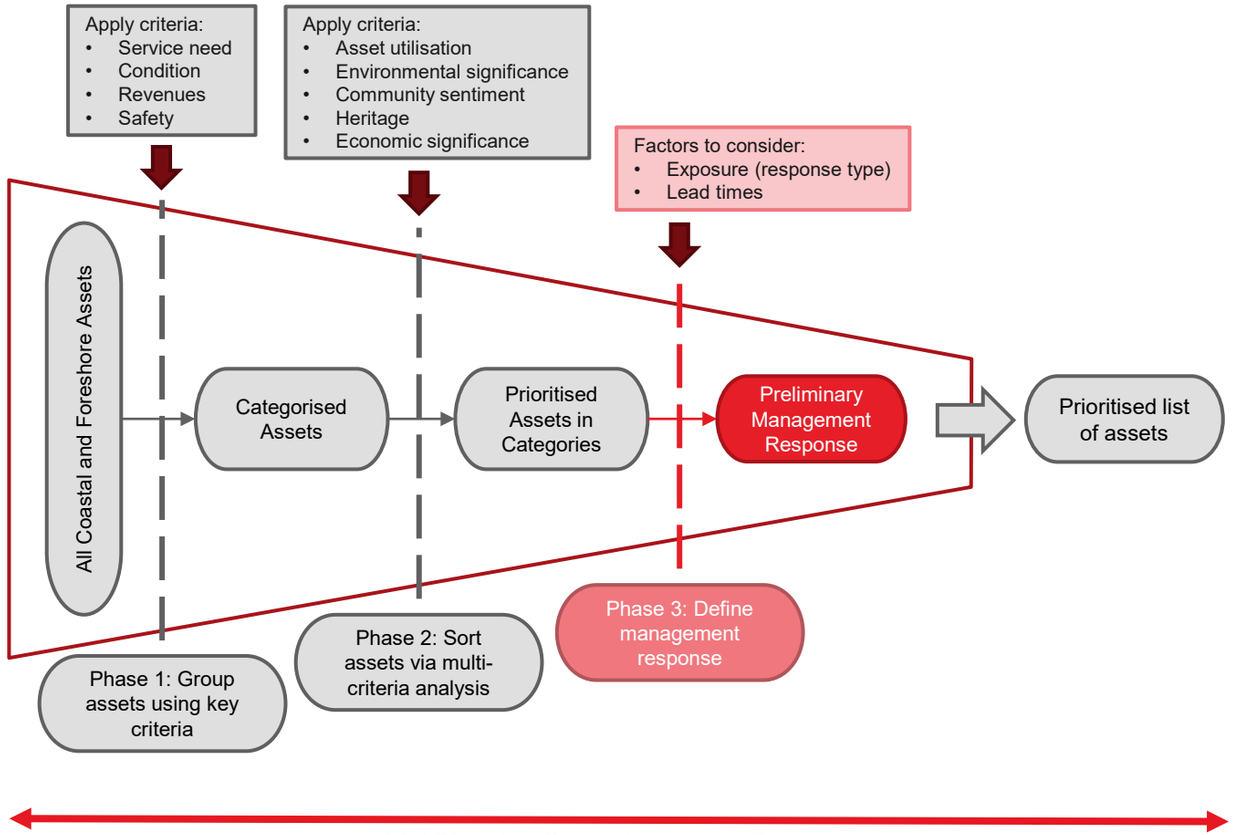

Figure 9 CIIF Overview – Phase 3 Steps

3. Next Steps

To further develop the CIIF beyond the current concept phase, next steps include rigorous testing, undertaking an application study and expanding the GIS study to include live data.

Next Steps

Success Factors to Enable CIIF to Achieve its Purpose

For the CIIF to enable land managers to make strategic and holistic informed decisions regarding coastal asset investment, the following factors are essential:

- **Complete asset data** – the CIIF steps and process is underpinned by comprehensive knowledge of the assets, their condition and details of their use. This data must be validated and up to date for the CIIF to produce legitimate results.
- **A digital application to support the implementation of the CIIF** – the CIIF has been developed to a concept stage with a basic supporting method to test its outputs. For its value to be fully realised, a digital application which supports its features and usability is needed. This digital application will need to interface with existing Assetic asset management systems for most effective use.
- **A dedicated resource from the land manager** – an understanding of the process, required land manager inputs, the limitations and uses of the CIIF is key for the land manager. For consistency, a dedicated resource is recommended to manage and own the use of the CIIF.

Further testing of the CIIF

At this stage, the CIIF concept has been developed and tested with one land manager, Great Ocean Road Coast and Parks Authority. This version of the product is an early concept plan to understand the flow of information and the purpose of the product. The CIIF will need further refinement, informed by longer and more rigorous pilot testing using validated data.

Development of CIIF Digital Application

An application study will need to be conducted to assess how the CIIF will be used and implemented in practice. Due to the type and magnitude of data it uses, likely a technology-based solution such as a web application which interfaces with existing asset management systems would be feasible. To further the use of the CIIF on a larger scale, an IT mapping assessment which looks into data collection and existing systems would be beneficial. Opportunities to automate the process and eliminate manual entries should be prioritised.

Live GIS Map

The GIS map created as part of the CIIF project captures data and assets at a particular point in time. This was created to showcase the usability of the format and map the diverse ownership and asset types. Developing a live version of this map will be useful for land managers as they will be able to have access to a central hub of up-to-date information for assets. The next steps for developing a live GIS map include linking the underlying data to the asset management systems used by the land managers.

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4. Limitations of the CIIF

The CIIF does not replace the business case process providing guidance only to land managers in there decision making relating to coastal assets.

CIIF Scope Limitations

The following limitations apply to the CIIF. The CIIF:

- **Does not replace the business case process**. The CIIF is to be applied during the initial strategic planning stage of the investment lifecycle. As it only screens assets to identify which ones require attention, it does not replace the business case process. The CIIF considers the various criteria at a high level and does not assess the social, economic, environmental and financial impacts in detail as seen in a business case.
- **Does not consider funding sources and whether land managers have the financial capabilities to sustain ongoing maintenance**. This should be considered in the next stage (e.g. business case) of the investment lifecycle.
- **Does not dictate the management response of the land managers.** The CIIF only identifies which assets require investment. The onus is on the land managers to consider the appropriate management response (rejuvenate, rebuild, relocate) and whether certain assets should be bundled together into a program for an efficient delivery.
- **Only applies to existing assets and not new assets**. The CIIF only focusses on existing assets. The number of existing assets to be assessed is significantly larger than new assets that are considered on an ad hoc basis. Therefore, the CIIF has been developed to only focus on existing assets in order to assist land managers to assess a large number of existing assets in a timely and effective manner.
- **GIS map currently only reflects data collected in 2020**. Although the GIS map is interactive, the data stored within the map is reflective of the current state in 2020 only. This data provided by Assetic did not accurately capture the ownership of assets by land managers, as GORCAPA had been newly formed.

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