ECOSYSTEM BASED ADAPTATION OPTIONS FOR NAVUA CATCHMENT AND BEQA LAGOON

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1 Introduction

1.1 The project

The Pacific-European Union Marine Partnership (PEUMP) programme promotes sustainable management and sound ocean governance for food security and economic growth, while addressing climate change resilience and conservation of marine biodiversity. It follows a comprehensive approach, integrating issues related to oceanic fisheries, coastal fisheries, community development, marine conservation and capacity building under one single regional action. The PEUMP is built around six Key Result Areas (KRA).

Designed to meet KRA 5 of the PEUMP, the By-catch and Integrated Ecosystem Management (BIEM) Initiative is led by the Secretariat of the Pacific Regional Environment Programme (SPREP) to support Pacific countries deliver their priorities to halt the decline of protected marine species, strengthen the sustainable management of their coastal and marine ecosystems and support poverty reduction. The objective of the BIEM Initiative is "*to reduce the by-catch of threatened species in Pacific islands' fisheries and to improve the health of coastal ecosystems through an integrated approach to coastal management and ecosystem-based adaptation to climate change".*

The current project underpins KRA 5.2 and 5.3 of the BIEUM which focus on supporting adoption of Integrated 'ridge to reef' ecosystem management and climate change adaptation. To support these KRAs the project seeks to address the economic, social and environmental challenges of the Navua catchment and Beqa Lagoon by halting the decline of biodiversity and strengthening the sustainable management of the coastal and marine ecosystems through an integrated ridge-to-reef management approach.

Specifically, this project aims to:

> *"Address these challenges by developing and implementing a gender, social inclusion (GSI) and human rights sensitive integrated ecosystem management (IEM) plan for Navua catchment and Beqa Lagoon area, Central Division, that identifies realistic activities to increase the natural adaptive capacity of coastal habitats to promote human health and poverty reduction, support sustainable livelihoods and contribute to the delivery of Fiji's conservation priorities."*

Drawing from the project brief, the objectives of the project include:

Objective 1 - Fully executed contract that delivers objectives and associated outputs to time and quality.

Objective 2 - Build understanding and support for the Navua catchment and Beqa Lagoon area ridge to reef initiative amongst communities and stakeholders.

Objective 3 - Put gender, human rights and poverty alleviation considerations at the heart of the planning and implementation of activities.

Objective 4 - Map and assess the ecological status of the selected coastal area and associated catchments that coastal communities depend upon for their livelihoods.

Objective 5 - Assess the threats to ecosystems, livelihoods and human health as a result of current/planned resource use and the expected impacts of climate change and identify opportunities to address them. In doing so, identify key users of selected coastal areas and associated catchments by gender, age, disability, ethnicity and socioeconomic status. Apply a GSI lens when identifying threats and risks as well as opportunities for best adaptation.

Objective 6 - Develop and secure endorsement of a widely supported integrated ecosystem management plan for the Navua catchment and Beqa Lagoon area that identifies realistic activities to increase the natural adaptive capacity of coastal habitats to promote human health and poverty reduction, support sustainable livelihoods and contribute to the delivery of Fiji's conservation priorities.

Objective 7 - Work with and increase the capacity of women, men and the youth in coastal communities, Government authorities and partners to actively manage natural resources. Identify appropriate capacity building activities carefully with regards to existing power dynamics and gender roles as to meet the 'do no harm' minimum standard. Capacity building opportunities should allow, however, for empowerment and agency enhancement such as building confidence through knowledge and training or support inclusive decision making.

1.2 Summary of ESRAM

As part of the broader project, an Ecosystem and Socioeconomic Resilience Analysis and Mapping (ESRAM) framework was used to assess the resilience of ecosystems and the communities that depend on them (Tilleard et al. 2025). An ESRAM considers both ecological and social factors to help decision makers design sustainable development strategies. The ESRAM for the Navua catchment and Beqa lagoon identified the ecosystem services provided by four key biomes in the area: native forests, land (excluding native forests), terrestrial waterways, and marine and coastal areas. These services include provisioning services (e.g., food, materials), regulating services (e.g., water quality regulation), cultural services (e.g., recreation, spiritual benefits), and habitat services (e.g., nursery habitats for fish).

The ESRAM also discussed the pressures and threats facing these ecosystems, including climate change, overfishing, pollution and habitat loss. These pressures can reduce the condition of the ecosystems and the value of the services they provide. The ESRAM provides a basis for identifying and prioritising Ecosystem-based Adaptation (EbA) options.

1.3 Purpose of this report

The purpose of this report is to outline the development and prioritisation of high-level EbA options to address key pressures and threats for the study area, with consideration of a range of different impacts of these options. This builds on the ESRAM and will inform the development of the Integrated Ecosystem Management Plan.

Figure 1. Mountains of the Navua catchment highlands

2 EbA options

This section discusses the EbA options assessed for this project.

2.1 Development of EbA options

A variety of EbA options have been considered for this assessment. Options were identified through two primary avenues:

1. **Through the consultation discussions (and by extension the ESRAM process):** Workshops undertaken with communities discussing key issues and possible adaptations. These informed the development of several EbA options that were outlined in the ESRAM report.
2. **Through the Pacific EbA tool:** The full list of EbA options provided in the Pacific EbA tool (SPREP 2018) was considered for inclusion in this assessment, with some options already being captured through the ESRAM and some with slight adjustments to better match this project.

It should also be noted that some options that may not be considered EbA are included to respond to issues identified through the project and to also provide a comparison to equivalent EbA measures. Other measures may also serve to facilitate EbA options.

2.2 Options longlist

The full list of options considered for the assessment is provided in Table 1. The table includes options related to five broad categories (coastal hazard protection, forestry management, sustainable fisheries management, sustainable land use practices, and water resources), and provides a description of each option as well as some indicative locations where they may be applied.

Figure 2. Stream near Namosi Village

Table 1. Options longlist

Category	Option	Description	Relevant threats/pressures	Indicative location/s
Coastal hazard protection	Seawalls and Breakwaters - roads	Construct seawalls and breakwaters along coastal areas adjacent to roads to mitigate the impacts of erosion, wave action, and sea level rise on road access. Seawalls are vertical structures built along shorelines to prevent erosion and flooding, while breakwaters are offshore structures designed to dissipate wave energy and reduce coastal erosion. Note that these approaches should be used as a last resort where more nature-based solutions may not be sufficient to address risks.	Erosion Saltwater inundation	Queens Road, focused where it may be too late for softer approaches.
	Seawalls and Breakwaters - communities	Construct seawalls and breakwaters along coastal areas adjacent to communities to mitigate the impacts of erosion, wave action, and sea level rise on community assets and livelihoods. Seawalls are vertical structures built along shorelines to prevent erosion and flooding, while breakwaters are offshore structures designed to dissipate wave energy and reduce coastal erosion. Note that these approaches should be used as a last resort where more nature-based solutions may not be sufficient to address risks.	Erosion Saltwater inundation Water-borne disease	Beqa Island, coastal mainland communities
	Mangrove restoration and conservation - coastal protection of roads	Implement mangrove restoration and protection programmes to restore degraded mangrove habitats in strategic locations to provide coastal protection for road access and enhance their resilience to environmental stressors. Mangroves act as nursery grounds for fish, improve water quality, and provide coastal protection against erosion and storms.	Erosion Saltwater inundation Overfishing, poaching Clearing of mangroves for development	Queens Road where mangroves may be suitable to address current erosion or prevent future erosion, noting that some locations may be beyond the point at which mangrove establishment will be sufficient.
	Mangrove restoration and conservation - coastal	Implement mangrove restoration and protection programmes to restore degraded mangrove habitats in strategic locations to provide coastal protection for communities and enhance their	Erosion Saltwater inundation Water-borne disease	Beqa Island, coastal mainland communities

Category	Option	Description	Relevant threats/pressures	Indicative location/s
	protection of communities	resilience to environmental stressors. Mangroves act as nursery grounds for fish, improve water quality, and provide coastal protection against erosion and storms.	Overfishing, poaching Clearing of mangroves for development	
	Mangrove restoration and conservation - biodiversity focus	Implement mangrove restoration and protection programmes to restore degraded mangrove habitats in strategic locations to improve biodiversity and enhance their resilience to environmental stressors. Mangroves act as nursery grounds for fish, improve water quality, and provide coastal protection against erosion and storms.	Erosion Saltwater inundation Water-borne disease Overfishing, poaching Clearing of mangroves for development	Small islands with surrounding coral habitat to restore fish nursery habitat (e.g., Naqara island and near-by mainland coastal areas, between Veivatuloa and former Ocean Pacific Resort and Yanuca Island).
	Beach nourishment - road access	Implement beach nourishment programmes to maintain beach profiles in strategic locations to provide coastal protection for road access. This may also serve to maintain the recreation values associated with sandy beach areas.	Erosion Population growth	Queens Road where mangroves may be suitable to address current erosion or prevent future erosion, noting that some locations may be beyond the point at which mangrove establishment will be sufficient.
	Beach nourishment - communities	Implement beach nourishment programmes to maintain beach profiles in strategic locations to provide coastal protection for communities. This may also serve to maintain the recreation values associated with sandy beach areas.	Erosion Population growth	Beqa Island, coastal mainland communities
	Environmental setbacks/buffers - coastal resilience	Coastal setbacks, buffers or managed retreat stipulate areas or zones along the coastline within which all or certain types of development are prohibited. This provides a buffer between coastal development and areas likely to be impacted by sea level rise, increased storm surges and beach erosion. Coastal setbacks are established based on historic	Erosion Saltwater inundation Water-borne disease	Beqa Island, coastal mainland communities

Category	Option	Description	Relevant threats/pressures	Indicative location/s
		erosion rates and/or extreme water levels and projected changes.		
	Coral reef restoration - storm tide mitigation	Use placement of coral rubble and coral restoration programmes to restore degraded mangrove habitats in strategic locations to provide coastal protection for communities and enhance their resilience to environmental stressors. Coral rubble in shallow areas can act as habitat for live coral and other fauna and provide coastal protection against erosion and storms. They can also protect nearshore environments creating low energy “backwaters" that allow other species to recruit successfully (e.g. mangroves). This effectively represents a nature-based seawall.	Erosion Saltwater inundation Water-borne disease Overfishing, poaching Loss of reef habitat Clearing of mangroves for development Crown-of-thorns starfish	Beqa Island, coastal mainland communities
Forestry management	Native reforestation of harvested forestry areas	Multi-species (native) reforestation of cleared land to promote biodiversity, reduce soil erosion, and enhance ecosystem resilience. Project could link to 30 million trees programme and also initiate native species nurseries or enhance existing nursery operations (e.g. focussed on traditional plant species - Gasau, Dawa, Ivi, Moli), providing opportunities for community development and capacity building. Historical practices of maintaining reserves for regeneration of land and food security as part of forestry leases could be reinstated. Note that road design to reduce erosion has been discussed under Sustainable Land Use category.	Erosion Sedimentation Commercial forestry operations Clearing for agriculture Mining exploration Mongoose and other invasive species Population growth Heavy rainfall Mahogany extract contamination	Highland communities and other harvested areas (e.g. upstream of Latianara and Korovisilou communities)
	Invasive Species Management	Develop and implement invasive species management strategies to control the spread of weeds and invasive plants in forest areas. This would prevent further habitat degradation and promote the recovery of native vegetation.	Mongoose and other invasive species Commercial forestry operations	Forested areas around villages, forestry areas and bordering zones, ecotourism areas and access roads where invasive species are likely to have the most impact on livelihoods (e.g., compete with cropped plants)

Category	Option	Description	Relevant threats/pressures	Indicative location/s
				and biodiversity (e.g., Upper Navua Conservation Area).
Sustainable fisheries management	Fish aggregating devices	Fish aggregating devices (FADs) are a long-used technique that utilises artificial structures to attract fish, potentially helping to address overfishing by aggregating fish in specific areas. These practices can be expanded to reduce fishing efforts on reefs and reef fish.	Overfishing, poaching Loss of reef habitat Clearing of mangroves for development Inappropriate fishing practices	Could be in many locations as overfishing is common however inshore reefs inside the Navua flood plume would support degraded biodiversity.
	Marine Protected Areas (MPAs)	Establishing or re-establishing MPAs to protect critical fish habitats, spawning grounds, and biodiversity hotspots. This could be supported by equipping local communities with the knowledge and resources to manage the MPAs.	Overfishing/poaching Loss of reef habitat Clearing of mangroves for development Inappropriate fishing practices	Areas with expired or near-to-expiry MPAs. The previous local community led MPA's potentially as a starting point. Community consultation required to finalise
	Coral reef restoration and conservation	Coral reef restoration utilises various methods like coral nurseries, relocation, and seeding to revive degraded reefs and enhance their resilience to future threats.	Erosion Saltwater inundation Sedimentation Overfishing, poaching Loss of reef habitat Crown-of-thorns starfish	Inshore reefs inside the Navua flood plume would support degraded biodiversity.
	Bio-control of COTS	Local species such as Davui predate on COTS and avenues of strengthening these populations could be assessed for feasibility and risks. This could be supported by the reinstatement of previous programme where payments were made to villagers for physical removal and reuse (e.g. fertiliser).	Crown-of-thorns starfish Overfishing, poaching Loss of reef habitat Nutrient pollution Lack of alternative income sources	Reefs in the lagoon where COTS are prominent, particularly around Beqa Island.
	Enhanced enforcement of fisheries regulations	Resources for enhanced enforcement of fisheries regulations such as catch limits, gear restrictions, and MPAs may support long-term viability of fish populations. Resources may	Overfishing, poaching Loss of reef habitat Clearing of mangroves for development	Beqa Island, coastal mainland communities

Category	Option	Description	Relevant threats/pressures	Indicative location/s
		include greater investment in human (e.g. fish warden capacity, patrol man hours, etc.) and physical capital (e.g. boats for wardens).	Inappropriate fishing practices Lack of alternative income sources	
Sustainable land use practices	Providing training and support for alternative livelihoods	Providing training and support for alternative livelihoods, such as eco-tourism, aquaculture, and community-based enterprises, to reduce pressure on natural resources. This may include training for livelihoods targeted towards women and youth.	Lack of alternative income sources Declining productivity of agricultural land Kava dieback disease Agricultural pests Commercial forestry operations Inappropriate fishing practices Overfishing poaching Clearing of mangroves for development	All communities
	Promotion of Agroforestry Practices	Agroforestry integrates trees and crops/pastures for sustainable land use. This approach promotes biodiversity, reduces soil erosion, and enhances ecosystem resilience.	Erosion Sedimentation Declining productivity of agricultural land Commercial forestry operations Clearing for agriculture	All communities
	Environmental setbacks/buffers - sensitive environmental assets	Establishing and maintaining buffers between intensive agriculture and sensitive environmental areas (e.g. mangroves, waterways) may serve to promote biodiversity and enhance ecosystem resilience.	Clearing for agriculture Clearing of mangroves for development Erosion Saltwater inundation Nutrient pollution Sedimentation	Grace Farms and other intensive agricultural areas, particularly in the coastal zone.
	Conservation tillage	Conservation tillage is a method of establishing crops in the leftover waste of a previous crop to protect the topsoil and there for reduce erosion and improve soil nutrient content.	Erosion Sedimentation Nutrient pollution	Less intensive agricultural areas (e.g. highlands).

Category	Option	Description	Relevant threats/pressures	Indicative location/s
	Crop diversification	Crop diversification is the practise of cultivating multiple crops on a farm. Crop diversification often takes the form of crop rotations or intercropping. It is considered one of the most feasible, cost effective and efficient ways of reducing the uncertainties in farm yield brought on by climate change impacts. The purpose of crop diversification is to increase resilience to uncertain impacts, improve soil fertility, reduce the impacts of pest and disease and ensure a more stable crop yield. This diversification could also include the incorporation of nitrogen fixing plants into the farming landscape to enrich the soil, potentially contribute to reducing fertiliser use, and stabilise soil condition.	Lack of alternative income sources Declining productivity of agricultural land Kava dieback disease Agricultural pests Nutrient pollution	All communities
	Revegetation of long-term fallow areas	Revegetation of cleared areas to support biodiversity and enhance ecosystem resilience. Natural recovery of these areas usually has a weedy stage before secondary forest, so this represents an opportunity to establish forests and reduce weed spread. Furthermore, this could be integrated with ecotourism and community groups for economic diversification and the support of livelihoods.	Erosion Sedimentation Commercial forestry operations Clearing for agriculture Mongoose and other invasive species Heavy rainfall	Long-term fallow agricultural land and suitable buffer zones.
	Riverbank stabilisation using vegetation and bioengineering	Targeted works to address riverbank erosion using vegetation and bioengineering measures. This could be linked with the establishment of buffer zones to maximise chances of success. With increasing risks of extreme events, it becomes crucial to undertake these works, particularly drawing on traditional practices and long-lived species.	Erosion Sedimentation Commercial forestry operations Clearing for agriculture Mongoose and other invasive species Heavy rainfall	Intersection between lowland areas and floodplain transition areas, particularly around gravel extraction.
	Water sensitive cities principles	Water Sensitive Cities approaches aim for holistic management of the integrated water cycle. It takes a whole of water cycle approach to water management. All the potential water sources like rainwater/stormwater, water	Drought Sedimentation Heavy rainfall Sedimentation Nutrient pollution	More urban areas (e.g. Navua Town), any development should consider water sensitive cities principles, note community

Category	Option	Description	Relevant threats/pressures	Indicative location/s
		supplies, wastewater, groundwater are not managed in isolation, instead integrated solutions are delivered to provide multiple benefits. Water Sensitive Cities seeks to protect and enhance the health of receiving waterways (e.g. creeks, rivers), reduce flood risk, and create public spaces that harvest, clean, and recycle water.		land vs private land
	Forestry/mining road design to reduce erosion	Provision of more detailed practice guidelines to inform better design to reduce runoff.	Erosion Sedimentation Heavy rainfall	All mining and logging roads and tracks
Water resources	Managed aquifer recharge investigation	Managed aquifer recharge refers to the intentional recharge of water to aquifers for subsequent human use or environmental benefit. An investigation into the primary drivers of aquifer resource decline may be required to understand the potential effectiveness of these approaches.	Drought Sedimentation Heavy rainfall	Focused on communities that are reliant on aquifer resources (e.g. Beqa Island). Some may be suitable for revegetation for improved infiltration while others may be more a case of diversification of water sources (i.e. focus on recharge vs focus on protection).
	Rainwater harvesting	Rainwater harvesting systems may reduce pressure on aquifer and other freshwater resources. Furthermore, it would provide clean water when other sources have poor water quality (e.g. during rainfall events).	Drought Sedimentation Heavy rainfall	All communities

3 Options assessment

3.1 Approach

A multi-criteria analysis (MCA) was used to prioritise the longlist of EbA options for the study area.

Introduction to MCA approach

Multi-criteria analyses are a useful decision support tool which enables decision makers to advance in solving complex problems where several conflicting points of view must be taken into consideration. Typically, they are useful where there is no obvious or optimal solution, thereby allowing decision makers to identify the most preferred solution(s). When an independent and impartial assessment of different options that considers the technical issues, cost-effectiveness as well as multiple stakeholder requirements (e.g. supporting community livelihoods), and other environmental and social factors is required, a multi-criteria analysis is a useful approach to the problem.

MCA has been widely adopted in the fields of water and environmental management as it is a valuable tool in assessing unique elements of a project that do not necessarily include financial components. Put simply, it is valuable as a technique for 'comparing apples and oranges'.

Figure 3 outlines the structure of the MCA, including a range of criteria under four categories of economic, social, environmental and secondary considerations.

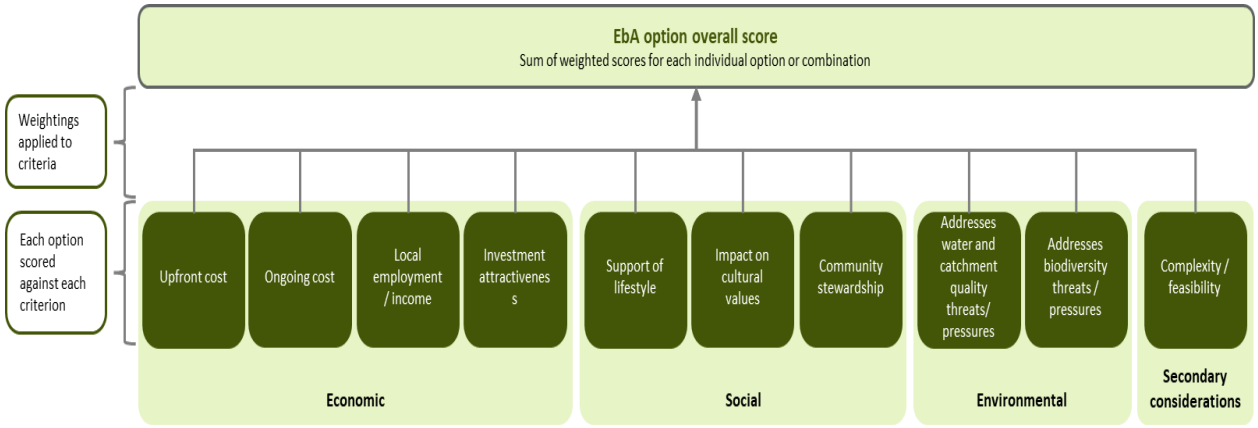

Figure 3. Structure of the MCA

Criteria and scoring

The selection of criteria and development of scoring approaches for criteria are a key part of the MCA analysis. For a reliable assessment it is important that the criteria used in MCA are collectively exhaustive and mutually exclusive (i.e. criteria cover all bases without double counting). The criteria used are presented in Table 2, with brief descriptions of each.

Table 2. Criteria descriptions

Criteria group	Criteria	Description
Economic	Upfront cost	Cost required to implement the action.
	Ongoing cost	Ongoing (average annual) costs required to maintain the action outcomes in the long term.
	Local employment or income	Potential of the adaptation option to support local employment or income (i.e. generation or avoided loss due to relevant pressures/threats).
	Investment attractiveness	Assessment of attractiveness of options to potential investors, with consideration of scale and tangibility/measurability of outcomes.
Social	Support of lifestyle	Degree to which an action enhances and preserves the lifestyle of local communities.
	Impact on cultural values	Impact on the cultural values that local communities derive from the catchment.
	Community connection and stewardship	Degree to which an action directly contributes to achieving the goal of community connection and stewardship.
Environmental	Water and catchment quality	Degree to which the action addresses water and catchment quality related pressures/threats in the Navua catchment and Beqa Lagoon (outlined in Table 3)
	Biodiversity	Degree to which the action addresses biodiversity related pressures/threats in the Navua catchment and Beqa Lagoon (outlined in Table 3)
Secondary considerations	Complexity and feasibility	Examines the technical complexity and practical feasibility of implementing the adaptation measure. It considers factors such as resource availability, technical expertise, regulatory requirements, stakeholder cooperation, and potential barriers to implementation.

Importantly, the criteria capture the degree to which previously identified pressures and threats are addressed by each option, particularly where they relate to water and catchment quality, and biodiversity. Table 3 presents the key pressures/threats considered under these two criteria.

Table 3. Key pressures/threats related to environmental criteria

Water and catchment quality	Biodiversity
• Commercial forestry operations • Erosion • Inappropriate fishing practices • Heavy rainfall • Mahogany extract contamination • Livestock along riverbanks • Wastewater and other polluted discharge • Sedimentation • Nutrient pollution • Increased litter generation	• Clearing for agriculture • Mining exploration • Mongoose and other invasive species • Overfishing/poaching • Inappropriate fishing practices • Mahogany extract contamination • Droughts • Sedimentation • Loss of reef habitat • Clearing of mangroves • Crown-of-thorns starfish • Nutrient pollution • Increased litter generation

In an MCA scoring can use quantitative, semi-quantitative, or qualitative approaches depending on the criteria. In this case the approaches are largely qualitative given the high-level definition of options at this stage. As a result, the scores themselves have been determined by the project team based on the work to date including the extensive consultation activities. Table 4 presents the scoring approaches used for each criteria.

Once determined, option scores for each criteria can then be normalised (i.e. put on a scale from 0 to 1 where 0 is the worst score and 1 is the best score) for weighting and aggregation.

Figure 4. Waterfall off the Navua River

Table 4. Scoring approaches

Criteria group	Criteria	1	2	3	4	5
Economic	Upfront cost	Extreme upfront costs	←→	Moderate upfront costs	←→	Minimal upfront costs
	Ongoing cost	Extreme ongoing costs	←→	Moderate ongoing costs	←→	Minimal ongoing costs
	Local employment or income	No contribution to local economy	←→	Moderate contribution to local economy	←→	Significant contribution to local economy
	Investment attractiveness	No investment attractiveness and private sector involvement	←→	Moderate investment attractiveness and private sector involvement	←→	Significant investment attractiveness and private sector involvement
Social	Support of lifestyle	No support of lifestyle and culture	←→	Moderate support of lifestyle and culture	←→	Significant support of lifestyle and culture
	Impact on cultural values	Strong negative impact on cultural values or practices	←→	No impact on cultural values or practices	←→	Strong positive impact on cultural values or practices
	Community connection and stewardship	No contribution to community connection and stewardship	←→	Moderate contribution to community connection and stewardship	←→	Significant contribution to community connection and stewardship
Environmental	Water and catchment quality	Negligible or negative impact to water and catchment quality	←→	Moderate positive impact to water and catchment quality	←→	Significant positive impact to water and catchment quality
	Enhance biodiversity	Negligible or negative impact to ecosystem health	←→	Moderate positive impact to ecosystem health	←→	Significant positive impact to ecosystem health
Secondary considerations	Complexity and feasibility	Extreme complexity of implementation	←→	Moderate complexity of implementation	←→	Minimal complexity of implementation

Weighting

After options are identified and a set of criteria is agreed upon, the next step in the MCA method involves determining whether different weights should be assigned to each criteria. These weights should reflect the relative importance of each criteria in achieving the overall objectives of the decision-making process. First, weightings for the criteria groups were determined, with equal weightings assigned to economic, social, and environmental criteria groups (30%), and less weighting assigned to secondary considerations (10%). Within the economic criteria, the greatest importance was given to local employment and income due to the projects focus on livelihood. In a similar vein, community connection and stewardship was given the highest weighting for social criteria. Environmental criteria were weighted equally.

It is important to note that weightings can be subjective and therefore it is important to test the impact of using different sets of weightings. This sensitivity analysis is outlined in Section 3.3.

Table 5. MCA criteria and weightings

Criteria group	Weighting	Criteria	Weighting
Economic	30%	Upfront cost	7.5%
		Ongoing cost	7.5%
		Local employment or income	12.0%
		Investment attractiveness	3.0%
Social	30%	Support of lifestyle	9.0%
		Impact on cultural values	9.0%
		Community connection and stewardship	12.0%
Environmental	30%	Water and catchment quality	15.0%
		Enhance biodiversity	15.0%
Secondary considerations	10%	Complexity and feasibility	10.0%
Total	100%	Total	100%

3.2 Results

After determining scores, normalising and weighting, each option's scores can be aggregated to determine a final ranking of options. These rankings can provide a focused list of options for SPREP or other funding agencies to prioritise in the future to work towards improving outcomes for the study area. Figure 5 presents the ten highest ranked options, including the contribution of different criteria scores to each of their totals.

Native reforestation of logged areas and **revegetation of long-term fallow land** emerge as the two highest ranked options with considerable contributions from the environmental and social criteria and the former also performing well on the other economic and secondary criteria. Based on ecosystem mapping undertaken for this project, there is currently around 85.35 km^2 of logged areas in the catchment which could be restored (Figure 6). Long-term fallow land has not been mapped.

Restoration of mangrove and coral habitats feature highly, with biodiversity enhancement being a key driver along with social outcomes. Based on ecosystem mapping undertaken for this project, there is currently around 40.54 km^2 of coral rubble/dead coral and dead/live coral matrix in the lagoon which could be restored (Figure 7). The areas of existing mangroves which restoration could build from are provided in Figure 7.

Other options included in the top ten are training and support for alternative livelihoods, riverbank stabilisation using vegetation and bioengineering, establishment/reestablishment of MPAs, and setbacks or buffers for environmentally sensitive assets.

Figure 5. Top 10 performing options with score contributions

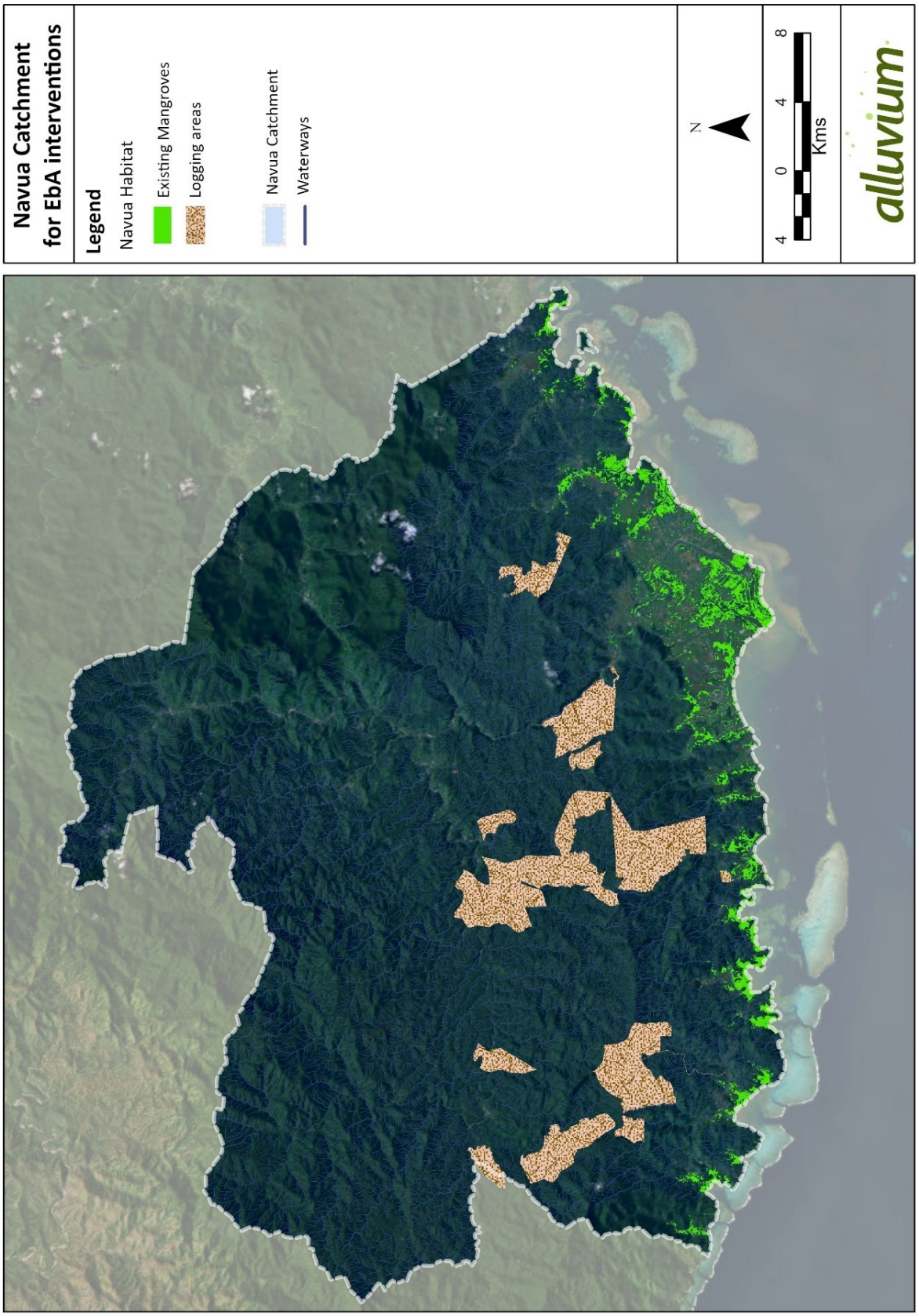

Figure 6. Potential areas for native reforestation of logged areas and restoration of mangroves in the Navua catchment

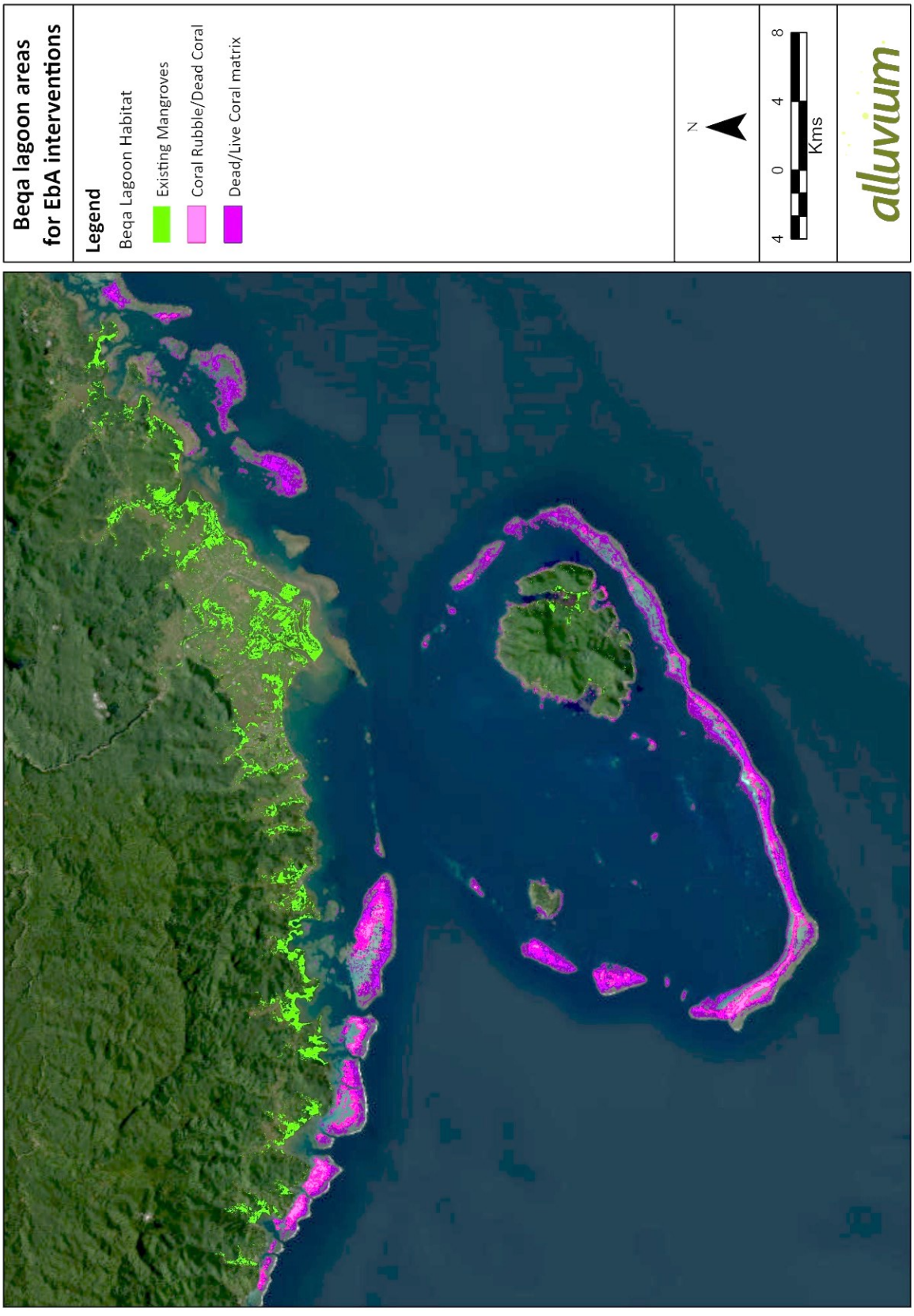

Figure 7. Potential areas restoration of mangroves and coral reef restoration

3.3 Sensitivity testing

When undertaking an MCA, sensitivity testing forms a key component of the analysis. Given that there is a degree of subjectivity and uncertainty involved in the scoring and weighting it is important to determine whether changes to any key assumptions would affect the outcomes. A number of tests were undertaken in this case including:

- **Equal weightings across all individual criteria** – a test that reflects a case where no one criteria is more important than another. This test had only minor impacts on the priority projects. The key change in the top ten options is the inclusion of fish aggregating devices at the expense of environmental buffers.
- **Higher weighting on economic criteria** – Economic criteria group weighting increased by 15% while reducing the other three groups' weightings by 5% each. The changes to the top ten projects were limited with fish aggregating devices being included along with bio-control of COTS, at the expense of MPAs and environmental buffers.
- **Higher weighting on social criteria** – Social criteria group weighting increased by 15% while reducing the other three groups' weightings by 5% each. The changes to the top ten projects were limited with enhanced enforcement of fisheries regulations being included at the expense of mangrove restoration for protection of roads.
- **Higher weighting on environmental criteria** – Environmental criteria group weighting increased by 15% while reducing the other three groups' weightings by 5% each. This had no impact on the options included in the top ten; however, there were some slight differences in the order of those projects.

The limited changes resulting from these sensitivity tests indicate that the priority projects are not heavily influenced by the choice of weightings. In particular, the reforestation and revegetation options performed highly across all sensitivity tests.

4 Conclusions and recommendations

The MCA approach provides a systematic and transparent approach to assessing the potential of EbA options. The results provide an indication of potential priorities for the Navua catchment and Beqa Lagoon in the future, with a focus on reforestation/revegetation and key habitat restoration/conservation activities. Other options shouldn't necessarily be discounted completely, however. For example, there may be cases where hard infrastructure is required to provide sufficient coastal protection and mangroves may not be sufficient.

The priority options will be explored further in the next stage of the project, the Ecosystem and Socioeconomic Vulnerability and Opportunity Assessment (ESVOA). This will discuss in more detail the key risks and vulnerabilities that the priority options provide, their potential benefits, and the distribution of those benefits across stakeholder groups (beneficiaries).

The assessment of EbA options presented in this report will also inform actions to be included in the Navua and Beqa Integrated Ecosystem Management Plan.

Figure 8. Hill-slope agriculture near Naceva

5 Bibliography

Tilleard S., Maxwell P., Vakasevuraki A., Nuske S., Charlton-Heston S. and Binney J. 2025. Ecosystem and Socioeconomic Resilience Analysis and Mapping for Navua catchment and Beqa lagoon 2024. Suva, Fiji. SPREP/Government of Fiji, 2025.

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Attachment A: Option scores

Option	Upfront cost	Ongoing cost	Local employment / income	Investment attractiveness	Support of lifestyle	Impact on cultural values	Community connection / stewardship	Water / catchment quality	Enhance biodiversity	Complexity / feasibility	Total weighted score
Seawalls / Breakwaters - roads	2	3	2	3	3	1	2	1	1	5	0.306
Seawalls / Breakwaters - communities	1	2	2	3	3	3	2	1	1	4	0.280
Mangrove restoration / conservation - roads	4	4	2	2	2	3	1	3	5	4	0.529
Mangrove restoration and conservation - communities	3	4	2	3	3	4	3	3	5	3	0.600
Mangrove restoration and conservation - biodiversity	2	3	2	3	4	5	3	3	5	3	0.615
Fish aggregating devices	5	5	3	1	3	2	3	1	3	4	0.514
Marine Protected Areas	3	4	2	1	3	3	4	2	4	4	0.545
Coral reef restoration / conservation	3	3	4	3	4	4	3	3	5	3	0.691
Bio-control of COTS	5	4	3	2	2	2	3	2	4	2	0.484
Enhanced enforcement of fisheries regulations	3	3	3	1	3	3	3	2	4	2	0.470
Providing training and support for alternative livelihoods	4	4	4	4	3	4	5	2	2	4	0.652
Native reforestation of logged areas	4	5	4	4	3	4	4	5	5	4	0.865
Agroforestry Practices	3	3	3	3	2	1	2	3	3	3	0.418
Invasive Species Management	2	3	2	2	2	3	3	2	4	3	0.425
Beach nourishment - road access	4	2	1	1	3	2	1	1	1	4	0.224
Beach nourishment - communities	3	2	1	2	4	2	2	1	1	3	0.242
Environmental setbacks/buffers - coastal resilience	3	3	1	2	2	1	1	3	4	3	0.336
Environmental setbacks/buffers - sensitive environmental assets	3	3	1	3	2	3	3	4	5	3	0.526
Conservation tillage	5	5	1	2	1	2	3	4	2	2	0.393
Crop diversification	5	5	3	2	1	2	2	2	2	4	0.434
Revegetation of long-term fallow areas	4	3	3	4	3	4	4	5	5	4	0.788
Managed aquifer recharge investigation	2	1	1	2	1	1	1	3	2	2	0.141
Rainwater harvesting	3	1	1	4	3	1	2	4	2	4	0.374
Riverbank stabilisation - vegetation / bioengineering	5	5	3	3	2	3	2	5	4	2	0.618
Water sensitive cities principles	3	3	2	3	2	1	1	5	3	3	0.423
Forestry/mining road design to reduce erosion	2	3	1	1	1	4	2	4	2	3	0.337
Coral reef restoration - storm tide mitigation	2	2	3	2	4	2	2	3	4	5	0.558

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