COASTAL WETLAND BLUE CARBON POLICY RESEARCH IN AOTEAROA

Final

August 2024 | Prepared by: Jacobs, Environmental Accounting Services, Anderson Lloyd and Conservation International for The Nature Conservancy

Ministry for the Environment
Manatū Mō Te Taiao

The Nature Conservancy
Aotearoa New Zealand
Te Papa Ao Tūroa, Aotearoa
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Cover note

The Nature Conservancy Aotearoa New Zealand and the Ministry for the Environment commissioned this report to look at the barriers and opportunities for enabling blue carbon projects in New Zealand to participate in carbon markets.

The report investigated which policy, legal, and market conditions would be needed to help landowners participate in blue carbon markets and support restoring New Zealand coastal wetlands. It recommends ways to address the policy, regulatory and legal complexities which currently exist, to remove barriers and allow New Zealand projects to participate at scale.

The New Zealand coastline includes over 300 estuarine ecosystems, many of which have been degraded due to impacts of rural and urban runoff, poor drainage, tidal barriers, grazing, cropping and urban development. There is growing interest in restoring these wetlands to realise multiple benefits such as carbon storage, biodiversity, habitat restoration and climate resilience.

Coastal wetlands help mitigate climate change by converting CO_2 emissions into plant biomass, potentially more effectively than forests. Coastal wetlands also help protect communities against storm surge and sea level rise by providing natural coastal protection.

Promoting the restoration of coastal wetlands via blue carbon credits can contribute to our collective climate response by helping New Zealand adapt to the impacts of climate change and supporting our communities through the transition.

Key recommendations of the report are:

- Develop a national blue carbon roadmap or strategy, with suggested pathways for enabling blue carbon projects at scale.
- A Māori-led study into the barriers, opportunities and benefits of blue carbon for Māori.
- Government and Māori to develop clear guidance and / or regulatory tools to grant carbon rights in the coastal marine area.
- Government to create an enabling environment for voluntary markets to operate in Aotearoa New Zealand, including Paris Agreement Article 6 policy clarity.

This report is intended to help inform future government policy and communities around management of coastal wetlands. However, the issues are complex, and considered policy analysis, research and consultation will be needed before any recommended approach can be developed.

- The Nature Conservancy and the Ministry for the Environment

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Final August 2024	Final	Jacobs, Environmental Accounting Services, Anderson Lloyd, Conservation International	Caroline Crosby, Jacobs

Purpose and audience

This report has been prepared for The Nature Conservancy (TNC) and the Ministry for the Environment (MfE). It forms part of TNC's ongoing research analysis on coastal wetland blue carbon in Aotearoa New Zealand. MfE has partnered with TNC to commission this report. As the Government's primary adviser on environmental matters, with a key function to provide policy advice and support the implementation of government policies, MfE is interested in the outputs of this project.

This report provides research analysis on the policy, legal, and market conditions necessary for establishing a blue carbon credit scheme focused on coastal wetlands (including seagrass, mangrove, and saltmarsh) in Aotearoa New Zealand.

This report is primarily intended to inform TNC and MfE's work, however will also be made publicly available to interested stakeholders.

Acknowledgements

This report was produced by Jacobs and project partners Environmental Accounting Services, Anderson Lloyd and Conservation International.

The project involved engagement with a wide range of stakeholders across Aotearoa NZ and internationally and we are thankful for the contributions from all who attended the project hui and who contributed in other ways.

Important note about this report.

The sole purpose of this report and the associated services performed by Jacobs is to research policy in accordance with the scope of services set out in the contract between Jacobs and The Nature Conservancy. In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by The Nature Conservancy and from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law. Gaps and limitations are outlined in the report.

Terminology

Carbon Accounting Methodologies: are detailed procedures used to estimate greenhouse gas emissions reductions, removals, or avoidance associated with a specific activity or project. They provide step-by-step instructions on how to quantify emissions, determine baseline levels, and assess the impact of emission reduction activities. Developed by technical experts, these methodologies are specific to different project types or activities. They establish the principles and assumptions necessary for accurate carbon accounting and ensure consistency in the measurement and reporting of emissions reductions.

Examples include:

- T-Restor: Tidal Restoration of Blue Carbon Ecosystems Method (Clean Energy Regulator 2024)
- VM0033: Methodology for Tidal Wetland and Seagrass Restoration (Verra 2023)
- Gold Standard A/R Methodology: Gold Standard A/R Requirements - Methodology for afforestation/reforestation (A/R) GHG emission reduction and sequestration (Gold Standard 2022)

Carbon Standards / Schemes: encompass rules, procedures, and methodologies for generating and issuing certified carbon credits. These standards, often developed by international organisations, governments, or non-profit entities, focus on specific sectors, regions, or project types. Carbon standards enable certification of voluntary carbon market activities and, as a result, facilitation of the carbon credit trade. For voluntary carbon market activities to achieve certification for emission reductions and removals and be issued tradable credits, they must adhere to the processes, rules, requirements, safeguards and approved methodologies as well as providing proof of compliance through impartial third-party audits. Carbon programs issue carbon credits into registries for transparent transactions (Climate Focus 2023).

Examples include:

- Australian Carbon Credit Unit Scheme – Australia's national carbon scheme, incentivising emission reduction through various activities, earning participants Australian Carbon Credit Units ('ACCUs'). The Clean Energy Regulator issues ACCUs, which can be sold to the Australian Government through a carbon abatement contract (through a reverse auction), or the secondary market.
- Verra's Verified Carbon Standard (VCS) Program, a globally recognized voluntary programme, issuing Verified Carbon Units (VCUs) from projects that can be traded on the voluntary carbon market.
- Plan Vivo, a certification standard for forestry, agricultural, and other land-use projects that promotes community-based sustainable development.

Key category of carbon emissions in a national GHG Inventory. Key categories are those emissions that sum to 95% of the total level when summed together in descending order of magnitude (IPCC 2006).

Mean High Water Springs / MHWS. Used to delineate the landward jurisdictional boundary of the coastal marine area in legislation such as the Resource Management Act 1991 and Marine and Coastal Area (Takutai Moana) Act 2011. Mean High Water Springs is the average of the levels of each pair of successive high waters during that period of about 24 hours in each semi lunation (approximately every 14 days) when the range of tides is greatest (https://www.qualityplanning.org.nz/node/745).

Acronyms

ACCU	Australian Carbon Credit Unit
A/R	Afforestation / reforestation
BlueCAM	Blue Carbon Accounting Model
C	Carbon
CDM	Clean Development Mechanism
CMA	Coastal marine area
CMP	Conservation Management Plans
CMS	Conservation Management Strategies
CO_2	Carbon dioxide
COP26	"Conference of the Parties 26" (26th conference of the parties summit attended by countries that signed the United Nations Framework Convention on Climate Change).
DoC	Department of Conservation
ETS	Emissions Trading Scheme
FullCAM	Full Carbon Accounting Model
GHG	Greenhouse gas
ha	hectare(s)
ICVCM	Integrity Council for the Voluntary Carbon Market
IPCC	Intergovernmental Panel for Climate Change LC
LCDB	Land Cover Data Base
LUM	Land Use Map
m	metre(s)
MACA	Marine and Coastal Area (Takutai Moana) Act 2011
MfE	Ministry for the Environment
MHWS	Mean high water springs
MPI	Ministry for Primary Industries
Mt	Megatonne(s) – One megatonne is equivalent to one million tonnes
NDC	Nationally Determined Contributions
NES-F	National Environmental Standard for Freshwater
NGO	Non-Governmental Organisation
NPS-FM	National Policy Statement for Freshwater Management
NPS-IB	National Policy Statement for Indigenous Biodiversity
NZ	New Zealand

NZCPS	New Zealand Coastal Policy Statement
RMA	Resource Management Act 1991
t	Tonne
tCO_2e	Tonne(s) of carbon dioxide equivalent
TNC	The Nature Conservancy
UNFCCC	United Nations Framework Convention on Climate Change
VCM	Voluntary Carbon Market
VCS	Verified Carbon Standard
VCU	Verified Carbon Unit
WCO	Water Conservation Order

Executive summary

CONTEXT AND OBJECTIVES

The Aotearoa New Zealand (NZ) coastline includes over 300 estuarine ecosystems, many of which are in poor condition from the impacts of run off, drainage, tidal barriers, grazing, cropping and urban development. There is growing interest in the potential for their restoration to realise multiple benefits such as carbon sequestration, biodiversity enhancement, habitat restoration and management of flooding and erosion risks.

Coastal blue carbon is the carbon stored and sequestered in the plants and sediments of coastal wetlands, incorporating mangrove, salt marsh and seagrass habitats. A 'blue carbon project' is a project where coastal wetlands are protected and / or restored for the purposes of capturing and storing carbon as a result of actions that are 'additional' to what is currently occurring (or would feasibly occur in future) and / or required under legislation. A variety of market and non-market approaches can be used to finance the projects.

Coastal blue carbon is an emerging part of a suite of nature-based solutions for climate mitigation and adaptation which includes native forests, plantation forests and peatland and soil conservation. Nature-based climate solutions play an important role in global climate mitigation efforts and are a priority in Aotearoa NZ's first National Adaptation Plan. Alongside the climate mitigation benefits of carbon sequestration and storage, nature-based solutions also provide a range of important climate resilience and adaptation, biodiversity, social, cultural, economic, air quality, water and soil benefits (Griscom *et al.* 2017).

Preliminary estimates of Aotearoa NZ's total area of seagrass, mangrove and saltmarsh is approximately 76,000 – 113,000 ha and preliminary carbon sequestration rates are estimated between 0.05–0.26 Mt CO_2 per year (Ross *et al.* 2023, Bulmer *et al.* 2024). Bulmer *et al.* (2024) also estimated approximately 88,000 ha of additional coastal areas that may be suitable for saltmarsh, mangrove and seagrass restoration.

Interest in coastal blue carbon is growing across Aotearoa NZ and there is a collaborative effort across government, iwi, non-governmental organisations, researchers, land owners and community members to share knowledge to create momentum and efficiencies. Coastal wetland contributions have not yet been sufficiently investigated to be included quantitatively in the national greenhouse gas inventory (with the exception of mangroves) because it is not a key category in the country's emissions profile. Aotearoa NZ has recognised the potential contribution of coastal wetlands to climate change mitigation in the most recent Nationally Determined Contributions under the Paris Agreement and in the Emissions Reduction Plan and nature-based climate solutions have been prioritised in the National Adaptation Plan and Climate Response Strategy.

The Nature Conservancy would like to support the development of a blue carbon credit scheme in Aotearoa NZ. This project aimed to:

(a) evaluate current policy, legal and market conditions,

(b) identify potential barriers and enablers, and

(c) suggest ways in which these barriers could be overcome and support an enabling environment e.g. through further research, changes to policy and collaboration amongst stakeholders.

RESEARCH THEMES, QUESTIONS AND FINDINGS

The research analysis identifies a range of policy-related issues that need to be resolved to support the development of a blue carbon credit scheme in Aotearoa NZ. Six priority research themes were identified by The Nature Conservancy related to the technical, policy and legal landscape at the inception of the project. These were developed throughout the project through collaboration with a range of stakeholders.

The key research questions and findings for each research theme are presented in Table ES.1, with recommendations outlined below. The findings and recommendations have resulted from the policy research team's review of the current literature, interviews with subject matter experts, and collaboration with The Nature Conservancy, Ministry for the Environment and stakeholders. Blue carbon policy, projects, methodologies, markets, integrity principles and best practice guidance are new and developing rapidly across the world. Much of the

research and grey literature reviewed by the team was published within the last two years and some within the time period of this research. The team acknowledges that the scope of this study was limited and is preliminary in nature. Further work is required across the research themes in order to reduce the barriers and create the enablers for blue carbon.

Table ES.1 Coastal blue carbon policy research questions and findings

Theme	Research Questions	Findings
Theme 1: Greenhouse Gas Inventories and Nationally Determined Contributions	• What are the implications of including blue carbon in Aotearoa NZ's Greenhouse Gas Inventory and Nationally Determined Contributions?	• Finding 1.1: Developing specific, national data sets for activity data, spatial data and greenhouse gas emissions factors for coastal wetlands is critical in order to include coastal wetland blue carbon data in the Aotearoa NZ Greenhouse Gas Inventory and as a quantitative target in the Nationally Determined Contributions. • Finding 1.2: Blue carbon ecosystems have the potential to sequester more carbon per hectare than other nature-based activities. Including coastal wetlands in the Aotearoa NZ Greenhouse Gas Inventory and the Nationally Determined Contributions will not have a significant impact on the country's net carbon emissions due to the comparatively small area available for restoration and protection. But it will elevate the visibility of blue carbon and have co-benefits for attracting investment in coastal restoration, nature-based climate adaptation and recognition of the important role of these ecosystems domestically and internationally.
Theme 2: Carbon Markets and Carbon Trading	• What is the demand for blue carbon credits in Aotearoa NZ, and who would the potential buyers be? • What are the strengths and weaknesses of incorporating blue carbon into the Emissions Trading Scheme, or in a voluntary market in Aotearoa NZ? • How would the introduction of blue carbon credits impact the overall market dynamics, pricing, and demand for carbon offsets in Aotearoa NZ?	• Finding 2.1: Weaknesses in the Emissions Trading Scheme, such as the price controls, risk of oversupply of New Zealand Units and lack of accountability of co-benefits, indicate that blue carbon may not receive price premiums to make the projects financially feasible. Blue carbon projects are more likely to be scalable and financially feasible in a voluntary carbon market where buyers are more discerning with an interest in integrity principles, measurable co-benefit outcomes and where carbon prices have the potential to be higher. • Finding 2.2: Voluntary blue carbon markets are nascent, with only 14 projects globally active and creating credits. Recent market activity indicates that there is potential demand for Aotearoa NZ blue carbon credits from domestic and offshore buyers. (Global demand for all voluntary carbon credits is approximately $1b with an estimated growth multiplier of 100 by 2050, Claes *et al.* 2022).
Theme 3: Environmental Policy and Law	• What are the barriers and enablers to blue carbon projects in current national and regional policies and rules? • What are the potential options and policy pathways to address identified barriers, using lessons from international examples?	• Finding 3.1: Coastal restoration broadly aligns with the purpose and objectives of key legislation in the coastal marine area (for example the Resource Management Act and Marine Reserves Act) but the complex regulatory framework is not fit for purpose for enabling blue carbon projects. Barriers are similar to any other development in the coastal marine area (the layered legal requirements, inconsistency between regions and

Theme	Research Questions	Findings
	• In what ways could the changing regulatory environment affect development of blue carbon projects?	multiple approvals processes) and can be overcome with good stakeholder engagement, using legal and planning specialists and allowing adequate time and budget. Time and cost burdens could be overcome through blue carbon enabling legislation. • Finding 3.2: Regulatory barriers and enablers are similar at small and large scales and are unlikely to hinder scalability. • Finding 3.3: Blue carbon is aligned with Aotearoa NZ's First National Adaptation Plan (2022-2028), the New Zealand Biodiversity Strategy and the Climate Change Strategy and will positively contribute to several objectives and priority actions.
Theme 4: Coastal Land Tenure and Carbon Rights	• What are the issues and opportunities regarding land tenure and carbon rights in coastal areas, for privately-owned, Māori-owned and Government owned/managed land? • What lessons can be drawn on from projects that have been implemented in the coastal marine area in Aotearoa NZ and internationally (not necessarily blue carbon projects)? • What opportunities exist to overcome the barriers (in the short and/or long term), and further work required in this area?	• Finding 4.1: The absence of land titles below mean high water springs in most situations presents a significant challenge for widespread blue carbon rights registration. The convention of granting registrable carbon rights to land title is not possible without a legal record of title to register the right on/against. • Finding 4.2: Alternative regulatory tools will likely be needed to enable the widespread grant of blue carbon rights, in a manner that respects Māori sovereignty and tikanga Māori and meets the integrity principles for blue carbon projects, particularly where legal title is not available. Several options were reviewed, including the use of customary title and vesting of land to the Crown under the Marine and Coastal Area (Takutai Moana) Act 2011. Multiparty legal agreements and / or a new category of resource consents under the Resource Management Act could be possible options for pilot programmes.
Theme 5: Blue Carbon Schemes and Methodologies	• What blue carbon accounting schemes exist internationally, and what are their attributes? • What lessons can be drawn from international application of the schemes? • How applicable are existing international blue carbon credit schemes to the Aotearoa NZ context? • What are the key opportunities, and challenges to do with development of a blue carbon credit scheme for Aotearoa NZ?	• Finding 5.1: While several blue carbon methodologies exist internationally, their uptake and application are nascent and this is still an emerging area of practice. Barriers for project proponents include complexity, cost and data requirements. • Finding 5.2: Key challenges for blue carbon projects in Aotearoa NZ are: complex land tenure and carbon rights, developing national data sets as explained in Finding 1.2 and clarity on the country's position on Article 6 of the Paris Agreement regarding the sale of credits offshore. Further research and studies would overcome some of the financial barriers for projects and increase efficiency, consistency, investment and integrity and enable faster development of projects. • Finding 5.3: To create high quality credits that respect Te Tiriti o Waitangi and maximise cultural, ecological and other co-benefits, blue carbon projects in Aotearoa NZ must integrate the core carbon principles of the Integrity Council for

Theme	Research Questions	Findings
		the Voluntary Carbon Market and mātauranga Māori approaches and perspectives. • Finding 5.4: Analysis shows that Aotearoa NZ has several options to adopt existing blue carbon schemes and methodologies or develop a bespoke scheme. One combination, adopting the existing Verra blue carbon methodology with the Climate, Community and Biodiversity Standard, appears to provide multiple benefits for Aotearoa NZ: existing integrity and international reputation, ability to recognise Māori sovereignty and integration of te ao Māori and mātauranga Māori, enable holistic assessment of co-benefits and be applied at various scales.
Theme 6: Co-Benefits of blue carbon projects	• How can co-benefits be incorporated in existing carbon accounting schemes (international examples)? • What are the opportunities and challenges of incorporating co-benefits into a blue carbon accounting scheme for Aotearoa NZ? • What are the best practices for assessing and monitoring the biodiversity benefits of blue carbon projects?	• Finding 6.1: International blue carbon methods only include minimum standards or rules for co-benefits. Higher value co-benefit outcomes are more likely with separate standards that can be stacked or stapled with blue carbon in the market. • Finding 6.2: Methods for valuing and measuring biodiversity co-benefits are well-developed, for example the Climate, Community and Biodiversity Standards. Coastal resilience methodologies (e.g. SD Vista Version 1.0) are in development and could be applicable in future and would catalyse investment in nature-based adaptation benefits.

RECOMMENDATIONS

The policy research has yielded two streams of recommendations, included in Table ES.2:

- **Priority recommendations:** Areas of work considered critical to enabling a blue carbon market. These are considered the essential 'building blocks' to enable carbon rights to be granted and traded in a manner that respects Te Titiri o Waitangi.
- **Enabling recommendations:** Further actions that are necessary to scale up blue carbon and maximise the conservation, cultural, resilience and social benefits of protecting and restoring coastal wetlands. These can be implemented in parallel to the priority recommendations or are secondary actions that naturally follow the critical actions.

Table ES.2 Recommendations from the policy research

Recommendation	Description and links to the findings
Priority Recommendations	
P1 Develop a Blue Carbon Strategy or Road Map for Aotearoa NZ *Responsibility: to be determined.*	Develop a strategy or road map with suggested pathways for developing the various regulatory and non-regulatory elements required for enabling blue carbon projects and at scale. Consider the roles and responsibilities of government, private sector, iwi and non-governmental organisations. This recommendation reflects the outcomes of recent, collaborative work by the emerging coastal wetland blue carbon community of practice and is relevant across all research themes.
P2 Māori-led study into the barriers, opportunities	There is a clear role for Māori in blue carbon as treaty partners, land owners, kaitiaki and owners of customary title and customary use of coastal marine areas. During

Recommendation	Description and links to the findings
Priority Recommendations	
and benefits of blue carbon for Māori. *Responsibility: to be determined.*	stakeholder hui it was acknowledged that it is time to begin engagement with iwi. A Māori-led study is recommended to understand the aspirations, barriers, opportunities and benefits for Māori and how these can be integrated into ongoing research, policy making, tools, markets and projects. The scope would include engagement with iwi across the motu. It is recommended the study also address the partnerships and benefit sharing between iwi and hapū and other blue carbon project partners (land owners, councils, Department of Conservation, community groups). The study would build on the 'Blue carbon futures in Aotearoa NZ: Law, climate, resilience' research by University of Canterbury and te iwi o Ngāi Tahu. Māori sovereignty, kaitiaki and customary use of the coastal marine area is relevant across all research themes. Findings 4.1 and 4.2 identify the importance of te Tiriti o Waitangi, kaitiaki and customary title and use in the granting of carbon rights. Finding 5.3 identified the importance of te Tiriti o Waitangi and te ao Māori in blue carbon methodologies. Finding 5.3 refers to a similar study carried out recently in Australia.
P3: Develop clear guidance and / or regulatory tool to grant carbon rights in the coastal marine area. *Responsibility: Government, Māori* *Engagement: land owners, councils, community groups*	Explore regulatory and non-regulatory options for granting rights to blue carbon created in coastal environments in the context of te Tiriti of Waitangi, Māori customary rights and uses and the absence of land title below mean high water springs. It is also recommended to explore and develop guidance and / or tools for granting of blue carbon rights to land with title above mean high water springs. Some options have been considered in this research project but each requires in depth analysis and potential pathways, and there may be more options and tools to be identified. Pilot projects can be used to test approaches. This work is connected to P2 and will take time as it relates to resource rights in an environment with legal, social, cultural and ecological complexity. An interim step may be to develop guidance and tools for granting carbon rights to non-forestry, nature-based sequestration and storage on land with title above mean high water springs. A national approach to granting carbon rights will provide consistency and clarity which is expected to reduce barriers to developing blue carbon projects and provided the integrity assurances to carbon credit purchasers. Finding 4.1 highlights the potential risks and barriers to granting carbon rights to any individual, organisation, iwi or hapū below mean high water springs. Land below the mean high water spring can generally not be owned due to the lack of land title. Land that was previously above the mean high water spring and re-flooded can have title, although this is not guaranteed in perpetuity. Barriers also exists due to the absence of tools to grant carbon rights from other nature-based carbon sequestration that is not forestry. Finding 4.2 highlights the significant importance of Te Tiriti o Waitangi in granting such rights. Finding 4.3 highlights Findings 2.2 and 5.2 highlight that markets require carbon rights to be clear for credits to be created and traded and give buyers confidence. Findings 4.2, 5.2 and 5.4 highlight the importance of a partnership between government and Māori and the principles of Te Tiriti o Waitangi in preparing suitable carbon methodologies for measuring, owning, trading and benefiting from coastal wetland carbon. This recommendation requires leadership from the government, Māori and communities to work collaboratively and requires further research and analysis into the legal, policy and non-regulatory tools and approaches.
P4: Create an enabling environment for the voluntary market to operate in Aotearoa NZ *Responsibility: Government*	This study concluded that a voluntary carbon market, with access to international trading, is more likely to facilitate the development of blue carbon projects at scale by creating high integrity carbon credits and access to a large pool of credit buyers. There remains uncertainty due to the limited scope of the research, limited access to transaction data, the early stages of blue carbon projects and markets globally and the future of the Emissions Trading Scheme*. The research has identified the potential enabling conditions to enable blue carbon projects to happen successfully at scale in Aotearoa NZ, such as: endorsing best practice guidance relating to high integrity, benefit sharing and equitable approaches

Recommendation	Description and links to the findings
Priority Recommendations	
	and policy clarity with regard to Article 6 and the sale of carbon credits offshore (see P5 below). Further analysis is recommended to build on this initial analysis focusing on the enabling conditions, implementation steps, policy tools, guidelines, roles and responsibilities and costs of international voluntary carbon market. This research can address the role of government and regulation and the implications for achieving blue carbon projects at scale. The analysis could take a staged approach and reduce barriers for blue carbon projects to meet existing international voluntary carbon market requirements and methodologies in the short term while looking at longer term options such as a domestic voluntary carbon market if that is feasible. It would build on the pilot studies and research already underway as discussed in the report. Findings 2.1 and 2.2 indicate that voluntary carbon markets are likely to have greater benefits to projects and to scaling blue carbon compared to the domestic Emissions Trading Scheme. Access to offshore buyers who would be interested in high quality, nature-based credits from Aotearoa NZ would further accelerate the opportunity. **If the Emissions Trading Scheme conditions change then approaches for integrating blue carbon could be considered in future.*
P5 Paris Agreement Article 6 policy clarity. *Responsibility: Ministry for the Environment, Ministry of Foreign Affairs and Trade*	To avoid any confusion or barriers in the ability of blue carbon projects to access offshore markets the government can provide clarity on the country's commitments under the Paris Agreement Article 6 as a key enabler for a voluntary carbon market. Article 6 allows countries to trade their carbon credits but there must be a system in place to enable that to happen and to account for it to avoid double-accounting and to ensure there are no adverse or perverse implications for Nationally Determined Contributions.
Enabling Recommendations	
E1: Research to prepare and maintain national data sets for emissions factors and detailed habitat mapping. *Collaborators: government, research organisations, councils, iwi, community groups, non-governmental organisations*	If the government prioritises the inclusion of quantitative data on coastal wetlands and blue carbon into the Greenhouse Gas Inventory and Nationally Determined Contributions, further research is recommended to prepare and maintain the emissions factors, activity data and detailed habitat mapping and hydrodynamic modelling required to quantify the net emissions on a national scale. As per Finding 5.2, national approaches to data set development and maintenance will also reduce the barriers to entry, facilitate investment in blue carbon and increase the integrity and consistency of blue carbon projects. There are numerous co-benefits to increasing the scientific knowledge of the location and extent of coastal wetlands and the blue carbon emissions factors in the Aotearoa NZ context (Findings 1.2, 5.2), whether or not the government decides to include the potentially small volume of blue carbon into the Greenhouse Gas Inventory and Nationally Determined Contributions. For example these data sets are valuable for coastal resource management under the Resource Management Act, Conservation Act and future National Adaptation Plans and Emissions Reduction Plans. Furthermore, inventory methods can be gradually refined, by incorporating site-specific data once available to improve the accuracy of emissions estimates from coastal wetlands in Aotearoa NZ. This work requires leadership by the government and collaboration with research organisations, councils, non-government organisations and the broader blue carbon community.
E2: Inclusion of coastal wetlands in the NDC as a qualitative commitment *Responsibility: Ministry for the Environment, Ministry*	Include qualitative commitments for coastal wetlands in the Aotearoa NZ Nationally Determined Contributions to acknowledge the role as nature-based solution for climate change adaptation. This will encourage confidence in the investment in coastal restoration and demonstrate commitments to our Pacific neighbours and the wider international community. The research Finding 1.2 demonstrates the broader benefits of the government signalling coastal wetlands in the Nationally Determined Contributions. This

Recommendation	Description and links to the findings
Priority Recommendations	
of Foreign Affairs and Trade	recommendation is a 'no regrets', short term policy action by the government, which aligns with the global trends, and does not commit the government to include quantitative blue carbon emissions reductions in the meantime.
E3: Review and update key parts of the Resource Management Act* regulatory framework *Responsibility: Ministry for the Environment*	Research indicates that the Resource Management Act* has some regulatory barriers that may create unnecessary cost and complexity to blue carbon projects. The Resource Management Act could be a tool to grant carbon rights. Several reviews are recommended: E.1 Conduct a review of the detail of the National Environment Standards for Freshwater Regulations 2020 on three key points: • Whether the purpose of works needs to be expanded to refer to carbon sequestration • Whether the definition of *natural inland wetland* is too narrow, or in fact whether the permitted regulation 38 should simply apply to all wetlands, and • Whether the permitted pathway for maintenance and restoration can be replicated for blue carbon/coastal wetlands below Mean High Water Springs. E3.2: Conduct a review of the National Policy Statement for Freshwater Management and New Zealand Coastal Policy Statement as they relate to blue carbon projects, to provide enabling conditions, drive consistency where possible throughout Aotearoa NZ, and enable scalable replication. E3.3: Review of activity category/consent types in the Resources Management Act relating to blue carbon restoration and protection – to investigate further enabling options including carbon rights. Finding 3.1 is clear that more targeted, enabling policy will reduce the barriers to developing blue carbon projects. **Any future versions of the Resource Management Act can consider similar enabling policies.*
E4: Review the Conservation Act and / or Reserves Act *Responsibility: Department of Conservation*	Recommend a review of the purpose of the Conservation Act and / or Reserves Act to unlock the potential for coastal wetland blue carbon projects located on land managed under the Acts. Blue carbon could be enabled through reforms to those Acts and the scope of the statutory instruments that implement them. Findings 3.1 and 3.2 identified the complexity of the regulatory framework generally, and with the narrow purpose (protection of ecosystem values) of these Acts specifically. To reduce the regulatory barriers to blue carbon, clarity and alignment is required on the purpose of coastal wetland blue carbon projects and any commercial activity or income derived from carbon credits.
E5: Research and mapping customary rights *Responsibility: to be determined.*	Conduct collaborative research, in partnership with iwi and communities, to map the extent and nature of customary rights (and claims) in the coastal marine area in relation to the potential implementation of blue carbon projects. This would provide more clarity on the potential rights to carbon and the nuances of layering of legislation in the coastal marine area across the motu. This could also provide visibility on the potential scale of opportunities for iwi.
E6: Best Practice Guidelines for blue carbon in Aotearoa NZ *Responsibility: to be determined*	Prepare guidance to reduce entry barriers and transaction costs for project proponents when applying international voluntary carbon market methodologies and meet Integrity Council for the Voluntary Carbon Market integrity principles in an Aotearoa NZ context. Topics may include: navigating the regulatory policy and planning frameworks, carbon rights and benefit sharing, stakeholder engagement protocols and other cultural, social and environmental aspects unique to Aotearoa NZ. The purpose is to make it easier for communities, land owners, iwi, councils and other potential project proponents to understand and implement the methodologies,

Recommendation	Description and links to the findings
Priority Recommendations	
	reduce entry barriers and therefore increase the potential for blue carbon at scale. This will also help to build the capability and capacity of the subject matter experts that can support projects such as scientists, legal advisors, planners and engineers.
E7: Pilot studies to inform application of the Verra methodology for specific application in Aotearoa NZ *Responsibility: to be determined.*	There are several pilot projects trialling blue carbon methodologies and potential market development. There is value in using pilot studies to test specific aspects of relevant methodologies, with objectives to build the body of knowledge, better policy and accelerate blue carbon investment: • Enable integration of coastal wetland blue carbon into the Greenhouse Gas Inventory and Nationally Determined Contributions through estimation approaches that align with the Wetlands Supplement to the Intergovernmental Panel on Climate Change Guidelines. • Test the feasibility of the "Verra + Climate, Community and Biodiversity Standards "blue carbon methodology, and confirm an approach which integrates integrity principles, mātauranga Māori approaches, and biodiversity values with minimum standards for co-benefits such as biodiversity and resilience. • Understand the full costs of project development, registration and verification to Verra (or other international voluntary carbon standard) over the lifetime of the project.
E8: Further explore and develop the standards and methodologies to enable the measurement and value capture of co-benefits such as biodiversity and coastal resilience. *Collaborators: government, project developers, emerging coastal wetland blue carbon community of practice members.*	E8.1 Collaborate with Ministry for the Environment and Department of Conservation to align blue carbon methods with the proposed Aotearoa NZ biodiversity credit scheme to enable stacking and to manage risks of additionality and double accounting. E8.2: Test/assess emerging co-benefit methodologies such as coastal resilience and otherwise invest in country-specific methodologies if these are not considered appropriate for Aotearoa NZ context. E8.3 Conduct further research on the potential for other relevant co-benefits to be valued and could provide additional income such as water quality, fisheries and other nature-positive outcomes and or cultural/social benefits as defined by the participating communities. The rationale is to maximise the opportunities for project proponents to attract additional income or investment and improve the financially feasibility of projects. Additionally, reducing the barriers to co-benefit value capture can accelerate the overall scale and effort of coastal restoration and incentivise higher value outcomes of projects.

Introduction

This report provides research and analysis on the policy, legal and market barriers and enablers of a potential coastal wetland blue carbon scheme in Aotearoa NZ, focused around six priority research themes.

WHAT IS COASTAL BLUE CARBON AND WHY IS IT IMPORTANT?

Blue carbon refers to the carbon stored in coastal and marine ecosystems (Shindler Murray and Milligan ed. 2023). Coastal blue carbon refers carbon stocks in the coastal zone in tidal marsh, mangrove and seagrass habitats[1]. These ecosystems can sequester and store carbon dioxide in the biomass and sediments, contributing to carbon reduction efforts (Macreadie *et al.* 2021). A 'blue carbon project' is a project where coastal habitats are protected and / or restored for the purposes of capturing and storing carbon as a result of actions that are 'additional' to what is currently occurring (or would feasibly occur in future) and / or additional to what is required under legislation. A variety of market approaches (carbon credits) and non-market approaches (grants, bonds, philanthropy) can be used to finance the projects.

Aotearoa NZ's coastline includes over 300 estuarine ecosystems and many are in poor condition from the impacts of run off, drainage, tidal barriers, grazing and cropping and urban development. There is growing interest in the potential for their restoration to realise multiple benefits such as carbon sequestration, biodiversity, habit restoration and climate resilience.

Preliminary analysis of Aotearoa NZ's current blue carbon stock is 2.66–3.76 Mt of carbon (C), over an area of 76,152 ha of seagrass, mangrove and saltmarsh (Ross *et al.* 2023). This is equivalent to 1% of the current area of terrestrial native forest. Ross *et al.* (2023) estimates a carbon sequestration rate (mangrove and salt marsh) of 0.12 (0.05–0.26) Mt CO_2 per year, which is equivalent to 0.16% of Aotearoa NZ's 2021 gross emissions. Bulmer *et al.* (2024) provides an updated estimate of 112,805 ha of current saltmarsh, mangrove, and seagrass habitat and a total estimated sequestration rate of approximately 57,800 t C per year (equivalent to 0.2 Mt CO_2 per year).

Bulmer *et al.* (2024) also estimated the *potential* coastal areas suitable for saltmarsh, mangrove and seagrass restoration and the associated carbon sequestration potential. The preliminary analysis indicates approximately 88,000 ha of additional blue carbon habitat could sequester an additional 92,000 tC (approximately) per year.

Blue carbon is part of a suite of nature-based solutions for climate mitigation and adaptation. Nature-based carbon mitigation refers to the range of options for increasing carbon sequestration and storage through conservation, restoration, and improved management practices across forests, wetlands, coasts, oceans, grasslands, and agricultural lands. Alongside the climate mitigation benefits, nature-based solutions also result in a range of important social, cultural, economic, air quality, biodiversity, water and soil benefits (Griscom *et al.* 2017).

WHAT IS BEING DONE IN AOTEAROA NZ TO SUPPORT BLUE CARBON?

The interest in blue carbon is building across Aotearoa NZ and there is a collaborative effort across government, iwi, non-governmental organisations, researchers, land owners and community members to share knowledge and create momentum and efficiencies. A coastal wetland blue carbon community of practice is emerging through the leadership of The Nature Conservancy, Department of Conservation (DoC) and Ministry for the Environment (MfE).

[1] Other blue carbon habitats beyond the scope of this report include kelp (macroalgae), tidal flats, marine fauna and ocean sediments (Howard *et al.* 2023).

There are several blue carbon pilot projects and research projects that have been recently completed or are underway in Tasman, Nelson, Northland, Christchurch, Otago, Firth of Thames and elsewhere. Initiatives include:

- Development of technical data sets focusing on the distribution of blue carbon habitats, rates of above and below ground carbon sequestration, and emissions for each habitat type (Bulmer *et al.* 2024; Ross *et al.* 2023; Stewart-Sinclair *et al.* 2024).
- Feasibility investigations relating to blue carbon projects (Weaver *et al.* 2022).
- A range of pilot projects by numerous collectives of iwi/hapū, community groups, non-governmental organisations and land owners.
- Collaboration of researchers, practitioners, non-governmental organisations, iwi/hapū and government through an emerging coastal wetland blue carbon community of practice in Aotearoa NZ, aimed at advancing knowledge on coastal wetland carbon storage and sequestration Kettles *et al.* (2024).
- Academic research. For example 'Blue carbon futures in Aotearoa NZ: Law, climate, resilience' led by Prof. Elizabeth MacPherson and sponsored by the Rutherford Discovery Fellowship and 'Carbon sink analysis in the Fiordland Marine Area' led by Dr. Rebecca McLeod at Otago University.

WHAT ARE THE KEY AREAS OF POLICY RESEARCH NEEDED TO SUPPORT THE DEVELOPMENT OF A BLUE CARBON CREDIT SCHEME IN AOTEAROA NZ?

Although coastal wetland blue carbon is not included in Aotearoa NZ's national greenhouse gas (GHG) inventory, coastal wetlands are mentioned in the country's Emissions Reduction Plan (MfE 2022) and the government is exploring ways to include wetlands in emissions reduction schemes (Kettles *et al.* 2024).

There are a range of policy related issues that need to be resolved to support the development of a blue carbon credit scheme in Aotearoa NZ. TNC identified six priority research themes related the policy and legal landscape at the inception of the policy research project. The research themes and priorities were developed throughout the project through collaboration with a range of stakeholders, forming the questions associated with each theme in Table I.1. These formed the basis for the policy research and this report has been structured in alignment with these themes. The following chapters present the research findings for each of the themes.

Table I.1 Priority policy research themes and questions

Theme	Research Questions
Theme 1: Greenhouse Gas Inventories and Nationally Determined Contributions	• What are the implications of including blue carbon in Aotearoa NZ's GHG inventory and Nationally Determined Contributions?
Theme 2: Carbon Markets and Carbon Trading	• What is the demand for blue carbon credits in Aotearoa NZ, and who would the potential buyers be? • What are the strengths and weaknesses of incorporating blue carbon into the ETS, or in a voluntary market in Aotearoa NZ? • How would the introduction of blue carbon credits impact the overall market dynamics, pricing, and demand for carbon offsets in Aotearoa NZ?
Theme 3: Environmental Policy and Law	• What are the barriers and enablers to blue carbon projects in current national and regional policies and rules? • What are the potential options and policy pathways to address identified barriers, using lessons from international examples? • In what ways could the changing regulatory environment affect development of blue carbon projects?

Theme	Research Questions
Theme 4: Coastal Land Tenure and Carbon Rights	• What are the issues and opportunities regarding land tenure and carbon rights in coastal areas, for privately-owned, Māori-owned and Government owned/managed land? • What lessons can be drawn on from projects that have been implemented in the coastal marine area in Aotearoa NZ and internationally (not necessarily blue carbon projects)? • What opportunities exist to overcome the barriers (in the short and/or long term), and further work required in this area?
Theme 5: blue carbon Schemes and Methodologies	• What blue carbon accounting schemes exist internationally, and what are their attributes? • What lessons can be drawn from international application of the schemes? • How applicable are existing international blue carbon credit schemes to the Aotearoa NZ context? • What are the key opportunities, and challenges to do with development of a blue carbon credit scheme for Aotearoa NZ?
Theme 6: Co-Benefits of blue carbon projects	• How can co-benefits be incorporated in existing carbon accounting schemes (international examples)? • What are the opportunities and challenges of incorporating co-benefits into a blue carbon accounting scheme for Aotearoa NZ?

RESEARCH METHODOLOGY

Collaborative approaches were used to understand the current policy landscape and provide analysis and pathway options.

Figure I.1 provides an overview of the policy research project including the context, purpose, key policy research themes and methodology steps involved. The project was delivered through four methodology steps:

- Step 1: Knowledge share hui: This brought interested stakeholders from central and local government, iwi representatives, academia and private industry together to agree on the research programme, approaches, and priorities and to share knowledge across the spectrum of research themes. The hui was attended by 73 participants and included four presentations on current research and issues relating to blue carbon in Aotearoa NZ and internationally.
- Step 2: Literature review: A literature review was completed to support this report and to summarise the policy context, current landscape and policy opportunities, gaps and challenges associated with blue carbon projects in Aotearoa NZ.
- Step 3: Analysis and recommendations: Draft analysis and recommendations were developed and drafted into a draft report for input and feedback from project stakeholders.
- Step 4: Hui and reporting: over 50 stakeholders came together to discuss, provide feedback on, and strengthen the draft findings and recommendations.

All project stages have involved engagement with subject matter experts and stakeholders throughout Aotearoa NZ and abroad.

This report presents the final research findings.

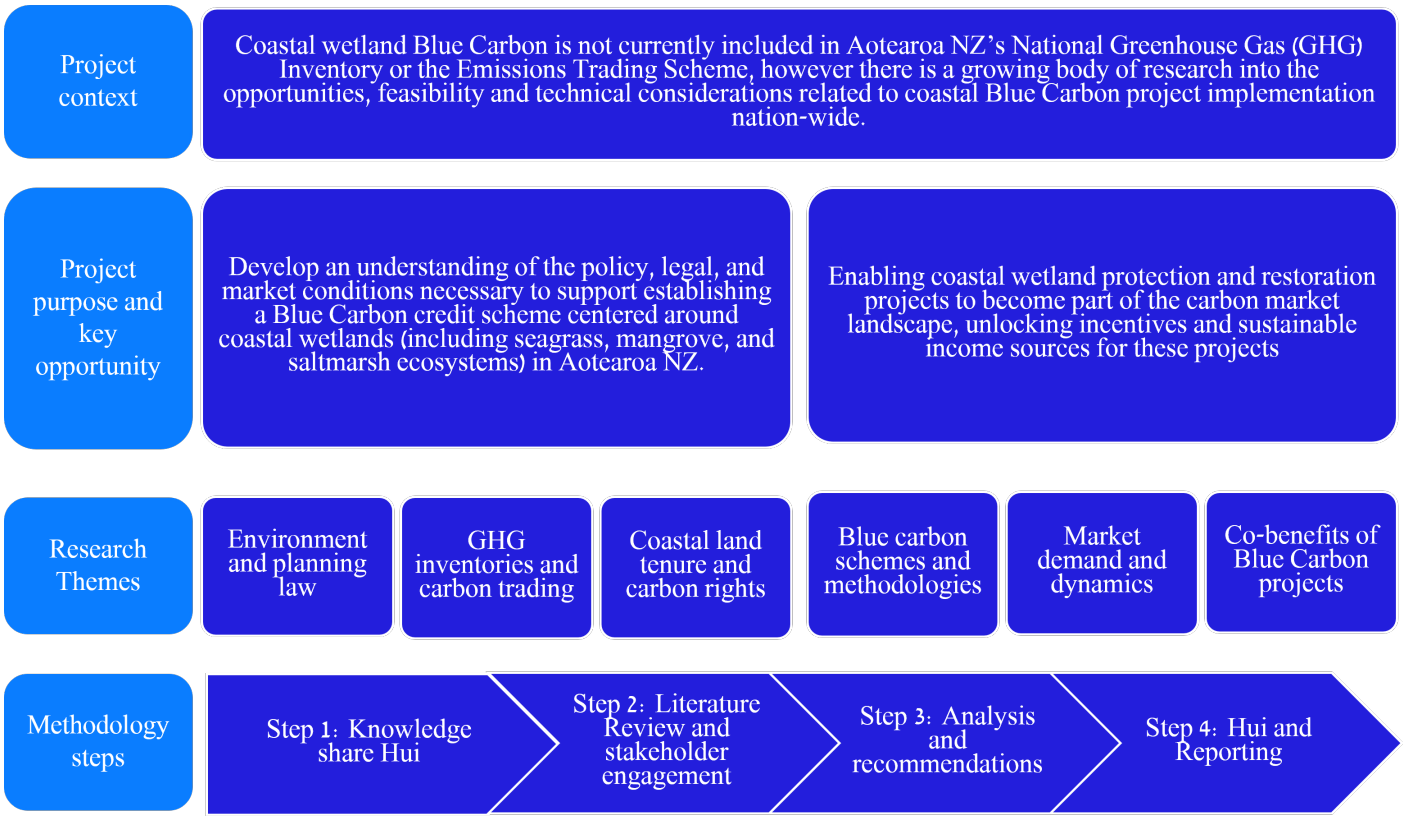

Figure I.1 Coastal blue carbon policy research project - overview

BLUE CARBON PROJECT SCENARIOS

Three blue carbon project scenarios have been used to demonstrate local issues and opportunities.

Three hypothetical blue carbon project scenarios were used throughout the policy analysis to:

- Frame up the research analysis and enable consistent application of analysis across the six research themes.
- Apply and test policy ideas and/or recommendations. For example, how restoration and blue carbon project implementation will vary under different council plans and policies.
- Focus findings on the practical and pragmatic considerations of policy development.
- Develop insights into the 'breadth' of applicability of policy solutions (i.e. where recommendations may differ between different cases).

Hypothetical project scenarios (in comparison to real pilot projects) reduce complexities to do with project sensitivities, access to information and data availability and allow the research team to control the variables to test relevant aspects of the research findings. The scenario attributes were developed from literature review and stakeholder engagement, focussed on potentially feasible and relevant typologies and interventions in key geographic areas. Note all scenarios are assumed to have a permanence of 100y minimum.

The hypothetical scenarios are described in **Error! Not a valid bookmark self-reference.** below:

Table I.2. Hypothetical blue carbon scenarios

Hypothetical Scenario:	Scenario 1: Northland Mangrove, Saltmarsh and Seagrass A: Small Scale: 25 ha B: Harbour Scale: 500 ha+	Scenario 2: Bay of Plenty Salt Marsh and Mangrove A: Small Scale: 25 ha B: Catchment Scale: 500+	Scenario 3: Tasman or Nelson Seagrass and Saltmarsh
Typology	• Protection of, and making room for, mangrove and seagrass migration as a result of sea level change. Co-benefits for saltmarsh and seagrass in the coastal community. • Will enable managed retreat and long-term coastal protection.	• Restoration of salt marsh – conversion of low productivity farmland. Co-benefits for mangrove in the coastal community. • Will enable managed retreat and long-term coastal protection.	• Protecting seagrass from further decline.
Spatial scale	• Small scale: 25 ha of additional coastal habitat. • Harbour scale: 500 ha+ of additional coastal habitat e.g. Kaipara harbour.	• Small scale: 45 ha restored. • Catchment scale: e.g. coastal Kaituna catchment or Ōhiwa catchment (estimated total restorable area hydrologically available for saltmarsh migration with sea level rise of 0.6m: for Kaituna 592 ha and for Ōhiwa 252 ha (Crawshaw and Fox 2022)).	• 100 ha of seabed protected to allow for natural regeneration of existing seagrass.
Baseline condition / context	• Estuarine mudflats draining rural catchment. Existing mangrove community has been growing in past 10+ years. Natural / historical extent unknown. • Saltmarsh and seagrass in decline due to catchment activities and historical land conversion to agriculture. • Future scenario: gradual increase in total mangrove cover in some areas and coastal erosion in other areas. Saltmarsh in further decline where barriers are installed to protect farmland from sea level rise.	• Majority of area is low productivity pastural farmland. River estuaries drained 50-80 years ago by series of bunds and drains. • Future scenario is likely to continue to be low productivity farmland and coastal erosion and sea level rise / inundation. If additional barriers are installed to protect farmland this will create 'coastal squeeze' limiting the area available for coastal wetland habitat.	• Fragmented sea grass meadow in coastal estuary draining rural and semi-urban catchments. Natural / historical extent unknown. • Future scenario is ongoing decline in size of habitat and further fragmentation due to poor water quality, sedimentation and moorings-related damage.
Activities and interventions	• Enabling inland migration of mangrove and saltmarsh. • No supplemental planting. • Weed and pest control.	• Removing tidal bunds and drains allowing tidal and freshwater rewetting. Realigning and naturalising freshwater flows and reducing the ground height of some areas (earthworks required).	• Protection from further decline (avoided loss) through water quality and coastal development controls in RMA Plans. • Council-controlled sediment control structures (check dams) and nature-based

Hypothetical Scenario:	Scenario 1: Northland Mangrove, Saltmarsh and Seagrass A: Small Scale: 25 ha B: Harbour Scale: 500 ha+	Scenario 2: Bay of Plenty Salt Marsh and Mangrove A: Small Scale: 25 ha B: Catchment Scale: 500+	Scenario 3: Tasman or Nelson Seagrass and Saltmarsh
	• Increase in conservation status under Conservation Act on DoC land. • Small scale: 1 or 2 land holdings adjacent to each other. • Harbour scale: multiple land holdings of various sizes that may or may not be adjacent. Clustered / grouped together to measure and register carbon credits.	• Supplemental planting (moderate intensity) of diverse range of salt marsh species. • Weed and pest control. • Public access for recreation. • Small scale: 2 – 4 land holdings adjacent to each other. • Catchment scale: multiple land holdings of various sizes that may or may not be adjacent. Clustered / grouped together to measure and register carbon credits.	solutions upstream to control sediment discharges. Changes in land use rules and regulations to encourage more forestry in the catchment (native and exotic). • Voluntary water quality and sediment run off improvements working with catchment landowners. • Future reseeding trials (assume achievable within project timeline).
Proponent	• Small scale: Iwi and DoC • Harbour scale: Iwi proponent on behalf of multiple land owners.	• Small scale: Iwi and private land owners. • Catchment scale: regional council proponent on behalf of multiple land owners.	• Council and community trust.
Land tenure	• Land above and below mean high water springs (MHWS). • Small scale: Marine reserve below MHWS + DoC land + iwi land above MHWS. No ownership or customary claim below mean high water springs. • Harbour scale: Marine reserve below MHWS + DoC land + iwi land+ regional council land + private land owners above MHWS. No ownership or customary claim below MHWS.	• Land above and below MHWS. • Small scale: Private land ownership above MWHS. No ownership or customary claim below mean high water springs. • Catchment scale: iwi land+ regional council land + private land owners. Customary marine title claim below MHWS.	• Land below MHWS. • Private land in catchment above seagrass habitat.
Permanence mechanism to explore	• Scenario will explore protection under Conservation Act, Resource Management Act (RMA) and protection under Iwi kaitiakitanga principles.	• Scenario will explore protection under easements on land title and explore protection under customary marine title.	• Scenario will explore protections using contracts for carbon trading or other finance.

Hypothetical Scenario:	Scenario 1: Northland Mangrove, Saltmarsh and Seagrass A: Small Scale: 25 ha B: Harbour Scale: 500 ha+	Scenario 2: Bay of Plenty Salt Marsh and Mangrove A: Small Scale: 25 ha B: Catchment Scale: 500+	Scenario 3: Tasman or Nelson Seagrass and Saltmarsh
Carbon credit potential	• Small scale: low, high transaction costs for small scale and low carbon sequestration potential of vegetation and sediments. • Harbour scale: Moderate to high based on economies of scale and carbon sequestration potential of vegetation and sediments.	• Small scale: low, high transaction costs for small scale, low carbon sequestration potential of vegetation and sediments. • Moderate, based on assumed scale and carbon sequestration potential of salt marsh vegetation and sediments. • Potential for leakage if farming intensifies elsewhere, beyond baseline, because of retiring coastal land.	• Low, based on assumed scale, no reseeding of seagrass and slow pace of natural restoration.

Greenhouse gas inventories and nationally determined contributions

A greenhouse gas (GHG) inventory is a comprehensive listing of all human-induced GHG emissions and removals of a country party to the United Nations Framework Convention on Climate Change (UNFCCC, 2024b). In Aotearoa NZ, the inventory informs policy recommendations on climate change and is used to monitor progress towards the country's emissions reductions targets. Emissions and removals from five sectors are covered: Agriculture, Energy, Industrial Processes and Product Use, Land Use, Land-Use Change and Forestry ("LULUCF") and Waste (Ministry for the Environment, 2024a).

Nationally Determined Contributions, or 'NDCs,' are countries' self-defined national climate pledges under the Paris Agreement. Their main purpose is to detail each country's commitments towards delivering on the goals of the Paris Agreement, including the collective long-term goal of limiting global temperature rise to 'well below' 2°C, ideally to 1.5°C, above pre-industrial levels (UNDP, 2023). Countries also need to outline how they will adapt to climate impacts and ensure sufficient finance to support these efforts. Aotearoa NZ 's current NDC sets a headline target of a 50% reduction of **net emissions** below our **gross 2005** level by 2030, covering the period 2021-2030 (Ministry for the Environment, 2023a; UNFCCC, 2021).

Each NDC is required to be progressively ambitious over five-year cycles to achieve the Paris Agreement's long-term goals, which is measured through "stocktake" exercises conducted between NDC submissions. This is referred to as the 'ambitious cycle' (The Blue Carbon Initiative, 2023).

Most NDCs and GHG inventories (including Aotearoa NZ) include emissions and removals from forestlands but a few, albeit an increasing number, include emissions and removals from wetlands and even fewer from coastal wetlands analogous to blue carbon ecosystems. By including coastal wetlands into NDCs and GHG inventories, countries could improve monitoring and reporting on the condition of coastal wetland ecosystems, acknowledging their role in climate change mitigation and adaptation (Green *et al.* 2021).

Emissions and removals from coastal wetland ecosystems within Aotearoa NZ are not considered a key category in the context of continuous improvement of the national GHG Inventory. As such there is no obligation on Aotearoa NZ to include this category in the national GHG Inventory.

The key question that was investigated as part of this research topic was:

- What are the implications of including coastal wetlands in Aotearoa NZ's national GHG inventory and NDC?

1 Summary of key research findings

The key research findings for this topic are summarised here. Analysis and discussion of each finding are provided in the sub-sections below:

Finding 1.1: Developing specific, national data sets for activity data, spatial data and greenhouse gas emissions factors for coastal wetlands is critical in order to include coastal wetland blue carbon data in the Aotearoa NZ Greenhouse Gas Inventory and as a quantitative target in the Nationally Determined Contributions.

Finding 1.2: Blue carbon ecosystems have the potential to sequester more carbon per hectare than other nature based activities. Including coastal wetlands into the Aotearoa NZ Greenhouse Gas Inventory and the Nationally Determined Contributions will not have a significant impact on the country's net carbon emissions due to the comparatively small area available for restoration and protection. But it will elevate the visibility of blue carbon and have co-benefits for attracting investment in coastal restoration, nature based climate adaptation and recognition of the important role of these ecosystems domestically and internationally.

1.1 Finding 1.1: Developing specific, national data sets for activity data, spatial data and greenhouse gas emissions factors for coastal wetlands is critical in order to include coastal wetland blue carbon data in the Aotearoa NZ Greenhouse Gas Inventory and as a quantitative target in the Nationally Determined Contributions.

1.1.1 Aotearoa NZ's national GHG inventory

Elements of blue carbon, such as mangroves, are currently incorporated, to some extent, in Aotearoa NZ's GHG inventory within the vegetated wetland land subcategory (Figure 1.1). In the most recent GHG inventory (Ministry for the Environment, 2023a), both vegetated wetlands and open water were initially reported as sinks in 1990 but are now reported as a source of GHG in 2020. This shift is due to the disturbance or conversion of these ecosystems between 1990 to 2020.

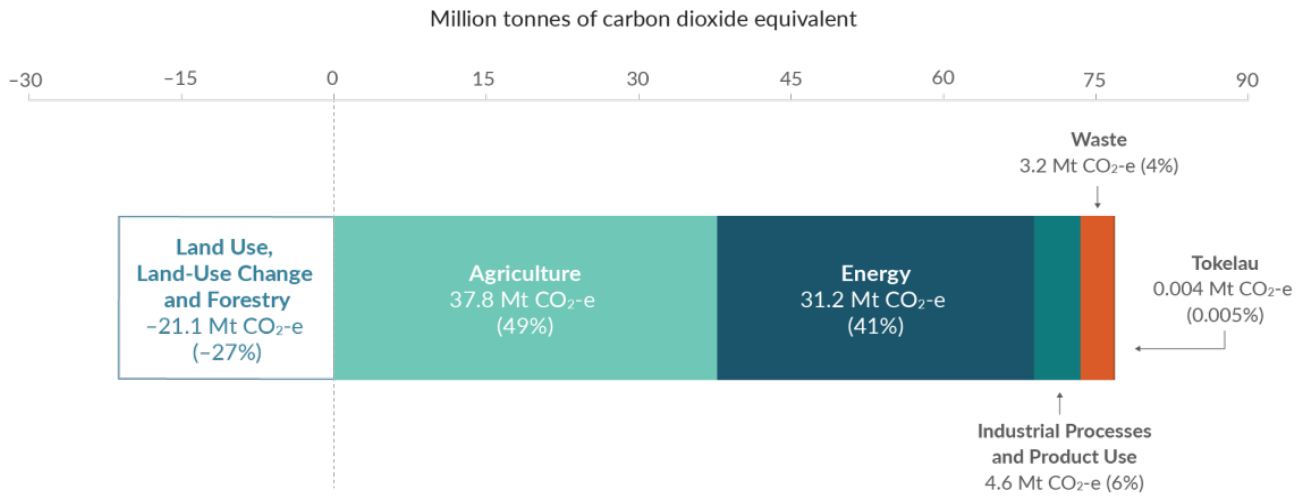

Figure 1.1 Breakdown of Aotearoa NZs emissions by sector in 2021. Net emissions from the LULUCF sector are expressed as a negative number because the sector removes more GHGs from the atmosphere than it emits (Ministry for the Environment, 2022).

Although it is strongly encouraged, Aotearoa NZ is not obligated to adopt the IPCC 2013 Wetlands Supplement guidelines for wetlands, which encompasses all blue carbon ecosystems. This is because emissions and removals from wetlands are not considered a key category. Key categories are identified using a pre-determined cumulative emissions threshold, where key categories are those that sum to 95% of the total level when summed together in descending order of magnitude (IPCC, 2006). A preliminary estimate of the blue carbon contribution to Aotearoa NZ's gross emissions is 0.16% (Ross *et al.* 2023), but due to the lack of existing data and challenges with delineating inland and coastal wetlands, further research is required to quantify the potential contribution of blue carbon in Aotearoa NZ.

Although coastal wetlands do have higher potential sequestration rates than terrestrial native forests the limited area available when compared to terrestrial native forests (approximately 1%) limits their potential to impact Aotearoa NZ's National GHG Inventory. Nevertheless, co-benefits of protecting and restoring blue carbon ecosystems exists and it is important to strive to better understand potential GHG emissions and removals from coastal ecosystems. To this end, the Ministry of Primary Industries lists 'Wetlands mapping - Inland and coastal delineation for wetlands' as key priority of research in their GHG Inventory Research Fund (Ministry for Primary Industries, 2023).

It is important to highlight that according to the IPCC GHG accounting guidelines, only tidal marshes, mangroves and seagrasses are currently recognised as actionable blue carbon ecosystems for mitigation efforts. While emerging blue carbon ecosystems, including macroalgae (kelp), benthic sediments and mud flats show potential for mitigation, significant scientific uncertainties currently prevent their inclusion in GHG accounting (The Blue Carbon Initiative, 2023).

Several countries are beginning to include or already have included coastal wetlands in their national inventories, including but not limited to: Australia, United States of America, Canada, Costa Rica, Indonesia and United Kingdom (Crooks, pers. comm. 2024). These countries are using the 2013 Wetlands Supplement and a mixture of Tier 1 (default values) and Tier 2 (country specific) data, depending on the resources such as funding and expertise

available. All of these countries have also included blue carbon in their NDCs[2] and some may be seeking to use the removals occurring in coastal wetlands to help achieve their national reduction targets and/or access finance for blue carbon projects.

Australia started to work on the inclusion of coastal wetlands in their national inventory in 2015 (Green *et al.* 2021). In their GHG inventory report from 2021 (National Inventory Report 2021, Volume 1), they:

- Include seagrass under the wetlands land use category in LULUCF. This accounts for emissions arising from the excavation of seagrass habitat due to capital dredging. They apply a seagrass excavation model using country-specific parameter values which are estimated from pooled data collected from the scientific literature and stratified by coastal region.
- Include mangroves and tidal marshes, where, at the spatial scale, a coastal vegetation layer, derived from the National Vegetation Information System Version 6.0 MVS, Major Vegetation Subgroups) and an intertidal extent model, was used to define the area of mangrove and tidal marsh. They report changes in mangroves under forest classifications, while net emissions from the loss of tidal marshes are reported under the wetlands land use category. Modelling of carbon dioxide emissions and removals (from changes in mangrove and loss in tidal marsh) is done by applying FullCAM, a spatially explicit Tier 3 modelling system calibrated, in this model, to mangrove ecosystems around Australia's coastal land area (FullCAM Wetlands – coastal sub-model).

For the next national inventory, improvements will be made to the FullCAM Wetlands – coastal sub-model. These will involve updates to spatial inputs for mangrove and tidal marsh extents, and to Australia's tidal extent, as these become available. Recently, a national saltmarsh map was developed (Australian Saltmarsh Map (saltmarshes.org)) and the mangrove mapping has also improved. Furthermore, a study by the Department of Climate Change, Energy, the Environment and Water and the Australian Bureau of Statistics developed Australia's first National Ocean Ecosystem Account ('the National Ocean Account') (Australian Bureau of Statistics, 2022). The National Ocean Account aims to support decision making about the sustainable use and management of blue carbon ecosystems that underpin Australian marine industries. This account could serve as a valuable resource for informing the development of the next national GHG inventory for Australia.

Lessons learnt from international literature on the challenges of including coastal wetlands in national inventories include (International Partnership for Blue Carbon; 2020):

- IPCC worksheets and reporting tables are not user friendly for coastal wetlands.
- Activity data can be difficult to obtain.
- Coordination between inventory teams with other government institutions responsible for providing data can be challenging.
- Aotearoa NZ recognises the potential contribution of coastal wetlands to climate change mitigation in our NDC (see below) and in the government's first Emissions Reduction Plan (Ministry for the Environment, 2022).

1.1.1.1 Gaps and challenges to do with incorporating coastal wetlands into the national inventory

Coastal wetland contributions have not been sufficiently investigated to be included in the national inventory at this stage. Only mangroves that are classified as part of vegetated wetlands are reported for completeness under the wetland category of Aotearoa NZ's GHG inventory. Aotearoa NZ's wetlands are currently mapped into two types: open water, which includes artificially flooded lands, lakes and rivers; and vegetated wetland, which includes herbaceous vegetation that is periodically flooded, and estuarine and tidal areas including mangroves. However, the current mapping approach treats vegetated wetlands as a single unit, lacking differentiation between various wetland that are likely to have different carbon stocks.

Other remaining challenges to incorporate coastal wetlands in the national inventory include:

- Accurately delineating coastland wetlands from inland wetlands in the satellite imagery used for the national reporting (MfE, pers. comm. 2024), yet this separation is needed to meet reporting requirements. To this end, Manaaki Whenua – Landcare Research prepared a report for MfE in 2022, presenting an approach for delineating coastal wetlands from inland wetlands within the area mapped as vegetated non forest wetlands by the Land Use Map (Easdale, 2022). However, they did not reach a definitive solution for delineation because

[2] Most blue carbon coastal wetland commitments currently included in NDCs are not expressed as quantitative emission reduction/mitigation targets. Instead, there are mostly captured within the adaptation sections as area-based commitments to protect, restore and/or manage ecosystem extent. This reflects an acknowledgment that many countries are still developing the frameworks and capacities to measure, manage, and monitor emission fluxes in blue carbon ecosystems.

their approach misclassified areas mapped as saline herbaceous vegetation and freshwater wetland vegetation. More research is needed to develop a robust method to delineate coastal from inland wetland – taking into account the findings from their report and potentially investigate using also globally available products such as maps of wetlands reported under the Ramsar convention[3] to assist with sub-categorisation. It is noted that areas of seagrass meadows were outside the scope of their report and it was recommended to consider seagrass meadows in any further work to refine the coastal/inland wetland delineation.

- The mapping for inventory purposes only extends to the terrestrial boundary of the country (MfE, pers. comm. 2024). To fully implement the IPCC 2013 Wetlands Supplement, this boundary would need to be expanded to include areas of tidal marshes, and seagrasses. Guidelines exist but expanding a country's reporting boundary would require historical back calculation of all annual GHG inventories as per the IPCC good practice guidelines.
- Aotearoa NZ specific data to quantify blue carbon stocks and sequestration rates are currently limited (Ross *et al.* 2023). More research is required to assess how these values differ across various habitats, environments, and locations throughout the country, which is essential for robust estimates of the blue carbon potential. While the paucity of country specific emissions factors prevents IPCC Tier 2 reporting for blue carbon, IPCC default values can be used as a first step to reporting blue carbon in the national inventories. However, a pre-requisite for that are reliable activity data (such as areas of coastal mangrove, seagrasses and tidal marshes) which is currently challenging to be obtained for Aotearoa NZ.
- Aotearoa NZ needs to clarify when mangroves meet the forest definition within Aotearoa NZ and therefore would need to count towards the forest category (according to the IPCC guidelines). Specifically, the inventory report states that: "The vegetated wetland category includes areas of forest that are part of the wetland ecosystem. Where the forest area has been judged to be part of the wetland ecosystem, it has been classed as vegetated wetland" (Ministry for the Environment, 2023a). However, it is not clear weather mangrove that meets the forest definition is counted toward vegetation wetland or forest category.

1.1.1.2 Current projects to reduce the gaps

Several national-scale projects are currently underway that might deliver valuable spatial outputs and sequestration estimates that are going to help in advancing Aotearoa NZ's understanding of coastal wetland sequestration potential and mapping, including:

- The 'Quantifying Carbon Sequestration and GHG Emissions' project, funded by the Ministry of Business, Innovation and Employment Endeavour Smart Ideas project, will produce GIS layers of restoration potential and use the coastal wetland accounting model (Blue Carbon Accounting Model 'BlueCAM') methodology to estimate the total (and regional council specific) carbon sequestration potential that could be obtained from restoration while accounting for sea level rise (Bulmer *et al.* 2024).
- Various projects collecting field data (e.g. sediment cores), quantifying carbon stocks to better understand and estimate carbon sequestration rates of saltmarsh and mangroves. More detail on these projects can be found in (Kettles *et al.* 2024).

Section 5 provides an overview and compelling case to conduct a series of pilot studies to assess the opportunities and challenges of developing a blue carbon project in Aotearoa NZ. At the same time, any pilot coastal wetland project offers an opportunity to develop a blue carbon methodology that aligns with the 2013 Supplement to the 2006 IPCC Guidelines for National GHG Inventories: Wetlands (IPCC, 2014), offering not only benefits for projects, but also a proof-of concept for incorporating coastal wetland into the national GHG inventory by demonstrating the processes for e.g. gathering activity data, such as accurately determining the area of coastal wetland and determine sequestration rates specific to the ecosystem using field data. (more details are provided in Section 5).

1.1.2 Nationally Determined Contributions

Countries with coastal wetlands can acknowledge the potential contribution these ecosystems have in achieving both the mitigation and adaptation objectives outlined in their NDCs. These benefits are supplementary and supportive, rather than serving as a replacement, to the crucial imperative for countries to decarbonise sectors like energy and transportation.

Protecting, restoring and conserving coastal blue carbon ecosystems is particularly effective to mitigate climate change and coastal and marine nature-based solutions can be an important part of countries' mitigation strategies to meet the goals of the Paris Agreement.

[3] https://rsis.ramsar.org/ris-search/?f%5b0%5d=regionCountry_en_ss%3ANew+Zealand&pagetab=1

The number of NDCs now recognising coastal wetlands in relation to their mitigation and adaptation potential has increased since the first round of NDC submissions in 2016 (NDC Partnership, 2019), which can be attributed to several factors including:

- The Wetlands Supplement has only been available since 2013. While challenges remain to implement these, countries that apply them are sharing their insights and thereby facilitating the adoption process for others.
- The challenges the global community are facing due to climate change are intensifying, and blue carbon ecosystems have a high potential of carbon sequestration, which leads to a growing interest in blue carbon as a climate solution (NDC Partnership, 2019).
- The science around coastal and ocean systems and their relevance for climate change mitigation and adaptation has improved considerably in recent years (World Bank, 2023).
- Enhancement of the ambition of the country's NDC by including nature-based solution (NDC Partnership, 2023).
- Increasing number of land sector remote sensing products becoming available, with more satellite images being freely available.

Out of 148 countries that have submitted their new or updated NDCs, as of 01 October 2023, 97 have included coastal and marine nature-based solutions (Lecerf, M. *et al.* 2023). Among these, 61 countries included coastal and marine nature-based solution for both mitigation and adaptation purposes, 1 for mitigation only and 35 for adaptation only, including Australia who are focusing on protecting marine areas and/or other effective area-based conservation measures "OECM" Australia's NDC states that they are applying nationally appropriate methods consistent with the IPCC 2006 Guidelines and informed inter alia by the IPCC 2019 Refinement and IPCC 2013 Wetlands Supplement. However, the NDC lacks clarity regarding Australia's approach to accounting for coastal wetlands and the specifics of protection and restoration activities solely from its contents. Given that Australia have also included blue carbon in their national GHG inventory, and they have a net emissions reductions target, any sequestration achieved by the enhancement of blue carbon ecosystems (ecosystems that are part of the inventory) will therefore be reflected in progress towards their NDC. The UK and USA included coastal and marine nature-based solutions for mitigation and adaptation in their NDCs.

Most blue carbon coastal wetland commitments currently included in NDCs are not expressed as quantitative emission reduction/mitigation targets (NDC Partnership, 2023). Instead, there are mostly captured within the adaptation sections as area-based commitments to protect, restore and/or manage ecosystem extent (Lecerf, M. *et al.* 2023). This reflects acknowledgment that many countries are still developing the frameworks and capacities to measure, manage, and monitor emission fluxes in blue carbon ecosystems (NDC Partnership, 2023). If a country has included blue carbon in their national GHG inventory and they have a net NDC target which covers all sectors then emissions or sequestration occurring in these ecosystems will be included in their inventory and NDC reporting, regardless of whether blue carbon is specifically mentioned within their NDC submission or not.

Despite Aotearoa NZ having a large coastline, Aotearoa NZ did not include coastal and marine nature-based solutions in their updated NDC. However, Aotearoa NZ acknowledged that coastal and marine ecosystems are actionable and important to mitigation and adaptation measures, and expressed their intention to integrate blue carbon ecosystems into their national GHG inventories - applying the IPCC guidance by stating:

"New Zealand looks forward to giving future consideration to methodologies introduced by the 2013 IPCC Wetlands Supplement and the 2019 Refinement to the 2006 IPCC Guidelines." (UNFCCC, 2021)

Considering the diverse array of mechanisms for incorporating coastal wetlands into NDCs, alongside the varying approaches, capacities, and data availability across nations, The Blue Carbon Initiative (2023) provides guidance on integrating coastal wetland ecosystems into NDCs and outlines a "tiered approach" for the inclusion of coastal wetlands in NDCs.

1.2 Finding 1.2: Blue carbon ecosystems have the potential to sequester more carbon per hectare than other nature-based activities. Including coastal wetlands into the Aotearoa NZ Greenhouse Gas Inventory and the Nationally Determined Contributions will not have a significant impact on the country's net carbon emissions due to the comparatively small area available for restoration and protection. But it will elevate the visibility of blue carbon and have co-benefits for attracting investment in coastal restoration, nature-based climate adaptation and recognition of the important role of these ecosystems domestically and internationally.

The Climate Change Commission strongly emphasised the importance of prioritising emissions reductions at the source in Aotearoa NZ, before seeking to remove carbon dioxide via forests or other approaches such as blue carbon ecosystems (Kremmer, pers. comm. 2024). However, blue carbon ecosystems, such as coastal wetlands, are facing imminent threats from rising sea levels and extreme weather events, highlighting the urgency of protecting and restoring these vital habitats. Furthermore, there are opportunities and positive implications if coastal wetlands are included in Aotearoa NZ's GHG inventory and NDC, including:

- Incorporating coastal wetlands will result in a more complete inventory, including a more accurate representations of the countries carbon emissions and sinks.
- The conservation and sustainable use of coastal and marine ecosystems would be promoted and Aotearoa NZ can lead by example and offer valuable insights for the broader Pacific region.
- Stimulating the development of robust and bespoke blue carbon methodologies that are applicable to Aotearoa NZ's coastal environment for measuring, reporting and verifying carbon stocks in coastal wetlands. This could potentially lead to increase investment in scientific research and data collection efforts to improve our understanding of blue carbon ecosystems and their carbon sequestration potential.
- Stimulating the development of policies and regulations aimed at incentivising the conservation and restoration of coastal wetlands.
- Signalling to the carbon markets and investors the importance of coastal ecosystem conservation and restoration for achieving climate goals and thereby, creating new opportunities in carbon markets for credits generated from blue carbon projects. Furthermore, high-quality nature-based carbon credits can be a powerful tool for driving climate mitigation and resilience through the conservation and restoration of nature (The Blue Carbon Initiative, 2023).
- Developing a national spatial database for coastal wetland ecosystems would have benefits beyond the GHG inventory, NDCs and carbon markets. Coastal wetland mapping would assist regional and national biodiversity management, climate risk and adaptation planning, coastal land use and marine area spatial planning and policies, customary use mapping etc.
- Incentivise the protection and restoration of coastal wetland, which in turn provides mitigation and adaptation benefits. The detailed mitigation and adaptation benefits of protecting and restoring blue carbon ecosystems has been discussed in detail in various reports and research papers, e.g. (Hocart et al. 2019, Duate et al. 2013).

The risks and challenges to consider when including coastal wetlands into Aotearoa NZ's inventory and/or NDC include:

- Inaccuracies due to the lack of adequate data, undermining the credibility of the GHG inventories and NDC targets. Inaccurate or incomplete data could lead to overestimation or underestimation of blue carbon contributions to climate change mitigation, affecting the credibility of Aotearoa NZ's NDC commitments.
- Risk of under- and overestimating sequestration rates if not properly accounted for. There are several factors that affect carbon stock changes in coastal ecosystems such as disturbance events and natural variability, leading to uncertainties in estimation that can introduce additional uncertainty in the national inventory.
- Financial and resource constrains: Implementing blue carbon into the national inventory (and the required data preparation and calculation of carbon sequestration estimates) requires time, financial resources, technical expertise, and institutional capacity and limiting funding as well as competing priorities might hinder the effective integration.

This finding is in alignment with the Climate Change Commission's advice (Climate Change Commission, 2021). While recognising the climate benefits of marine protection in helping to maintain stores of carbon in marine environments such as sea grasses, salt marshes and marine sediment, their conclusion was that there is currently limited information on the potential scale of carbon removals, the permanence of carbon removals, and policies to incentivise and account for those carbon removals from coastal ecosystems. Robust measurement and monitoring frameworks are required to include this option in emissions budgets.

Including coastal wetlands in the NZ GHG inventory has a minor impact on net carbon emissions. However, their inclusion could be beneficial for regional emissions inventories in areas with available coastal wetlands. Further investigation into the scale and potential of regional inventories was not conducted in this study, as it was beyond the scope.

1.3 Conclusions and recommendations

Despite their small contribution to the emissions budget, including coastal wetlands in the inventory will not only lead to a more complete inventory, it will formally recognise this important ecosystem, lead to increased and

improved data related to these ecosystems and also provide various co-benefits. Additionally, it creates incentives for protecting and restoring coastal wetland ecosystems. However, it is important to note that Aotearoa NZ's GHG inventory will require recalculation to maintain consistency throughout the reported inventory timeseries (1990 – 2022) if coastal wetlands are included.

Green *et al.* (2021) provides guidance on integrating coastal wetland ecosystems into national GHG inventories and outlines a framework that could be adopted by Aotearoa NZ to include coastal wetlands in their inventory. The recommended key steps for Aotearoa NZ to follow include:

1.3.1 Subdividing coastal and inland land cover classes

Countries need to develop a nationally appropriate definition of coastal wetland and its boundaries (e.g. distance from the coast), taking into account national circumstances and capabilities, and to apply that definition consistently both nationwide and over time. The IPCC Wetlands Supplement (IPCC, 2014) provides direction for delineating coastal land.

Aotearoa NZ's vegetated wetlands are identified using the 'vegetated non forest wetland' class of the Land Use Map (LUM), which encompasses various coastal and inland ecosystems. The Land Cover Data Base (LCDB) offers spatial data on vegetation cover nationwide and can be used to subdivide the vegetated non forest wetlands land use class into different types of wetland vegetation. However, both the LUM and the LCDB do not explicitly map coastal ecosystems separately from inland ecosystems. This separation is needed to meet reporting requirements and include coastal wetlands in the national GHG inventory. Easdale (2022) has prepared a method to distinguish coastal wetlands from inland wetlands using a combination of elevation and distance from the coastline. Further refinement is needed to ensure its reliability and suitability. Nonetheless, progress has been made in developing an approach to differentiate coastal from inland wetlands, a crucial initial step toward incorporating coastal wetlands into the national GHG inventory.

1.3.2 Stratification

Once coastal wetland areas have been identified and quantified, it is necessary to consider the capacity and need for further stratification. Stratification is the process of disaggregating a land-use category such as coastal wetland into logical, typically homogenous subdivisions (e.g. mangrove ecosystem). Stratification can reduce uncertainty and improve efficiencies in producing emissions/removals estimates. According to the IPCC 2013 Wetland Supplement, all land use classes should undergo stratification based on climate regions and major vegetation or soil types, using either default or country-specific classifications. Coastal wetland ecosystems are naturally stratified based on factors such as geographical location, climate conditions, floristic and species composition, and level of tidal inundation. The size and number of strata should aim to balance desired accuracy, required time, and available resources for Aotearoa NZ to compile its national inventory. The 2013 Wetlands Supplement classifies mangroves and provides their default emissions factor for tropical wet, tropical dry, and subtropical regions reflecting differences in their above-ground biomass. Stratifying land-use categories based on climate domains can be achieved using overlays of land-use on appropriate climate and soil maps.

It is recommended that stratification be carried out such that the criteria used to define the strata are related to the variable being measured (Espejo *et al.* 2020). In the context of coastal wetland ecosystems this could be related to ecosystems, carbon pools, or specific activities. Stratification needs to be consistently applied across the entire time series.

1.3.3 Changes and Disturbances

Changes and disturbances in coastal wetlands represent activity data in the AFOLU sector of the national inventory. Monitoring land-use changes and disturbances involves monitoring the land surface between two time periods, either using field measurements or sample data combined with maps. Aotearoa NZ also has remote sensing systems available which can be used for land change mapping, to generate activity data. While Aotearoa NZ is not yet in a position to map changes in coastal wetland nationwide, with the availability of new satellite imagery, new technology, and machine learning approaches, Aotearoa NZ may be able to robustly monitor any changes to coast wetlands in the future and thereby estimate the future sequestration potential of coastal wetlands. Several case studies took place in Aotearoa NZ to develop methods of mapping wetlands and their changes (Pattle Delamore Partners, nd; Lawrence, 2015) and a more recent study (Raj & Pasfield-Neofitou, 2024) present a method to assess coastal wetland changes in the Pacific Island region.

Once sophisticated methods are developed for identifying and quantifying coastal wetlands in Aotearoa NZ and for assessing changes and disturbances to these ecosystems, **the country can use the basic Tier 1 method to include coastal wetlands in its inventory for the first time**. This approach allows for gradual refinement of inventory

methodologies. The 2013 Wetlands Supplement provides Tier 1 default values for variables that are required to generate estimates from coastal wetland ecosystems or in the context of reporting as coastal wetland activities. Tier 1 is considered to have higher uncertainties due to its reliance on simple models and default emission factors. To reduce uncertainty, Aotearoa NZ can transition to a Tier 2 approach when specific national factors become available, replacing the default values with more accurate data. When adopting national specific data to generate estimates, the IPCC states that it is good practice to assess existing data.

National data sources from various government agencies, non-government organisations, and research institutions may be available to estimate emissions from activities in coastal wetlands. These sources may include surveying and mapping data, as well as measurements of ecosystem carbon stocks and GHG emissions to determine emission factors. For improving national data, the blue carbon manual (UNEP, 2014) provides useful data collection advice for assessing carbon stocks in mangroves, tidal marshes, and seagrass meadows.

Aotearoa NZ requires site-specific carbon sequestration rates and GHG emissions factors for different salt marsh, mangrove, and seagrass habitats and environmental parameters nationwide (Weaver *et al.* 2022) to refine default sequestration numbers for coastal wetland ecosystems. Improving monitoring of coastal wetlands and conducting field measurements will complement available satellite imagery and further enhance data accuracy and reliability.

Overall, inventory methods can be gradually refined, by incorporating site-specific data once available to improve the accuracy of emissions estimates from coastal wetlands in Aotearoa NZ.

Carbon markets and carbon trading

Carbon markets are trading systems in which carbon credits are bought and sold. They consist of carbon credits that represent avoided emissions or removed carbon (or its equivalent) from the atmosphere. A carbon credit is a tradable unit representing a tonne of carbon dioxide equivalent or tCO_2e. Carbon credits aim to act as a financial incentive for companies and organisations to invest in emission reduction projects and technologies.

There are broadly two types of carbon markets: compliance (regulatory) and voluntary.

- **Compliance markets** are created as a result of any national, regional and/or international policy or regulatory requirement (such as the NZ Emissions Trading Scheme (ETS) which is informed by a target that aims for GHG emissions to be 50% below 2005 levels by 2030 (Ministry for the Environment, 2023a). These markets seek to have emitters purchase compliance units to compensate for some or all of their emissions.
- **Voluntary carbon markets (VCMs)** can operate at the national or international level. Voluntary markets refer to the issuance, buying and selling of voluntary carbon credits, to 'offset' emissions and make marketing claims. These voluntary programmes (such as Verra (2024) GoldStandard (2024)) have set methodologies and reporting requirements, and allow for wider access of credit sales and purchases outside of more limited regulatory markets.

Whilst the compliance and voluntary markets fundamentally do the same thing, i.e. issues credits to offset emissions, the primary difference is the obligation or legal requirement. Also, the voluntary market allows for wider access of credit sales and purchases outside of more limited regulatory markets.

Where emitters are forced to purchase carbon credits in a compliance market, a high carbon credit price should encourage these agents to seek to reduce emissions, and thus avoid the cost of purchasing carbon credits. It is a measure by which address the costs to the environment and internalise the environmental externalities of production and economic activity more generally. While in voluntary schemes, it might be expected that the criticality of managing cardon credit costs as compared to investment in emission reduction activities is not as strongly defined. Emitters seek to lower costs, so when compulsory, they will seek the most cost effective method to lower these emission, which will include emission reduction activity itself if the carbon price is higher. For voluntary actors, there may be flexibility in the level of investment in carbon credits. Although still very important, the cost of carbon credits themselves may not be as important as in the compliance market, unless too high, then then take will be constrained. The type, quality and impact of the carbon credit itself remain important in the voluntary market. In this example there may be a market for 'premium' high-ecological impact carbon credits, such as might be presented in the case of blue-carbon credits.

One difference between compliance units and voluntary carbon credits is that voluntary carbon credits must demonstrate they meet integrity principles, such as through ICVCM, and to ensure claims made using voluntary credits to offset emissions are real, while compliance units are established by the scheme. The compulsory regulatory scheme accepts that carbon credits purchased under the respective scheme meets the necessary integrity principles. It also means that to meet an accepted international standard and accreditation, the carbon credits established under the compulsory scheme will need to be maintained and managed in line with accreditation requirements.

VCMs work like any other financial market – the price of credits is set by projects who list them on trading exchanges (or via direct sales) and is primarily driven by supply and demand.

Key questions that were investigated as part of this research topic include:

- What is the demand for blue carbon credits in Aotearoa NZ, and who would the potential buyers be?
- What are the strengths and weaknesses of incorporating blue carbon into the ETS, or in a voluntary market in Aotearoa NZ?
- How would the introduction of blue carbon credits impact the overall market dynamics, pricing, and demand for carbon offsets in Aotearoa NZ?

2 Summary of key research findings

The key research findings for this topic are summarised here. Analysis and discussion of each finding are provided in the sub-sections below:

Finding 2.1: Weaknesses in the ETS, such as the price controls, risk of oversupply of New Zealand Units and lack of accountability of co-benefits, indicate that blue carbon may not receive price premiums to make the projects financially feasible. Blue carbon projects are more likely to be scalable and financially feasible in a voluntary carbon market where buyers are more discerning with an interest in integrity principles, measurable co-benefit outcomes and where carbon prices have the potential to be higher.

Finding 2.2: Voluntary blue carbon markets are nascent, with only 14 projects globally active and creating credits. Recent market activity indicates that there is potential demand for Aotearoa NZ blue carbon credits from domestic and offshore buyers. (Global demand for all voluntary carbon credits is approximately $1b with an estimated growth multiplier of 100 by 2050, (Claes *et al*., 2022)).

2.1 Finding 2.1: Weaknesses in the ETS, such as the price controls, risk of oversupply of New Zealand Units and lack of accountability of co-benefits, indicate that blue carbon may not receive price premiums to make the projects financially feasible. Blue carbon projects are more likely to be scalable and financially feasible in a voluntary carbon market where buyers are more discerning with an interest in integrity principles, measurable co-benefit outcomes and where carbon prices have the potential to be higher.

Blue carbon is likely to better adapted to the VCM, as compared to the ETS. Reasons for this include issues with the ETS itself, as well as the opportunities afforded by the scale and 'premium' carbon unit potential of blue carbon. The sections below outline the analysis and rationale for this finding.

2.1.1 Aotearoa NZ's Emissions Trading Scheme

Aotearoa NZ's ETS is set up under the Climate Change Response Act 2002 and is the Government's main tool for reducing GHG emissions and meeting our domestic and international climate change targets, including the 2050 target and emissions budgets for Aotearoa NZ. The ETS is a domestic compliance market. It requires entities covered under the scheme to measure and report their GHG emissions and surrender one emissions unit (NZU, equivalent to $1TCO_2e$) to the government for every tonne of CO_2e they emit. The ETS is a trading market that has a limited number of NZUs, which the government purchases and auctions off quarterly. The prices of NZU are controlled by the government within these auctions, and the methods of control and the consequences have been critiqued by the Climate Change Commission and others as not optimising emissions reduction (Climate Change Commission, 2023). Most of the trading occurs on a secondary market and the price in the secondary market is driven by supply and demand.

The NZ ETS covers all sectors of the economy, excluding agriculture which has a reporting obligation only (i.e. no obligation to obtain and surrender NZUs). Forestry participation is voluntary, and it is the only sector which can generate NZUs. NZUs are generated from the establishment of permanent or plantation forests on lands that were not in forest on the 31st December 1989.

The Climate Change Commission supports further research and investigation of nature-based solutions such as coastal blue carbon and their carbon removal opportunities and recommends that methods be developed for tracking emissions and removals by sources and sinks not yet included in target accounting (Climate Change Commission, 2023). However, they do caution the inclusion of nature-based solutions in the Aotearoa NZ ETS due to its complexity and the potential for unintended consequences. Key reasons for this caution include:

- The sole carbon focus of the ETS. The ETS does not incorporate assessment of the Integrity Council for the Voluntary Carbon Market (ICVCM)'s Core Carbon Principles (refer Section 5.3.1) or co-benefits such as biodiversity, resilience, or community benefits (refer Section 6.1). As outlined in Section 2.2), the carbon credit market in Aotearoa NZ is experiencing market shifts toward nature-based carbon credits that meet the ICVCM standard, rather than the sole carbon focus of the ETS.
- Concerns about the surplus of carbon credits in the system from forestry and as a result of the decarbonisation of NZ Steel and broader issues with the current ETS settings and domestic compliance market (Farmers Weekly, 2024).

2.1.2 Voluntary carbon markets

VCM refer to the issuance, buying and selling of voluntary carbon credits, to compensate for voluntary GHG reduction claims and hard to abate emissions as part of the net zero transition, outside of compliance markets such as the ETS. In VCM, credits are issued and certified against criteria established by carbon crediting programmes, also known as "carbon standards". These standards are rules and requirements defined by private standard organisations – typically international Non-Governmental Organisations – who outline the methodologies and procedures for verification, validation, and monitoring that developers of VCM projects must adhere to certify that their activities measurably reduce, remove or avoid GHG emissions. VCM projects must demonstrate they are: Real, Measurable, Permanent, Additional, Independently Verified and Unique to generate voluntary carbon credits.

To ensure that voluntary carbon credits reflect these principles, the ICVCM has established a set of Core Carbon Principles and Assessment Frameworks (ICVCM, n.d.) (refer Section 5.3). In November 2023, ICVCM started assessments of Carbon-Crediting Programs and Credit Categories against the Core Carbon Principles.

The Verified Carbon Standard (VCS, managed by Verra) is by far the largest standard (refer Section 2.2.2). Within Aotearoa NZ one project, Rarakau Rain Forest Project, was registered with Plan Vivo in 2019 and has issued 16,589 carbon credits to date (Plan Vivo n.d.). Aotearoa NZ companies/businesses that wish to make voluntary climate claims currently rely on offshore-sourced credits.

Incorporating blue carbon projects into a voluntary market offers an alternative to the ETS for generating income, particularly if there is potential to benefit from the important co-benefits of conservation and restoration of coastal wetlands. Unless Aotearoa NZ develops a domestic voluntary carbon programme that meets the ICVCM Core Carbon Principles, blue carbon projects would need to be developed and registered with entities such as Verra (more detail on Verra and other carbon credits schemes is provided in Section Blue carbon schemes and methodologies). Credits can be traded domestically and potentially internationally if they are not part of the GHG inventory and NDC claims. However, voluntary carbon projects can be expensive with relatively high set-up, implementation, monitoring, verification and reporting costs to ensure compliance with international verification schemes. Within Aotearoa NZ, the scale of potential blue carbon projects can be small which in turn will make transactions cost to revenue disproportionately high. As a result, it is likely that the return on credits will not cover the implementation and running costs of a voluntary carbon project, and complementary funding will be required.

2.1.3 Comparison of opportunities and barriers of entering blue carbon in the ETS or VCM

Table 2.1 provides an analysis of the opportunities and barriers of entering blue carbon into the ETS or VCM. Given the complexity and weaknesses, there are several barriers to overcome if blue carbon is to become part of the ETS in the short-term. Conversely, there are a range of opportunities associated with incorporating blue carbon into the VCM, particularly related to integration of the ICVCM Core Carbon Principles and other high quality carbon principles.

Appendix B contains further analysis on the implications entering blue carbon into the ETS or VCM.

Table 2.1 Opportunities and barriers of entering blue carbon into the ETS or VCM

Market	Opportunities	Challenges and Risks
ETS	• Opportunity to broaden the nature-based sequestration beyond forestry. • Verification costs could be lower if a simple carbon method is developed, which could lower transaction costs for project proponents. • Lower establishment and monitoring costs with a simplified carbon method may assist in scalability. • Adding a new NZU to an existing system may be more cost effective to the government compared to setting up an entirely new and parallel regulatory framework and methods for a VCM. • Price signals can be more stable from the ETS than a voluntary market and are quite high compared to VCS currently.	• At present NZU generation is limited only to sequestration through terrestrial afforestation. A specific coastal wetland carbon method would need to be developed. • The ETS solely focuses on carbon reduction and does not account for co-benefits such a biodiversity, resilience or community benefits. As discussed in Section 5.3 and Section 6.1, consideration of these are fundamental to maximising the co-benefits, avoiding perverse outcomes and are aligned with international integrity principles. Trading in the ETS could lead to perverse outcomes where important co-benefits are weakened in order to maximise carbon storage and sequestration. • There may already be an oversupply of units in the ETS system from forestry (Farmers Weekly, 2024)

Market	Opportunities	Challenges and Risks
	• Landowners might find ETS projects would be easier to implement and manage than VCS. Given time and resource constraints for farmer and other property managers facing other land management pressures.	and broader issues with the current ETS settings and domestic compliance market. • Data gaps and limitation would need to be addressed for blue carbon to be incorporated into the ETS. • Changes to the market and carbon methodologies are required to enable blue carbon credits to be recognised as NZU. • Governance of the sequestration is currently administered by the Ministry of Primary Industries, making expansion into other nature-based solutions complex where management control extends beyond the Ministry's responsibility. Multi-agency administration for NZU production may lead to increased complexity, uncertainty and / or increased transaction costs. • NZUs should only be traded among businesses participating in the NZ ETS – NZUs should not be sold internationally, nor to corporates wanting to make a voluntary offset claim.
VCM	• Internationally there has been an increase supply to meet demand for blue carbon. The potential exists for Aotearoa NZ-located blue carbon to contribute to the supply. VCM are one avenue to manage this outcome. • Verification through Verra (or other international VCM entities) would enable integration of the ICVCM Core Carbon Principles and other high quality carbon principles. • There is potential to establish a 'premium' carbon market sector – underpinned by blue carbon – that will be attractive to firms wishing to invest in biodiversity, resilience or community enhancements as well as carbon offsets. • Aotearoa NZ-based blue carbon projects could be sought after beyond the domestic market (refer Section 2.2).	• Voluntary carbon projects can be expensive with high set-up, implementation, monitoring, verification and reporting costs to meet high quality standards. • Government would need to create an enabling environment for the voluntary market to operate in Aotearoa NZ by endorsing best practice guidance relating to high integrity, benefit sharing and equitable approaches and clarity with regard to Article 6 to prevent double counting. Consideration of how the regulatory framework would work, including best-practice guidelines, the potential for a NZ specific VCM, and the relationship of projects to Article 6, requires further investigation. • The VCM market prices are influenced by supply and demand, and therefore potentially less predictable than the ETS where price signals are more stable.

In addition, with consideration of Article 6, there may be further opportunities Article 6 may bring to VCM and regulated markets (Granziera *et al.* 2023).

Article 6 of the Paris Agreement

In support of the Paris Agreement goals, Article 6 introduces new models for market-based cooperation. This relates to the voluntary carbon market through the establishment of new accounting rules and processes to ensure the integrity of credits used towards offset claims. The Nature Conservancy has a very comprehensive explainer of the impact of Article 6 on carbon markets and what they mean for National Determined Contributions, nature and the voluntary carbon market. Of relevance is the following text and image:

"Article 6 does not directly regulate the VCM and it is expected that voluntary transactions will continue to exist in parallel to Article 6 cooperation between countries. The expectation is that not much clarity regarding voluntary claims will come out of the negotiations. However, outside of the negotiations, some countries might choose to regulate the VCM or restrict carbon exports, which might affect projects on the ground. In addition, corporate demand could drive the market towards credits with corresponding adjustments by standards like Verra and Gold Standard, and guidelines like the ICVCM if they require a corresponding adjustment for offsets".

Clarity around these issues from the Government of Aotearoa New Zealand will enhance the enabling environment for voluntary Blue Carbon Projects.

2.2 Finding 2.2: Voluntary blue carbon markets are nascent, with only 14 projects globally active and creating credits. Recent market activity indicates that there is potential demand for Aotearoa NZ blue carbon credits from domestic and offshore buyers. (Global demand for all voluntary carbon credits is approximately $1b with an estimated growth multiplier of 100 by 2050, Claes et al. 2022).

Blue carbon market influences and dynamics were explored, including investigation of the:

- Demand for blue carbon credits and size of the domestic compliance market and VCM in Aotearoa NZ
- Current market shifts toward nature-based carbon credits that meet the ICVCM standard
- blue carbon project establishment costs
- Market impacts of domestic or international sale of blue carbon Credits

2.2.1 Demand and size of the blue carbon credit market

Demand for blue carbon in Aotearoa can be anticipated to increase, based on investigation of global trends over the past few years. Internationally, the supply and take up of blue carbon has been increasing. In 2022, the supply of blue carbon credits increased by 90% to over three million credits. The recent surge of retirements was due to the Delta Blue Carbon Project in Pakistan (restoration of mangroves) traded in the VCM[4] and its recent sale of 250,000 credits, auctioned at a price of US$27.80 (NZ$46) per tonne (DGB Group, 2022).

Claes *et al.* (2022) values the global carbon market for CO_2 at $US851b in 2021 and $1b of that was on the VCM. Whilst the data in the literature around the size of the 'Nature-Based Biodiversity Enhanced' Credits within the VCM is patchy, it is estimated by this team that the proportion of 'Nature-Based Biodiversity Enhanced' Credits is equivalent to approximately 10% of the VCM. In other words, a very small part of the current VCM is carbon credits from nature-based solutions. Claes *et al.* (2022) estimate a growth multiplier of 100 for the VCM by 2050, indicating strong demand for nature-based solutions as part of that growth.

2.2.2 Market shifts toward nature-based carbon credits in Aotearoa NZ that meet the ICVCM standard

The ICVCM is a governance body established to set and enforce global standards for the VCM. It aims to overcome the fragmentation and lack of transparency that currently hinders the VCM (ICVCM, n.d. a). To achieve these aims, the ICVCM has established 10 Core Carbon Principles that will act as a global benchmark for a high-quality carbon credit by establishing a consistent and standardised guide to assess the quality of carbon credits (ICVCM, n.d.). These are discussed in detail in Section 5.3.

At the end of 2023, Toitū Envirocare, a leading NZ carbon reduction and environmental programmes management firm, announced that they would be transitioning away from purchasing and retiring NZUs for their clients, to align

[4] Verra and Climate, Community and Biodiversity

with the ICVCM core carbon principles and global standards. Units that have been issued under the PFSI (Permanent Forest Sinks Initiative) and PP89 (Permanent Post 1989 Forest category of the ETS) will no longer be accepted for offsetting in the Toitū carbon certification programmes. Toitū said that this a strategic shift which aligns with the evolving standards in the global VCM. It was noted that PFSI of the Aotearoa NZ ETS no longer the latest international best practice (Toitū, 2023).

Toitū state that "*market expectations for carbon credits have changed. While there are excellent indigenous forestry projects in Aotearoa, the NZ schemes that issue carbon credits are not being assessed by the ICVCM, against the quality requirements, so cannot show that they meet expectations. We conducted a thorough review of options for continuing to use the New Zealand credits, but none are yet suitable for meeting best practice*" (Toitū, 2023).

This action illustrates the market demand for heightened integrity and transparency in carbon credit projects. It represents a strong signal about the demand for nature-based carbon credits in NZ that meet the ICVCM standards.

Of the verification standards, the Verified Carbon Standard (VCS, managed by Verra) is by far the largest standard. Within Aotearoa NZ, as of 15 Feb 2024, there are no known current projects that have been issued credits by a VCM standard. Aotearoa NZ companies/businesses that wish to make voluntary climate claims rely on offshore sourced credits. The cost of project validation (registration) and verification (audited) under the VCS can be significant, with estimates of around USD60,000. It is noted that the VCS has been recognised by the ICVCM as fully aligned with the CCP.

2.2.3 Blue carbon project establishment costs

The cost of establishing a blue carbon project can be significant. The scale of the project can have a significant influence on cost. Due to economies of scale, capital expenditure for the overall project would reduce as the project size is bigger, noting that there are examples to the costs ranging from NZ$9,100 per ha for a 20 ha project (170NZ/tCO_2$) to NZ$3,100 per ha for a 50 ha project (50NZ/tCO_2$) (Weaver *et al.* 2022). It is noted that these costs are indicative only and include capital cost which can vary significantly between projects.

2.2.4 Market impacts of domestic or international sale of blue carbon credits

- The government will need a clear statement on Article 6.2 of the Paris Agreement whether or not credits can be sold overseas, effectively enabling the 'exporting' of emissions reductions. At present, there is some uncertainty as to whether not NZUs can be traded overseas despite the impact on NDC. It is noted that VCM-based blue carbon credits could be traded domestically and potentially internationally if they are not part of the GHG inventory.
- Whether blue carbon credits are able to be sold overseas will impact whether blue carbon is included in the GHG inventory and NDC and vice versa. There are advantages for being in the GHG inventory and NDC in that the level of engagement by government and Aotearoa NZ entities could be expected to be higher (refer Section Greenhouse gas inventories and nationally determined contributions). Clarity should also be provided on the extent that blue carbon systems (seagrass, march, and mangroves) are included in the national GHG inventory and the potential contribution to the NDC inventory.
- Being accessible to international markets may lead to more options for the sale of these credits. This requires further investigation, including investigating the potential for blue carbon to provide a 'premium' carbon credit option globally and compared to market expectations within Aotearoa NZ.
- As outlined above, there is a market demand for verified carbon units in line with heightened integrity and transparency requirements for carbon credit. Compliance with ICVCM will be important for market confidence. It can also be expected to add value to the blue carbon credits themselves as a 'premium' carbon unit.

2.3 Conclusions and recommendations

There are several challenges to overcome in the short term if blue carbon is to become part of the ETS, most notably: the current oversupply risks relating to NZU, the irrelevance of co-benefits and the technical data relating to the emissions factors and mapping of blue carbon environments (Section 1.1). The ETS framework would need updating to include blue carbon as a source of NZU. The broader critiques of the ETS including price controls and the use of the ETS to achieve NDCs also create challenges for introducing a new NZU. The scale of blue carbon NZU would be insignificant to affect the market fundamentals and dynamics. Conversely, there are a range of opportunities associated with incorporating blue carbon into the VCM, particularly related to integrating ICVCM Core Carbon Principles and other high quality carbon principles which may attract higher prices for project proponents. Market influences and dynamics indicate that there is increasing demand for high integrity, high quality blue carbon credits both locally and internationally.

Individual projects can enter the VCM without national policy, guidelines or market interventions, although the analysis concludes there are barriers to entry (habitat restoration costs, data costs, uncertainty about Aotearoa's position in Article 6 of the Paris Agreement to allow international trade). Options to consider to reduce the barriers and enable blue carbon credits to come to market more quickly and at scale:

- Legislation or other guidance to set out the requirements for selling credits offshore consistent Article 6 of the Paris Agreement,
- Best practice guidance for developing blue carbon projects and credits for VCM to reduce the barriers to entry and provide consistency and quality in the sector.
- Developing the blue carbon data inventory which could be used as default values under an international VCM, thereby reducing a lot of the set-up costs per project and enabling project scaling.
- Develop a country-specific VCM methodology once the international VCM has proven to work and there is uptake and increased demand for these projects which make a country-specific VCM and regulatory body more effective at managing and implementing these projects.

Environmental policy and law

The coastal environment and coastal wetlands in Aotearoa NZ are managed through a range of Acts and statutory instruments, however these do not directly address or specifically enable blue carbon projects. Several layers of legislation and regulation relate to property rights, ownership, occupation, use of the coastal environment and the protection and management of natural habitats and wildlife. Various agencies have roles and responsibilities in the coastal environment. The legislation overlaps and often times duplicate regulatory functions as they might relate to the enhancement and protection of blue carbon features, in a way that is not well integrated or efficient in application. Enhancing the enabling conditions and reducing barriers that exist in legislation is critical to accelerate implementation of blue carbon projects in Aotearoa NZ.

Figure 3.1 illustrates some of the complexity in terms statutory instruments as at 2024. Appendix B provides a summary of the barriers and enablers of the current legislation and national policies.

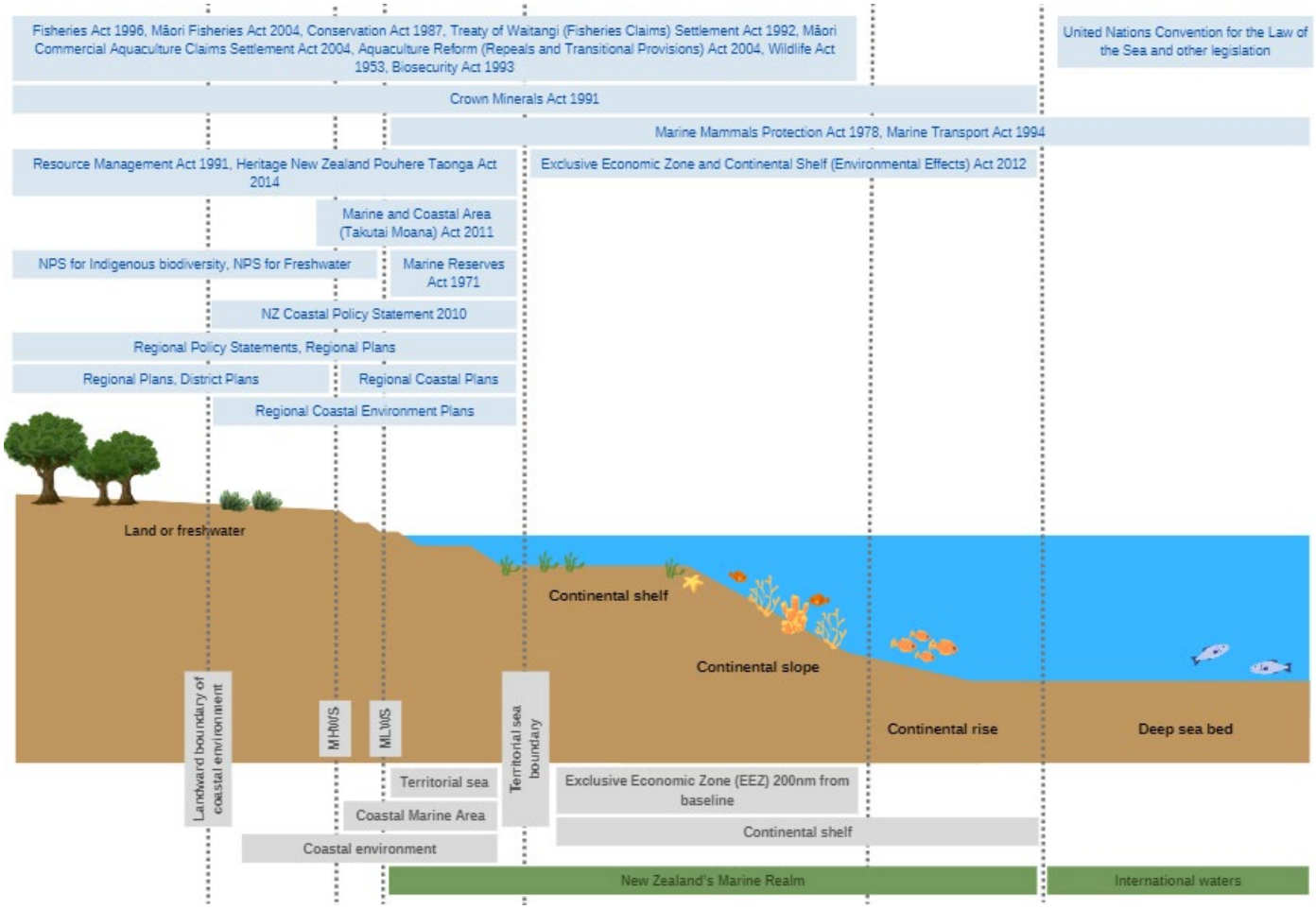

Figure 3.1 Key marine and coastal legislation and regulation (adapted from Sustainable Seas Challenge (2024) and Parliamentary Commissioner for the Environment (2020))

The legislative and policy framework has been reviewed insofar as it relates to the implementation of coastal blue carbon projects, including sea grass, salt marsh and mangroves in the "coastal wetland" space, above and below MHWS. It is a review of key aspects of the legislation (including relevant case law and commentary) for legal, structural and process alignment and impediments, related to blue carbon sequestration. District and regional plan provisions have been specifically considered for three locations considering both the operative and proposed planning documents.

Research for this topic has investigated Aotearoa NZ's key environmental policy and legislation as it relates to the implementation of blue carbon initiatives. Key questions that were investigated include:

- What are the barriers and enablers to blue carbon projects in current national and regional laws, policies and rules?
- What are the potential legal options and policy pathways to address identified barriers, using lessons from international examples?
- In what ways could the changing regulatory environment affect development of blue carbon projects?

3 Summary of key research findings

The key research findings for this topic are summarised here. Analysis and discussion of each finding are provided in the sub-sections below:

Finding 3.1: Coastal restoration broadly aligns with the purpose and objectives of key legislation in the coastal marine area (for example the Resource Management Act and Marine Reserves Act) but the complex regulatory framework is not fit for purpose for enabling blue carbon projects. Barriers are similar to any other development in the coastal marine area (the layered legal requirements, inconsistency between regions and multiple approvals processes) and can be overcome with good stakeholder engagement, using legal and planning specialists and allowing adequate time and budget. Time and cost burdens could be overcome through blue carbon enabling legislation.

Finding 3.2: Regulatory barriers and enablers are similar at small and large scales and are unlikely to hinder scalability.

Finding 3.3: Blue carbon is aligned with Aotearoa NZ's First National Adaptation Plan (2022-2028), the New Zealand Biodiversity Strategy and the Climate Change Strategy and will positively contribute to several objectives and priority actions.

3.1 Finding 3.1: Coastal restoration broadly aligns with the purpose and objectives of key legislation in the coastal marine area (for example the Resource Management Act and Marine Reserves Act) but the complex regulatory framework is not fit for purpose for enabling blue carbon projects. Barriers are similar to any other development in the coastal marine area (the layered legal requirements, inconsistency between regions and multiple approvals processes) and can be overcome with good stakeholder engagement, using legal and planning specialists and allowing adequate time and budget. Time and cost burdens could be overcome through blue carbon enabling legislation.

While fundamentally the legislation, policy and regulation framework tends to be more enabling than prohibitive of blue carbon restoration and protection because of the general association with restoration and protection of indigenous biodiversity and natural character and ecosystems, the processes and lack of integration and consistency are an issue. The legislation overlaps and, in some cases, duplicates regulatory functions as they might relate to the enhancement and protection of blue carbon features, in a way that is not well integrated, not efficient in application, complex and not consistent in terms of the institutional role for iwi Māori in the statutory processes. The duplication occurs when the site for a blue carbon project is administered under the Conservation Act 1987 or Reserves Act 1977. In these scenarios there is effectively duplication in the environmental authorisations required under the RMA as well as the Conservation Act or Reserves Act, whichever is applicable.

Section 64 of the RMA requires regional councils to develop a regional coastal plan. However, councils may choose to develop coastal environment plan. A coastal environment plan can place controls on the wider coastal environment, such as the approach adopted by Bay of Plenty. This has benefits of being able to being able to consider the coast more holistically. However, a regional council does not issue building consents or subdivision consents which can mean that control is split between the two Councils and there is a risk of conflicting decisions. Fundamentally, this means that there are different approaches to managing the coastal environment across Aotearoa NZ and the approach adopted in one geographic region may differ in the neighbouring region.

There are numerous government and other agencies and stakeholders with standing, roles and responsibilities in the coastal marine space as illustrated in Figure 3.2: MfE; DoC; Ministry for Primary Industries (MPI); Territorial Authorities, Regional Councils and Unitary Authorities. This creates both competing and overlapping priorities,

unbalanced resourcing and siloed legislation and policy. Collaboration between agencies is generally good despite these barriers. Figure 3.2 provides an example of the complex relationships in managing the coastal environment. The Fast-track Approvals Bill may help reduce some of this complexity by simplifying the process required to get the needed multiple approvals across different jurisdictions.

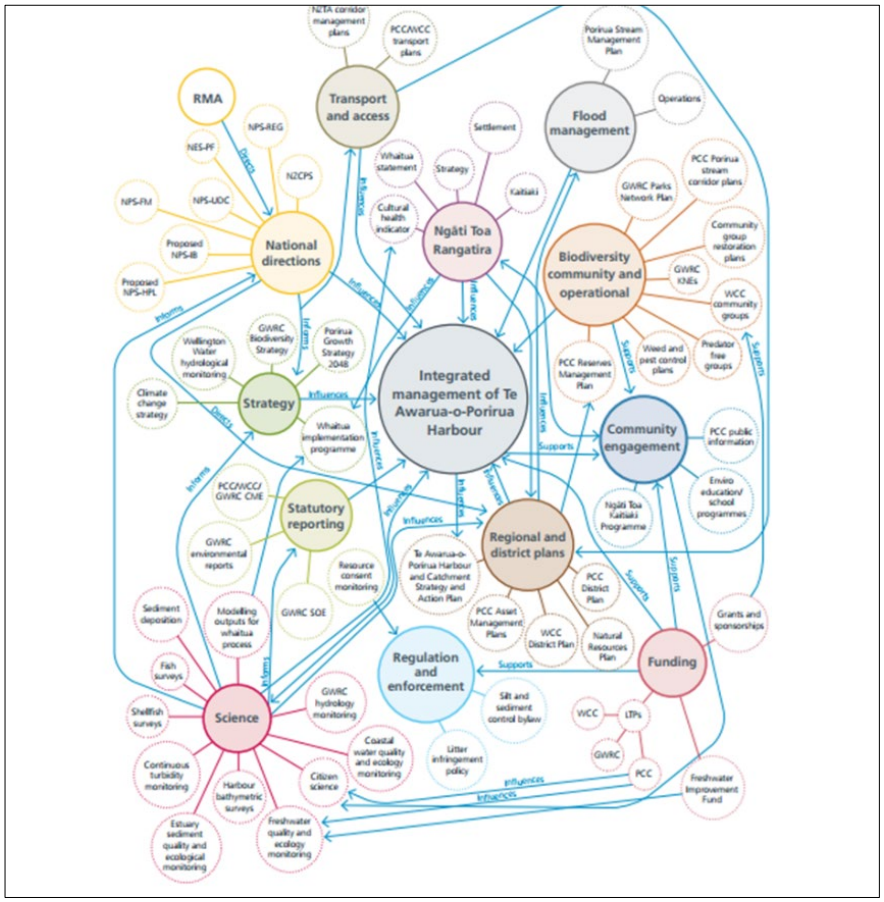

Figure 3.2 Example of agencies, roles and responsibilities in the coastal marine space. Source: Parliamentary Commissioner for the Environment, 2020

The narrow statutory purposes of Acts that have the potential to ensure protection of coastal wetlands in perpetuity (Reserves Act, Conservation Act, Marine Reserves Act) reduce the potential for these Acts in their current form to allow for the protection, restoration and commercial benefits derived from blue carbon rights. This arises primarily due to the material disconnect or inconsistency between the **purpose** of protecting the coastal wetland (carbon sequestration and commercial benefits) and the more purely conservation or science focus of these Acts.

There is also inconsistency in terms of timeframes, that could inhibit effective protection, with RMA permissions likely to be for 35 years or less, statutory protections potentially in perpetuity, and local government cycles of three years.

Where a blue carbon project is located on land administered under the Conservation Act 1987 or Reserves Act 1977 there is a level of regulation in addition to the RMA, that is not, on the face of it, enabling of commercial blue carbon projects. However, if the crown or administering body could lead a project and ensure it had multiple purposes that included those central to the purposes of the governing acts, that could provide an appropriate pathway for approval.

For private land subject only to the RMA the authorisation process is comparatively less complex. However, the RMA rules for land use in the coastal environment differ across Aotearoa NZ, and differ above and below MHWS on each site, and therefore each project faces different challenges and hurdles.

In summary, there is no direct or enabling regulation for enabling blue carbon initiatives, however the existing regulatory framework is not prohibitive. Coastal blue carbon projects are, at a high level, aligned with the outcomes most Acts and regulations are aiming for. The barriers listed above are not unique, they are also experienced by other project developers in the coastal marine area (CMA) and can be overcome – by engaging with stakeholders, using legal and planning specialists and allowing adequate time and budget. Time and cost burdens could be overcome through blue carbon enabling legislation.

3.2 Finding 3.2: Regulatory barriers and enablers are similar at small and large scales and are unlikely to hinder scalability.

Both large and small scale were considered as part of the scenario analysis (Appendix A). There is no obvious barrier of size in consenting blue carbon initiatives. Some smaller projects may be tripped up by the same planning rules as larger projects. This may reduce the efficiency of smaller projects due to the cost of preparing consent applications and the time/cost of obtaining any required approvals. There may be a slight benefit of smaller projects in that the area requiring assessment is smaller and the effects are likely to be simpler and more readily understood. Larger projects may require more complicated assessments but will benefit from the economies of scale and therefore such projects may be more viable from a consenting perspective.

The rules for land use in the coastal environment differ across Aotearoa NZ and therefore each project faces different challenges and hurdles making it more challenging for projects to leverage off previous learnings. Even within the same District the zoning of the land or applicable overlays may alter whether a project can be replicated easily.

The primary issue relevant to scale is also a locational point. If a part of a blue carbon project is above MHWS, and in respect of a wetland that comes within the definition of *natural inland wetland,* the works associated with the restoration and maintenance of that *natural inland wetland* have a permitted pathway through the National Environmental Standard for Freshwater (NES-F). But as a site increases in scale and crosses over/straddles the MHWS, works below the MHWS will not benefit from that same permitted pathway. Projects that are in respect of natural inland wetlands above MHWS will be replicable/scalable across Aotearoa NZ, because the same regulations under the NES-F apply nationwide. The same cannot be said for projects below MHWS as each regional coastal plan is different.

3.3 Finding 3.3: Blue carbon is aligned with Aotearoa NZ's First National Adaptation Plan (2022-2028), the New Zealand Biodiversity Strategy and the Climate Change Strategy and will positively contribute to several objectives and priority actions.

Aotearoa NZ's first National Adaptation Plan (Ministry for the Environment, 2022b) sets out the Government-led strategies, policies and proposals as required by the Climate Change Response Act 2002. It outlines the approaches to adapt to a changing climate and reducing the potential harms of climate change as well as identifying the potential opportunities, in response to the National Climate Change Risk Assessment (Ministry for the Environment 2020).

The National Adaptation Plan prioritises the protection and enhancement of the natural environment as part of the overarching goals. Nature-based solutions to climate adaptation are highlighted as key solutions to buffer climate change impacts while also achieving positive social and biodiversity outcomes and sequestering carbon and contributing to reducing our net carbon emissions. While not specifically mentioned in the Plan, coastal blue carbon projects are part of the basket of nature-based climate adaptation solutions and will contribute to Objective NE3: *Support working with nature to build resilience. Blue* carbon projects led by councils, communities and iwi will also contribute to Objective C1: *Enable communities to adapt* and Objective HBP3 *Māori connections to whenua and places of cultural value are strengthened through partnerships.*

Coastal blue carbon credit schemes are directly relevant to the implementation of the National Adaptation Plan (Ministry for the Environment, 2022b). This study on blue carbon policy research is contributing to the following actions:

Table 3.1 Summary of relevant National Adaptation Plan actions

Actions in the National Adaptation Plan	Activities aligned with blue carbon
Action 3.14 Deliver the Integrated Farm Planning Programme	Supporting farmers to support biodiversity, climate adaptation and emissions reduction/sequestration on their farm. Blue carbon may be an opportunity for farmers in coastal areas.

Actions in the National Adaptation Plan	Activities aligned with blue carbon
Action 5.9 Prioritise nature-based solutions	Prioritise nature-based solutions in planning and regulation for both carbon removals and climate adaptation. An enabling regulatory environment will support blue carbon projects.
Action 5.14 Support the development of definitional tools to encourage greater investment in 'green' projects	Development of 'green' taxonomy for consistent / common definition of climate and nature-positive investments. Blue carbon methodologies and markets will support the investment in adaptation using nature-based solutions.
Action 6.5 Establish an integrated work programme to deliver climate, biodiversity and wider environmental outcomes	This research is improving the knowledge of the use of non-forest carbon sequestration options. Under Action 6.5, blue carbon is relevant for the following activities: Supporting biodiversity outcomes as a result of carbon offsets under the Carbon Neutral Government Programme Incentivising public and private investment in biodiversity
Action 7.3 Partner with Māori to support Māori-led approaches to adaptation planning	The objectives relate to community adaptation, housing and urban form, but blue carbon projects can create mechanism for partnership between Government, mana whenua and communities to enable self-determined adaptation on Māori land, coastal areas where Māori land is vulnerable and in areas of customary use.
Action 8.7: Embed nature-based solutions as part of the response to reducing transport emissions and improving climate adaptation and biodiversity outcomes	Blue carbon projects are aligned with the Action 8.7 and could provide opportunities for the Ministry of Transport to offset transport emissions and contribute to broader biodiversity benefits.
Action 9.9: Expand current funding for proactive community resilience	Blue carbon projects could form part of the kete of support to communities to respond to coastal risks.

Te Mana o te Taiao – Aotearoa New Zealand Biodiversity Strategy 2020 sets out the government's key outcomes to be achieved by 2050:

- Outcome 1: Ecosystems, from mountain tops to ocean depths, are thriving.
- Outcome 2: Indigenous species and their habitats across Aotearoa New Zealand and beyond are thriving.
- Outcome 3: People's lives are enriched through their connection with nature.
- Outcome 4: Treaty partners, whānau, hapū and iwi are exercising their full role as rangatira and kaitiaki.
- Outcome 5: Prosperity is intrinsically linked with a thriving biodiversity.

These outcomes are supported by three pou which provide direction and focus. Objectives are identified with each pou. All of the objectives are aligned with blue carbon initiatives. Of particular relevance are:

- Objective 10: Ecosystems and species are protected, restored, resilient and connected from mountain tops to ocean depths.
- Objective 13: Biodiversity provides nature-based solutions to climate change and is resilient to its effects.

While recognising that Government priorities change, blue carbon is well-aligned with both the National Adaptation Plan and the Te Mana o te Taiao – Aotearoa New Zealand Biodiversity Strategy 2020. Blue carbon will support key actions for both climate adaptation and climate mitigation across infrastructure, Māori partnerships and self-determination relating to adaptation, community adaptation and protecting and enhancing the natural environment.

The government's Climate Change Strategy focusses on five pillars to meet the NDCs and prepare Aotearoa NZ for the effects of climate change. Coastal wetland restoration and blue carbon credits are directly aligned with:

- Pillar 2 Credible markets support the climate transition - Pricing emissions fairly and effectively to incentivise emissions reductions.
- Pillar 5 Nature-based solutions address climate change - Restoring biodiversity, while investigating new ways of harnessing nature to remove emissions from the atmosphere.

3.4 Conclusions and Recommendations

Aotearoa NZ laws and policies were not developed with blue carbon restoration projects in mind. The legal and policy framework was designed to regulate activities that might have negative impacts on the environment. This framework often inadvertently captures restoration projects causing barriers to implementation.

- In some cases the legislation is out of date - there have been no substantive reforms to ensure the statutes remain fit for purpose. This is particularly in respect of the Conservation Act, Reserves Act, Marine Reserves Act and Wildlife Act, all of which it is generally acknowledged are overdue for reform. Kettles *et al.* 2024 notes that the RMA review is currently in a state of flux and uncertainty providing an opportunity to develop a comprehensive blue carbon strategy.

The narrow statutory purposes of the above Acts that have the potential to ensure protection of coastal wetlands in perpetuity (Reserves Act, Conservation Act, Marine Reserves Act) reduce the potential for these Acts in their current form to allow for the protection, restoration and commercial benefits derived from blue carbon rights. This arises primarily due to the material disconnect or inconsistency between the purpose of protecting the coastal wetlands (carbon sequestration and commercial benefits) and the more purely conservation or science focus of these Acts.

3.4.1 Legislative and policy enablers

- Considering the above assessment most blue carbon projects involving coastal wetland restoration would require resource consent from the regional council prior to proceeding. However, given the policy framework identified above it would seem probable that resource consent would be granted. The consenting project is likely to be more challenging where there is a site of significance. In this case the consent process may be more prolonged as a wider range of effects are considered. The project may also be forced to show it is not having a negative effect on the environment.
- The areas for scenarios 1a and b that are covered by the marine reserve are protected in perpetuity. The assumption was made that the active intervention and restoration works are consistent with the conditions of the marine reserve, however in the hypothetical alternative, the marine reserve conditions could prohibit the interventions in which case an amendment to the marine reserve would be required.
- The area administered under the Conservation Act will also already have a degree of protection in perpetuity, and this could be improved by elevating the specific protection to be applied to the area under the Conservation Management Strategy, and applying a special status such as ecological area, or sanctuary area to the site.

3.4.2 Legislative and policy barriers

- There are numerous laws, polices and plans that are involved. These differ between districts and regions and therefore is not possible to replicate projects and assessments between projects. One catchment can also have multiple districts and therefore multiple sets of plans. The required assessments to support consent applications can be costly and this may prevent projects pursuing consent.
- For scenarios 1a and 1b, the commercial aspect is likely to trigger requirements for concessions under the Conservation Act. Unless the Northland Conservation Management Strategy is amended so that it contemplates blue carbon projects of this nature, there is likely to be a statutory barrier.
- As above the areas for scenarios 1a and b that are covered by the marine reserve are protected in perpetuity. The assumption was made that the active intervention and restoration works are consistent with the conditions of the marine reserve, however in the hypothetical alternative, the marine reserve conditions could prohibit the interventions in which case an amendment to the marine reserve would be required.
- Most of the scenarios are located below MHWS and cannot take advantage of the NES-F regulations permitting restoration and maintenance works in natural inland wetlands. However the NES-F framework would be useful if reviewed and replicated for broader application.
- Carmody (2024) undertook an assessment of the State Laws of New South Wales and Queensland as they apply to blue carbon. They identified three key barriers: complexity, time and cost. Similar barriers are experienced in Aotearoa NZ, although some of our complexities differ.
- There are several examples internationally where legal frameworks have been developed. King (2023) has undertaken an extensive literature review of blue carbon policy in Asia and the Pacific. This work is due to be published in 2024. The summary of their findings identify both land tenure and conflicting jurisdictions as two key issues (similar to the issues identified in this assessment).

3.4.3 Recommendations

- Unlocking the potential for coastal wetlands located on land managed by under the Conservation Act or Reserves Act would be enabled through reforms to those Acts and the scope of the statutory instruments that implement them.

The RMA policy framework is still relatively siloed in terms of provisions between the management of land, freshwater catchments and the management of the coast. The RMA planning provisions are supportive of enabling biodiversity or natural character restoration which is beneficial. However, there is an argument that if the driver of the project is to gain carbon credits, then the purpose of the project is not restoration, but is a commercial activity, and therefore the planning provisions are a lot more restrictive. For example, on the face of it the NES-F permitted regulation 38 should be able to be utilised for the restoration and maintenance of natural inland wetlands. However, each sub-clause has the qualifier if it is for the purpose of natural inland wetland restoration, wetland maintenance, or biosecurity. Aside from this, the regulation covers all of the interventions one might expect – vegetation clearance, earthworks, taking, use, damming, diversion, discharge, and is a key enabler.

A review of the detail of the NES-F is recommended, on three key points:

- Whether the purpose of works needs to be expanded to refer to carbon sequestration
- Whether the definition of natural inland wetland is too narrow, or in fact whether the permitted regulation 38 should simply apply to all wetlands
- And whether the permitted pathway for maintenance and restoration can be replicated for blue carbon/coastal wetlands below MHWS.
- A review of the National Policy Statement on Freshwater Management (NPS-FM) and New Zealand Coastal Policy Statement (NZCPS) as they relate to blue carbon projects is also recommended, to drive consistency throughout Aotearoa NZ, and enable scalable replication more easily.

Finally, there is also inconsistency in terms of timeframes, that could inhibit effective protection, with RMA permissions likely to be for 35 years or less, statutory protections potentially in perpetuity, and local government funding cycles of three years.

A key recommendation on the scope of resource consents is also relevant to coastal land tenure and carbon rights (Section 4.2), for land that was below MHWS when title was originally issued – such land has no title (in the absence of a customary marine title order) and no instrument against which to register or attach a carbon right in perpetuity. (NB this does not apply to land that was below MHWS when title issued, but that is subsequently inundated and classified as below MHWS, as title is not automatically extinguished in that circumstance.)

- A review of activity category/consent types in the RMA relating to blue carbon restoration and protection is recommended – for example a new activity blue carbon sequestration category could be created that either sits over and is in addition to the various water and coastal permits or is instead of those permits, that endures in perpetuity like a land use consent. This option is also referenced in Section 4.2 as it could provide a legal mechanism where there is no title, by which to secure a carbon sequestration right.

There is ongoing research underway in this field, including that being undertaken by Associate Professor Elizabeth Macpherson pursuant to the Rutherford Discovery Fellowship she has been awarded. Professor MacPherson's research will be developed in partnership with te iwi o Ngāi Tahu and will look at all aspects of blue carbon legal frameworks in Aotearoa NZ.

Table 3.2 Potential options and policy pathways

Options	Strengths	Weaknesses
RMA	Permitted pathway for maintenance and restoration of coastal environments.	Water and coastal permits have a finite term of 35 years which may not meet 'permanence' requirements of blue carbon methodologies.
National Coastal Wetland Blue Carbon Strategy or Road Map	Kettles *et al.* (2024) proposes a national strategy or road map determining that a strategic vision should predate any policy development. This could provide an umbrella document in which to guide a more comprehensive package of change.	A national strategy or road map would take time to trickle down and be implemented. It is also likely to require a national policy statement or national environmental standard to make change happen. It is unclear which agency or group would administer the strategy or road map.

Options	Strengths	Weaknesses
National Policy Statement	Local authorities are required to amend regional policy statements, proposed regional policy statements, plans, proposed plans, and variations to give effect to NZCPS provisions that affect these documents as soon as practicable under section 55 of the RMA. National Policy Statements provide national direction but enable local flexibility.	National Policy Statements take time to trickle down through the planning instruments. They can be interpreted by different Councils different leading to inconsistency in how the objectives and policies are applied.
Amend NZCPS	The NZCPS is an existing document that could be amended to include a great focus on blue carbon. Objectives 1 and 2 are particularly relevant. The objectives seek to safeguard the coastal environment including to maintain and enhance the natural biological and physical processes, preserving natural character, and encouraging restoration of the coastal environment.	The NZCPS only covers the coastal environment. blue carbon projects may span areas wider than this.
National Environmental Standard	Would provide for nationally consistent regulation that would take effect on a given date. Regional and District Plans can be more stringent than and NES.	This would add an additional layer of regulation. Rules in plans can be more stringent than an NES.
Bylaws	Territorial authorities are able to make bylaws to address certain issues and this may be helpful to address some smaller localised impacts such as stopping or restricting vehicles travelling in the coastal environment.	Bylaws are local laws and therefore add a further layer of complexity. They tend to be used to restrict or prohibit activities as opposed to enable them. They may be able to support national documents but are unlikely to be sufficient on their own.
Guidance document	Guidance documents can help fill the gap that currently exists in the legislation. They are non-statutory, but the NZCPS does require consideration of guidance documents. Such document could provide support around matters that don't suit regulation, such as advice for implementation.	Non-statutory so can provide advice supporting projects but will not remove any hurdles.
New or reformed legislation	Bespoke legislation or significant reform of existing legislation could provide the most simplistic implementation pathway.	There is significant cost in developing new legislation and there may be unintended consequences which are not realised until the legislation is implemented.

Coastal land tenure and carbon rights

Blue carbon credit schemes, whether compliance or voluntary, rely on several aspects of land tenure and carbon rights:

- Land tenure is clear and landowners are signatories to the project.
- The rights to own and trade carbon are clear and registered to land titles.
- Carbon rights can be registered for a minimum defined period of time, as per the definition of 'perpetuity' per permanence under the scheme.
- Indigenous peoples rights and interests are respected and upheld throughout the project.

Land tenure challenges for blue carbon projects

Land tenure in Aotearoa NZ's coastal environment presents a series of challenges for blue carbon projects (Stewart-Sinclair *et al.* 2024). A clear distinction exists between ownership rights above and below the mean high-water spring (MHWS) mark (in most situations). Land above MHWS can be private or public with a formal title under the Land Transfer Act 2017 – a system derived from the Torrens system (Te Rūnanga o Ngāti Whātua Ōrākei Trust v Attorney-General [2013] NZCA 200). However, the Crown or any other entity generally cannot own land below MHWS, with some exceptions outlined in the MACA Act such as specific reclamation projects or where the MHWS has moved onto privately held land. The challenges and considerations outlined in this section are equally applicable to voluntary and compliance schemes.

Legal framework for land ownership and access to resources

This section reviews the legal framework for land ownership and access to resources, which is relevant for assigning the rights to occupy and use land and resources and to assign carbon rights.

Aotearoa, NZ's vast CMA presents a rich tapestry of environmental, cultural, and economic significance. Blue carbon projects, by their very nature, bridge the divide between land and sea. A single project may encompass a mosaic of separate land titles and ownership categories. For project proponents, this necessitates navigating a complex labyrinth of policies, laws, and regulations that govern land and resource tenure, as well as their use. Appendix A provides a concise summary of these key statutes.

Aotearoa NZ has a robust land title system. Under this title system, there is a clear distinction of tenure between above MHWS and common CMA below the MHWS. Land above MHWS may be privately or publicly owned and have a title allocated (the title-based Torrens system). Below MHWS, common CMAs are incapable of being owned by the Crown or any other person subject to the exceptions outlined in the legislation. There are however some common law challenges to the distinction. Stewart-Sinclair *et al.* (2024) note that the common law surrounding this distinction and the associated rights is much more complex. In Whakatōhea Kotahitanga Waka (Edwards) & Ors v Te Kāhui and Whakatōhea Māori Trust Board & Ors (2023), the Court of Appeal confirmed that customary title extends to the beds of rivers, which is above the MHWS.

Adding to this complexity is the fact that the margins of rivers, estuaries and coast in tidal areas are dynamic, shaped by natural processes and human activities such as bunds and drains and likely to be exacerbated by climate change. Land tenure in the coastal wetland environment is therefore complicated and likely to change over the lifespan of a blue carbon project.

Aotearoa, NZs' approach to land tenure in the CMA is somewhat unique, as in many other jurisdictions (including Australia) the common CMA is held in public ownership (e.g. local or national government). However, the challenges of defining boundaries in the face of erosion, sea-level rise, and shifting tides are universal. Even in nations with public ownership, indigenous customary rights and practices add another layer of complexity, as seen in places like the Marshall Islands and Indonesia. Furthermore, even in countries where land ownership is vested in public ownership, there are indigenous customary uses and norms which add another layer of complexity, as seen in places like the Marshall Islands and Indonesia.

Recognising Māori rights and challenges

Māori rights to blue carbon resources are complex and evolving. Te Tiriti o Waitangi guarantees Māori ownership of lands and estates, including customary rights extending to intertidal zones rich in blue carbon ecosystems. Recent legal cases like Whakatōhea Kotahitanga Waka (Edwards) v Te Kāhui and Whakatōhea Māori Trust (2023) and Takamore v Clarke (2017) recognise the significance of Māori customary rights and spiritual connections to wai (places of significance) for managing blue carbon resources. The Ngā Rohe Moana o Ngā Hapū o Ngāti Porou Act 2019 exemplifies how specific legislation can recognise Māori land tenure and blue carbon rights. While the Act doesn't explicitly mention blue carbon rights, it does focus on recognising and protecting the continued mana of ngā hapū o Ngāti Porou in relation to CMAs, ensuring their voice in decision-making processes.

Māori land tenure in the coastal zone presents a unique set of challenges that intersect with ancestral practices (tikanga Māori), historical grievances, and the evolving legal framework. Pre-colonially, Māori land tenure operated under tikanga Māori, an interrelated system of customary principles emphasising connection and responsibility. Concepts like mana whenua (tribal authority over land and resources), whanaungatanga (kinship relationships), and kaitiakitanga (guardianship) established deep connections between Māori people and both terrestrial and marine resources (Durie, 1990).

Despite the growing recognition of tikanga, customary principles remain largely outside the purview of the formal legal system. This creates hurdles in their recognition and application when it comes to blue carbon rights. In recent years, there has been a growing convergence of interest in Māori customary rights and blue carbon. This has garnered significant attention, raising questions about ownership, management, and potential benefits.

Aotearoa NZ's multifaceted land tenure directly impacts how carbon rights in coastal areas are registered. This topic examines some of the complexities of land tenure and how that influences the registration of rights to blue carbon.

Key questions that were investigated as part of this research topic include:

- What are the issues and opportunities regarding land tenure and carbon rights in coastal areas, for privately-owned, Māori-owned and Government owned/managed land?
- What lessons can be drawn on from projects that have been implemented in the CMA in Aotearoa NZ and internationally (not necessarily blue carbon projects)?
- What opportunities exist to overcome the barriers (in the short and/or long term), and further work required in this area?

4 Summary of research findings

The key research findings for this topic are summarised here. Analysis and discussion of each finding are provided in the sub-sections below:

Finding 4.1: The general absence of land titles below mean high water springs presents a significant challenge for widespread blue carbon rights registration. The convention of granting registrable carbon rights to land title is not possible without a legal record of title to register the right on/against, which generally are not available below the mean high water springs.

Finding 4.2: Alternative regulatory tools will likely be needed to grant blue carbon rights, in a manner that respects Māori sovereignty and tikanga Māori and meets the integrity principles for blue carbon projects, where title to the land is not available. Several options were reviewed, including the use of customary title and vesting of land to the Crown under the Marine and Coastal Area (Takutai Moana) Act 2011. Multiparty legal agreements and / or a new category of resource consents under the RMA could be possible options for pilot programmes.

4.1 Finding 4.1: The general absence of land titles below mean high water springs presents a significant challenge for widespread blue carbon rights registration. The convention of granting registrable carbon rights to land title is not possible without a legal record of title to register the right on/against, which generally are not available below the mean high water springs.

A key feature of land tenure in Aotearoa NZ, relevant to blue carbon, is the distinction between land above the mean high-water springs, which can be privately and publicly owned and sold, and land below the mean high-water springs, which is generally incapable of being owned. There are or could be situations where land with title that was previously above the mean high-water spring is re-flooded or the mean high-water spring rises so that parts of the land are now below the mean high-water spring, but retain legal title (at least for a period of time). However, if this land is ever re-surveyed, then that portion of land below of the mean high-water spring would become part of the common marine and coastal area and therefore be incapable of being owned. This approach is relatively unique to Aotearoa NZ as in other jurisdictions, such as Australia, land below the mean high-water springs is usually held in public ownership.

Some aspects of the complexity of land tenure relevant to blue carbon include:

- Where there is no title, carbon rights cannot be registered (this is explored further in Finding 2).
- Blue carbon projects will cover many land titles and have a myriad of landowners (iwi, government, private). At scale, this will be administratively complex.
- The presence of customary title which recognises interests that Māori have in CMAs (much of which is unresolved/in train) but which is not a formal legal title with associated ownership rights that is capable of registration or against which sub-interests can be registered;
- The current legal framework for land tenure and carbon rights does not adequately recognise and integrate tikanga Māori (customary law) concepts and alignment with the principles of Te Tiriti o Waitangi;
- Common law regarding customary use rights in the CMA is evolving and likely to continue to evolve, therefore there is uncertainty with how the courts will interpret laws, tikanga etc.
- Tidal areas are dynamic and can change, whether through natural erosion / inundation or climate change. This means that land that sits above the mean high-water springs at the beginning of a blue carbon project may end up below the MHWS at some stage during the life of the project.
- blue carbon projects that involve changing the mean high-water springs and therefore could inundate land with title and revert the land to the CMA.
- Land tenure rights may also change where land is re-flooded, accreted or eroded and that land is re-surveyed.

See Table 4.1 applying these barriers/complexities to the scenarios:

Table 4.1 Barriers, risks and complexities associated with land tenure for the blue carbon scenarios.

Scenario	Barriers and Risks	Complexities
Scenario 1 – DoC and iwi land above MHWS.	Project development and governance will be complex at harbour scale due to the number of land owners / land titles. At small scale, iwi and DoC are able to partner and agree on governance of the project across the land titles. Concession likely in form of a lease required on DoC Land. Mandatory public notification for an application for a lease under s17SC Conservation Act 1987.	Te Tiriti issues around land, that could still be subject to Treaty settlements. Tikanga and kaitiakitanga considerations, especially at scale where there may be several iwi / hapū. Changing coastal boundary could change land tenure over the time period of the project.
Scenario 2 – private land, iwi land, regional council land, above and below MHWS	Land that is re-flooded or where the MHWS has risen can remain as legal title that can be owned however there is a risk that if the land is re-surveyed, the portion of the land that is below the MHWS will become part of the common marine and coastal area. Customary land below the MHWS is form of legal title, however this title cannot have interests registered against it.	Tikanga and kaitiakitanga considerations. Regional council representing multiple landowners Determining the correct legal instrument to grant rights to the blue carbon project operator. Changing coastal boundary. Pending customary marine title claim

Scenario	Barriers and Risks	Complexities
	Incentivising private landowners to allow their land to be used for a blue carbon Scheme (aided by the fact that the land is likely to be low productive pastureland).	
Scenario 3 – above and below MHWS, private land in catchment above seagrass habitats	Land that is re-flooded or where the MHWS has risen can remain as legal title that can be owned however there is a risk that if the land is re-surveyed, the portion of the land that is below the MHWS will become part of the common marine and coastal area. Incentivising private landowners in catchment area.	Changing coastal boundary.

4.2 Finding 4.2: Alternative regulatory tools will likely be needed to grant widespread blue carbon rights, in a manner that respects Māori sovereignty and tikanga Māori and meets the integrity principles for blue carbon projects. Several options were reviewed, including the use of customary title and vesting of land to the Crown under the Marine and Coastal Area (Takutai Moana) Act 2011. Multiparty legal agreements and / or a new category of resource consents under the Resource Management Act could be possible options for pilot programmes.

A robust regulatory framework is essential for unlocking the potential of blue carbon projects in Aotearoa NZ. This framework needs to not only provide clear and secure rights for project operators and investors, but also ensure alignment with Te Tiriti o Waitangi (The Treaty of Waitangi). The Treaty guarantees certain rights and protections for Māori and their relationship with the land and sea. However, current complexities in land tenure, particularly the general absence of ownership / title below the mean high-water spring, pose significant challenges for establishing widespread blue carbon rights mechanisms that are consistent with both international models and Te Tiriti. This necessitates exploring innovative solutions to ensure a future where blue carbon projects can contribute to climate change mitigation while respecting the rights and traditions of iwi / hapū. There will be situations where legal title will be available below the mean high water springs, such as where the mean high water spring rises or land adjacent to the coast is deliberately inundated with the sea. We have not identified how widespread these situations will be, as it requires a case by case analysis.

The ability to establish clear legal rights to undertake and operate a blue carbon scheme will be fundamental to enabling the widespread development of blue carbon projects. Operators and investors will require unambiguous certainty regarding ownership and minimal risk of losing rights or investments. However, complexities in land tenure, particularly below the MHWS, pose significant challenges.

The general absence of land ownership below the MHWS in Aotearoa NZ creates a significant hurdle in establishing blue carbon rights mechanisms that directly align with international models. This necessitates exploring innovative solutions. In the interim, considering the complexities of land tenure below the MHWS, an option is that central or local government entities could join land owners and other project proponents to assume a participatory role in all blue carbon projects operating in these areas along with iwi and hapū groups with customary claims in respect of the areas. The scenarios outlined above offer promising alternatives that warrant further investigation.

Presently only carbon sequestered on terrestrial tree habitats is recognised by the ETS under the Climate Change Response Act 2002. Carbon projects undertaken on land can be sold with the land, or carbon rights can be granted to a separate entity (who can then usually on-sell or transfer these under common law principles, and the Land Transfer Act 2017). However, there is no comprehensive legislative framework enabling terrestrial carbon projects – instead, carbon rights have been added into forestry rights or forestry leases granted under the Property Law Act 2007 and Forestry Rights Registration Act 1983.

The Climate Change Response Act 2002 prescribes who can receive NZUs in respect of carbon sequestered on terrestrial tree habitats. It can either be the owner of the land, the holder of a registered lease, or the holder of a registered forestry/carbon right. Where a registered lease or forestry right holder wishes to claim the NZUs, they must show that the landowner has agreed to this. Blue carbon does not fit under the forestry carbon regulatory framework. There are no such restrictions in terms of voluntary schemes.

4.2.1 Māori rights to blue carbon resources are complex and evolving

Many Māori customary titles remain unresolved or unrecognized within the formal legal framework. This creates uncertainty and hurdles when it comes to translating these customary rights into ownership rights suitable for claiming carbon rights under the current system. Additionally, the concept of carbon sequestration as a tradable commodity is a relatively new one and its integration with traditional Māori values and practices requires careful consideration.

The complexity is further compounded by the evolving nature of the legal landscape where recent court cases recognise the significance of Māori customary rights and spiritual connections to the coastal environment. This growing recognition paves the way for a future where Māori rights are appropriately recognized and integrated into frameworks for blue carbon initiatives. However, ongoing efforts are needed to fully resolve outstanding customary title claims and develop clear legal pathways for Māori participation in blue carbon projects.

4.2.2 Challenges and opportunities for Māori in blue carbon projects

The current system for registering carbon rights relies on formal land title ownership. This disadvantages Māori land with unresolved or unrecognized customary titles. Because these titles haven't been formalized through the high court process, they cannot be used to claim carbon rights under the existing framework. This creates a significant barrier for Māori participation in blue carbon projects and prevents them from capitalising on the potential economic and environmental benefits these projects offer.

One promising approach to address these challenges is the development of co-governance models. These collaborative frameworks would involve Māori and Crown authorities (government) working together to manage large-scale blue carbon projects. This fosters equitable decision-making by ensuring Māori voices are heard throughout the process, respecting their knowledge and connection to the land. Partnership models can also help address the administrative complexities that arise when multiple landowners, including iwi, government agencies, and private entities, are involved in a blue carbon project.

Finding solutions that acknowledge and integrate tikanga Māori (Māori customary practices) alongside existing legal frameworks is crucial. This ensures that Māori rights and knowledge are respected and inform decision-making related to blue carbon projects, particularly in areas with unresolved customary title claims. Supporting the development of clear legal frameworks that uphold Te Tiriti o Waitangi principles can provide greater certainty and protections for Māori rights in blue carbon initiatives. This includes addressing the evolving nature of common law regarding customary use rights in the CMA and ensuring that these rights are protected even if the legal classification of the land changes due to coastal erosion or inundation.

4.2.3 Granting carbon rights to blue carbon project areas above MHWS

Where land for a blue carbon project has clear legal title (which is generally the case for land above MHWS) a similar system to forest-based carbon could be used whereby the landowner grants a carbon right/lease to the blue carbon operator which gives the operator access to the land, grants the operator the right to any carbon sequestered on the land, deals with benefit sharing (e.g. a rental for the landowner or share of carbon credits), and sets out what happens at the end of the project / wind up obligations. However, there is technically no legally recognised 'right to carbon'. To date, where a landowner wishes to grant someone else carbon rights over their land these have been dealt with as an ancillary part of forestry rights or forestry leases. This is specifically allowed for in the Forestry Rights Registration Act 1983. It may be that new legislation, or a court decision, is required in order for rights to extract and sequester carbon using organic biomatter to be formally recognised in the legal context.

4.2.4 Granting Carbon rights to blue carbon project areas below MHWS

Complexities in land tenure below the MHWS pose significant challenges. Where land sits below the MHWS the situation becomes more complicated as generally land cannot be owned below the MHWS, meaning that generally there is no 'landowner' to grant the carbon rights. (Note however this complexity does not arise for land that was above MHWS when title issued, but is subsequently inundated, as title does not automatically extinguish, it will only extinguish if the land is re-surveyed). Five legal options that may be able to be used to address this have been analysed:

1. Option 1 – Vest the land in the Crown as a reserve, which is provided for under section 12 of the Marine and Coastal Area (Takutai Moana) Act 2011 (MACA). The Crown could then grant carbon rights once the reserve was created. Note however the assessment of environmental law and policy recommends in Section 3.4 a review of the Reserves Act 1977 and Conservation Act 1983 because authorisations (likely in the form of a

lease) will be required and the purposes of both Acts are not likely to be compatible with blue carbon projects in their current form.

2. Option 2 – Resource consents will likely be required under the RMA. Other projects in the CMA (for example – aquaculture farms) rely solely on resource consents as providing the right to occupy the CMA. However resource consents in the CMA have a finite duration (35 years maximum). If a right to occupy and undertake the activity in perpetuity is required to secure the carbon rights, then it may require a review of the consent categories in the RMA to address this (refer Section 3.4).
3. Option 3 – Enable customary marine title holders (under the MACA) to benefit from the carbon rights and use their status to impose protections on the areas to restrict and permit others from benefitting.
4. Option 4 – Legislate to enable the granting of carbon rights and setting up of blue carbon projects in the CMA by an empowered entity (e.g. a government department, or a new entity collaboratively representing government, iwi and stakeholders). This could include changes to the MACA to allow registration and recognition of these rights in respect of customary title.
5. Option 5 – Multiparty agreements are entered into (similar to what has occurred in various overseas blue carbon projects) with key stakeholders including central/local government, iwi, research institutes and project operators. Successful blue carbon schemes in other jurisdictions have to date relied on contractual frameworks between the landowner (usually a governmental entity, particularly where the project is located below the mean high-water springs) and other project participants such as research institutes, charitable organisations and other stakeholders (Department of Planning, n.d.). This model may not be easily replicated in Aotearoa NZ due to the lack of clarity as to ownership below the MHWS, although the pilot project at Pūkorokoro-Miranda by the Nature Conservancy was located on a recently created reserve (the Repo ki Pūkorokoro Reserve) facilitated by the DoC, meaning that land ownership was clear (Living Water, n.d.).

An analysis of the pros and cons of these options is outlined in Table 4.2.

Table 4.2 Pros and cons of options for granting carbon rights to blue carbon project areas below MHWS

Option	Pros	Cons
Vest land below MHWS in Crown (where no current legal owner).	Would allow the Crown to regulate the blue carbon market by being the one to grant carbon rights.	MACA allows for vesting CMAs in the Crown in very limited circumstances. Vesting CMAs in the Crown have historically been controversial and raises insurmountable Te Tiriti issues.
Resource consents	Grants a right to set up and operate a blue carbon project without needing the land to be owned by a particular party. Coastal and water permits are able to be transferred.	RMA currently does not have a consent category for carbon. It is assumed in this option that carbon rights could be connected to the rights associated with land use and / or water permits. Otherwise a new resource consent category may be required with specific intent. Only land use consents exist in perpetuity – coastal and water permits currently last no longer than 35 years and will need to be renewed. Extent of rights is also limited meaning this could cause issues for scalability – developers and funders of blue carbon projects may require better tenure rights.
Customary title	Consistent with Te Tiriti obligations. Customary title owners have an inalienable right to benefit from CMAs. Customary title owners are able to *have a say on* resource consents.	Numerous customary claims can make things more complicated. However these claims can be resolved through mediation such as what was seen in the Tokomaru Bay claim. Customary title not like a 'normal' land title that can have interests registered against it with the protections associated with this. The limited rights

Option	Pros	Cons
	A supposedly "easier" application process for customary title.	and inability to register interest could cause issues for scalability – developers and funders of blue carbon projects may require better tenure rights.
Legislate to create new carbon right	Able to use the forestry sector as a basis for creating blue carbon rights. Provides clarity and protections that should enable blue carbon projects to become scalable, without relying on central or local government to be a participant in each project.	Relies on the government introducing a new suite of rights, which may be controversial and legally somewhat novel (although there is precedent with the Forestry Rights Registration Act 1983). Partnership with iwi will be critical in developing this framework. There will be Te Tiriti issues around granting rights in the CMA.
Multiparty agreements	Relatively straightforward to implement. Ability to ensure all partners / rights holders are in agreement. Offers flexibility in terms of approach and easily scalable.	An agreement only approach may not be sufficiently legally robust as there is no link to the land and or protections usually associated with being registered on title. Developers and funders of blue carbon projects, and blue carbon credit buyers, may require better tenure rights.

As noted above, it appears that the requirement for land tenure certainty likely influenced how Aotearoa NZ's ETS system was set up – with only landowners or holders of registered leases or forestry rights able to participate in the ETS system and be able to claim NZUs from the Government. If carbon sequestered by blue carbon projects were to be allowed into the existing ETS scheme, it is assumed that the Government would require anyone wishing to claim NZUs be able to establish with a similar level of certainty their ownership / tenure in respect of the blue carbon.

4.3 Conclusions and recommendations

This analysis has identified the key challenges and briefly outlined some potential options. There is a need for additional research, collaboration, engagement and options analysis to develop an acceptable way forward on blue carbon rights to enable blue carbon projects to happen at scale.

- **Collaborative Research:** Further research is needed to map the extent and nature of customary rights in the CMA. This research should be conducted in partnership with iwi communities to ensure their knowledge and perspectives are incorporated.
- **Law Reform Considerations:** Exploring legislative amendments or the development of a dedicated blue carbon regulatory framework is necessary. This framework should explicitly recognise Te Tiriti o Waitangi principles and provide clear guidance on integrating customary rights and kaitiakitanga into the blue carbon rights regime.
- **Innovative Solutions:** Investigating innovative solutions for dealing with dynamic tidal areas and their impact on land tenure and carbon rights is crucial for long-term project planning.
- **Focus on Co-management and Benefits Sharing:** Developing clear mechanisms for co-management and equitable benefit sharing with iwi communities is essential to incentivise their participation and ensure alignment with Te Tiriti o Waitangi principles.
- As noted elsewhere in the report, there is ongoing research underway in this field, including that being undertaken by Associate Professor Elizabeth Macpherson pursuant to the Rutherford Discovery Fellowship she has been awarded. Professor MacPhersons research will be developed in partnership with te iwi o Ngāi Tahu and will look at all aspects of blue carbon legal frameworks in Aotearoa NZ.
- Government and Māori to explore regulatory and non-regulatory options for granting rights to carbon created in coastal blue carbon environments in the absence of land title below MHWS, with the certainty required by the blue carbon credit buyers.

Blue carbon schemes and methodologies

There are a range of international voluntary carbon standards that incorporate blue carbon methodologies that enable verifiable carbon credits to be generated from projects. Verified credits can then be traded within the VCM, serving as a revenue stream for carbon projects that remove carbon from the atmosphere.

The main carbon standards offering methodologies for blue carbon credits are summarised below while more details can be found in Appendix C.

- **Australian Carbon Credit Units** ('ACCU') scheme (domestic / national only): Tidal restoration of blue carbon ecosystems method 'T-Restor' (Australian Government Clean Energy Regulator, 202). The methodology is unique in that it does not require field measurements, which is intended to simplify the requirements of the method and reduce costs associated with sampling. Method applies to the reintroduction of tidal flow to coastal wetlands.
- **Verra** (international): The world's most widely used voluntary standard: VM0033 method – Methodology for Tidal Wetland and Seagrass Restoration (Verra, 2023). As the Verra methodology AR-AM0014 (CDM, n.d.) was replaced by VM0033 and since VM0007 (Verra, n.d.) will be phased out, the focus of the research has only been on investigating the applicability of VM0033 to Aotearoa NZ blue carbon ecosystems. Verra is currently revising VM0033 to also include conservation activities (currently covered under VM0007) and to ensure the methodology incorporates the latest science, data, and technology for blue carbon ecosystems (Verra, 2023a).
- **Plan Vivo** (international): Permits mangrove projects to use the AR-AM0014 methodology published by the UNFCCC Clean Development Mechanism (CDM) program (CDM, n.d.). Since Nov 2023, Plan Vivo's methodology PM001 "Agriculture and Forestry Carbon Benefit Assessment Methodology" (Plan Vivo, 2023) is applicable to mangroves and should be used. Plan Vivo is currently developing a new blue carbon methodology, specifically with marine and coastal projects in mind (Plan Vivo, 2024).
- **Gold Standard** (international): Approved methodology for the certification of mangrove afforestation/reforestation, which is based on the much broader Gold Standard Methodology for afforestation/reforestation (A/R) GHGs Emission Reduction and Sequestration Version 2.0 (Gold Standard 2022). Forliance, together with Gold Standard, has developed a new methodology for blue carbon projects: the Sustainable Mangrove Management Methodology (Gold Standard 2024a), which is currently open for consultation.

The blue carbon market is nascent and there are very few blue carbon projects that are registered and actively issuing carbon credits. The body of evidence regarding efficiency and effectiveness is very small. But blue carbon projects are gaining momentum globally and numerous projects are currently under development (Fair Carbon, 2023), so it is anticipated that data will continue to improve.

At the time of this research, there are two primary methodology types being applied by blue carbon projects to generate carbon credits internationally: 1) the conservation and 2) restoration of coastal wetlands. While the methodologies are not restricted to mangroves, to date the only active blue carbon projects consist of mangroves only. There are no registered active projects with saltmarsh and / or seagrass ecosystems. Blue carbon constitutes a very small portion of the carbon market (Section Carbon markets and carbon trading) and as of 8 February 2024 only 14 projects were registered worldwide (Figure 5.1) – with the majority being located in Central America (project areas >1,200 ha), Western and Eastern Africa (project areas between 100 ha and > 10,000 ha) and South-East Asia (project areas >1,000 ha). Currently, the world's largest blue carbon project is Delta blue carbon (https://deltabluecarbon.com), aiming to protect and restore 350,000 hectares of tidal wetland on the south-east coast of Sindh in Pakistan. To date, only approved mangrove projects are active (Fair Carbon, 2023).

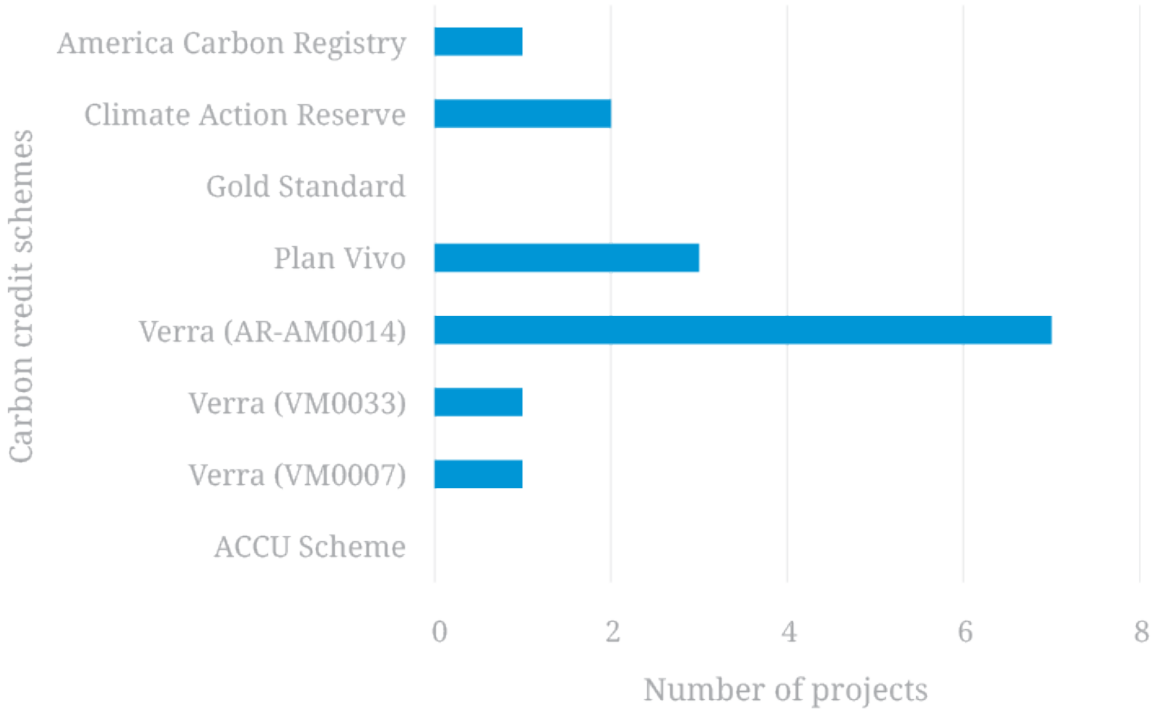

Figure 5.1 Number of registered blue carbon Projects (as of 8 Feb 2024). Source: Verra (2024), Gold Standard (2024) and ACCU registry (Clean Energy Regulator, 2024a)

Of the globally registered blue carbon projects, the predominant methodologies used are Verra's VM0033, VM0007 (being phased out) and AR-AM0014 as well as the three registered projects adopting the AR-AM0014 methodology under Plan Vivo – making Verra's Verified Carbon Standard and Plan Vivo currently the most commonly adopted standards for blue carbon initiatives. While there are no blue carbon projects currently registered with the ACCU scheme, stakeholder consultations revealed that there are two projects that may be registered in 2024 (Kondylas, pers. comm. Feb 2024).

Key questions that were investigated as part of this research topic include:

- What international voluntary carbon standards incorporate blue carbon, and what are their attributes?
- What lessons can be drawn from international application of the schemes?
- How applicable are existing international blue carbon credit schemes to the Aotearoa NZ context?
- What are the key opportunities, and challenges related to the development of a blue carbon credit scheme for Aotearoa NZ?

5 Summary of research findings

The key research findings for this topic are summarised below. Analysis and discussion of each finding are provided in the sub-sections below:

Finding 5.1: While several blue carbon methodologies exist internationally, their uptake and application are nascent and this is still an emerging area of practice. Barriers for project proponents include complexity, cost and data requirements.

Finding 5.2: Key challenges for blue carbon projects in Aotearoa NZ are: complex land tenure and carbon rights, developing national data sets as explained in Finding 1.2 and clarity on the country's position on Article 6 of the Paris Agreement regarding the sale of credits offshore. Further research and studies would overcome some of the financial barriers for projects and increase efficiency, consistency, investment and integrity and enable faster development of projects.

Finding 5.3: To create high quality credits that respect Te Tiriti o Waitangi and maximise cultural, ecological and other co-benefits, blue carbon projects in Aotearoa NZ must integrate the core carbon principles of the Integrity Council for the Voluntary Carbon Market and mātauranga Māori approaches and perspectives.

Finding 5.4: Analysis shows that Aotearoa NZ has several options to adopt existing blue carbon schemes and methodologies or develop a bespoke scheme. One combination, adopting the existing Verra blue carbon methodology with the Climate, Community and Biodiversity Standards, appears to provide multiple benefits for Aotearoa NZ: existing integrity and international reputation, ability to recognise Māori sovereignty and integration of te ao Māori and mātauranga Māori, enable holistic assessment of co-benefits and be applied at various scales.

5.1 Finding 5.1: While several blue carbon methodologies exist internationally, their uptake and application are nascent and this is still an emerging area of practice. Barriers for project proponents include complexity, cost and data requirements.

The attributes of international carbon standards and methodologies, and the Australian domestic scheme (ACCU) have been analysed and summarised, along with the lessons learnt so far from the small number of projects that are active and from sector stakeholders.

Attributes of carbon standards and blue carbon methodologies

Table 5.1 summarises the main attributes of the three crediting schemes – Verra (VM0033), Plan Vivo and ACCU scheme - along with the key characteristics of their respective methodologies. Some of these attributes (marked as bold) align with the Core Carbon Principles established by the ICVCM (refer Section 5.3), acting as a global benchmark for a high-quality carbon credits. Appendix C provides more detail on each scheme.

Table 5.1 Key attributes of the ACCU scheme, Verra and Plan Vivo

Attributes	ACCU Scheme	Verra	Plan Vivo
Methodology	Tidal Restoration of Blue Carbon Ecosystems Method 'T-Restor' (Clean Energy Regulator 2024)	VM0033 Methodology for Tidal Wetland and Seagrass Restoration "VM0033"(Verra 2023). • Earlier methods that are no longer active or are likely to be phased out in the near future are explained in Appendix C.	PM001 Agriculture and Forestry Carbon Benefit Assessment Methodology "PM001" (*PM001*, 2023). Plan Vivo is currently developing a new blue carbon methodology, specifically with marine and coastal projects in mind (Plan Vivo, 2024).
Permanence period	• Project must be maintained for a nominated period of either 100 or 25 years (Clean Energy Regulator 2024b). Period chosen affects the risk of reversal buffer applied to ACCUs - (5% for 100 years and 25% is applied if the project has a 25-year permanence period project).	• A minimum of a 40-year project longevity (Verra 2024d). • Buffer deductions for any projects that cannot demonstrate a permanence period of 100 years. Projects must evaluate the risk of loss events, such as sea-level rise. Verra provides a mandatory tool for assessing the potential future impacts on the project's carbon stocks and to determine the number of credits that need to be deposited into the AFOLU pooled buffer account. The pooled buffer account holds non-tradable buffer credits to cover the non-permanence risk associated with AFOLU projects.	• Maintenance of the carbon benefits for a period of at least 50-years (Plan Vivo 2024). • Projects must contribute 20% of their climate benefits to the Plan Vivo Non-Permanence Buffer, which remains unsold as insurance against the risk of reversal of carbon benefits. • At least 60% of the income from credit sales must directly benefit the project participants and stakeholders.
Crediting period	25 years	Minimum of 20 years and a maximum of 100 years (Verra 2024d)	Minimum of 10 years and a maximum of 100 years (Plan Vivo 2024).
Additionality requirement	Regulatory additionality requirement, to ensure sequestration projects are not eligible to receive ACCUs if those activities are already required by law (Clean Energy Regulator n.d.).	Projects must exceed the likeliest "business-as-usual" scenario and demonstrate that GHG emission reductions or removals would not occur without revenue from the sale of Verified Carbon Units (VCUs) (Verra 2021). However, if an activity is part of the 'positive list', they are deemed additional and do not require further demonstration or assessment of additionality, unless the project activities are already required by law. Wetlands are on Verra's positive list.	Additionality must be demonstrated for each Project Intervention by following the procedures in an approved Methodology. Projects are not eligible if those activities are already required by law. Additionality must be re-assessed at least every 10-years

Attributes	ACCU Scheme	Verra	Plan Vivo

Legal requirements	• Participant must have the legal right to carry out the project activities on the project site (Clean Energy Regulator 2024d), and the lawful and exclusive right to be issued all ACCUs.
	• Legal arrangements might be required to transfer the rights from the landowner to the project participant, addressing responsibilities regarding:
	  • Maintenance of the carbon stock for the required permanence period.
	  • Ongoing monitoring and reporting requirements.
	  • Ownership of carbon credits.
	  • Data sharing arrangements.
		Legal documentation demonstrating ownership or rights to the project area and its associated carbon benefits must be provided. This includes ensuring compliance with relevant land tenure laws.
		Must demonstrate the legal right to operate the project activities.
			Project description must operate in compliance with all applicable national and international policies, laws, and regulations, and with approval from the relevant authorities.
			Projects must take place within defined Project Area(s) for which the Project Participants have statutory or customary rights that enable them to implement land management activities and benefit from the sale of Plan Vivo Certificates.

Audit / reporting requirements – verification of emissions reductions by independent third-party	• The blue carbon projects require a complete audit to align with legislative requirements when the project is initially registered, alongside its first project report. • Further audits will be scheduled by the Clean Energy Regulator and the number of audits required depends on project size and abatement estimates. Most blue carbon projects will require **three audits** including one with the first report.	• GHG emission reductions and removals must be verified to a reasonable level of assurance by an accredited validation/verification body with the expertise necessary in both the country and sector in which the project is taking place (Verra 2024d). Verification is required at every monitoring period, prior to issuance of VCUs (Verra 2024d). Verifying the project frequently will increase costs but in some cases the revenue from the sale of carbon credits is used as an incentive for local communities. This could be further analysed in a robust financial model to investigate the benefits of more frequent verification periods.	• Verification is required prior to issuance of vPVCs (at minimum, every 5-years) • Annual Report must be submitted to Plan Vivo for each 12-month period throughout the Project Period. Projects producing 10,000 tCO_2e or more annually require validation by a VVB (Validation and Verification Body). PV Climate Projects generating less than 10,000 tCO_2e yearly can opt for microscale validation or use a VVB.
Transparent	Projects must be registered under the Emissions Reduction Fund project register (Clean Energy Regulator 2024c).	Projects must be listed in the Verra Registry (Verra 2024) to ensure sufficient and appropriate public disclosure of GHG- related information.	All Plan Vivo Certificates issued to a Project are recorded and tracked using the Plan Vivo Registry
Jurisdiction /applicability	National (Australia only)	Globally	Globally

Attributes	ACCU Scheme	Verra	Plan Vivo
Ecosystem	Tidal saltmarsh and mangroves, including rewetting of drained coastal wetland ecosystems and conversion of freshwater wetlands to brackish or saline wetlands.	Tidal wetlands systems (i.e. tidal forests, such as mangroves, tidal marshes and seagrass meadows).	Mangroves
Activity (restoration / protection)	ACCU Scheme is designed to encourage people and businesses to run projects that reduce emissions or store carbon, for example by: • using new technology • upgrading equipment • changing business practices to improve productivity or energy use • changing the way vegetation is managed For blue carbon, the activity under the T-Restor methods is reintroduction of tidal flow to a coastal wetland.	Restoration. Eligible activities include: creating, restoring and/or managing hydrological conditions, altering sediment supply, changing salinity characteristics, improving water quality, (re-)introducing native plant communities, and improving management practice(s).	Afforestation and reforestation, Forest restoration and protection, applicable to all types of forest including forested wetlands such as mangroves.
Activity data requirements	**Model-only approach** - the net carbon abatement from each of the soil and vegetation sequestration and emissions avoidance components of a project are calculated using BlueCAM. Calculation also needs to account for any increases in emissions resulting from the project.	Dependent on type of restoration activity, but for all activities, continued compliance with applicability conditions of the methodology must be demonstrated (Verra 2023).	Methods must identify Carbon Indicators for each relevant Carbon Pool and emission source and describe approaches for estimating Project emissions and removals achieved in each Verification Period.

Lessons from international application of the schemes

While several blue carbon methodologies exist internationally, their uptake and application are nascent. The main lessons from stakeholders from the USA, Australia and the UK who have been involved in developing blue carbon projects, are provided in Table 5.2.

Table 5.2 Lessons from international application of the schemes

Topic	Key lessons from international application
Financial	• It is important not to underestimate the time and costs involved in development a blue carbon project following any internationally available methodologies. Financial support is likely to be necessary and key for all projects using any methodology, in order to meet the monitoring, reporting and verification costs and other requirements and principles of the scheme such as community engagement. • Small projects can have disproportionately large monitoring, reporting and verification costs (Weaver *et al.* 2022, Crooks, pers. com. 2024). As a result, international standards and methodologies on an individual small scale basis in Aotearoa NZ might not be financially viable. Projects could consider adopting grouped projects (with multiple project proponents) which could reduce the operational costs per project. However, grouped projects might bring other layers of complexity, such as challenges in how best to account loss events if they occur. • Voluntary carbon project development/implementation costs are higher under any voluntary standard when compared to forestry NZU under the Aotearoa NZ ETS. The NZ ETS has simplified methodologies using emissions factors which reduces the field work and modelling required to calculate emissions reductions from a forestry plot. Carbon funds alone may not cover the costs of blue carbon projects (Weaver *et al.* 2022), therefore being able to recognise and value other benefits (such as enhancing biodiversity and wairua) could increase the financial viability of a project (refer Section 2.2 and Section 6.1).
Legal	• A clear right to carbon credits is a requirement of accreditation under any standard. Inadequate or insecure tenure and property rights are recognised as a longstanding barrier. The complex nature of land tenure and carbon rights are discussed in Section 4.
Technical	• Any scientifically valid method for measuring the carbon uptake in a coastal wetland to relatively high degree of confidence (as required for third party verification) will require fieldwork (Huxley, pers. comm. 2024). The environments are highly dynamic and involve complex interactions between water, sediment and biodiversity which all affect the site specific GHG sequestration and emissions. • Mapping and modelling requirements, especially any required hydrodynamic assessments, can be extensive and will require expertise from specialist consultancies, research organisations and or universities. • Blue carbon ecosystems are vulnerable to climate change (sea level rise, coastal erosion, flood damage) and long-term protection could become a barrier by threatening permanence requirements. Nonetheless, some of these threats could be mitigated e.g. by prioritising areas more resilient or adaptable to climate-related risks. • The definition of baselines in approved methodologies have created barriers to the use of some methodologies by project proponents. There is a need to try and keep the descriptions of baselines simple and workable to facilitate the adoption of the methodologies. To that end, Verra is moving towards a dynamic baseline rather than projected baseline in their methodology (McMahon, pers. comm. 2024) to allow projects to report climate benefits more accurately.
Scheme alignment and management	• National schemes (such as ACCU and the UK's Saltmarsh Code (in development)), can be tailored to overcome alignment issues with other national policies and schemes, potentially reduce verification costs and introduce flexibility for updates, however these require in-country management (Pontee, pers. comm, 2024).

5.2 Finding 5.2: Key challenges for blue carbon projects in Aotearoa NZ are: complex land tenure and carbon rights, developing national data sets as explained in Finding 1.2 and clarity on the country's position on Article 6 of the Paris Agreement regarding the sale of credits offshore. Further research and studies would overcome some of the financial barriers for projects and increase efficiency, consistency, investment and integrity and enable faster development of projects.

Several key challenges that must be addressed in order to develop or adapt blue carbon scheme and / or methodology in Aotearoa NZ and improve the financial viability and integrity of blue carbon projects are:

- Resolving the legal land tenure challenges to enable the acknowledgement and transfer of carbon rights within blue carbon ecosystems. As discussed in Section 4.1, legal and / or policy positions on land tenure and carbon rights in the CMA are essential for enabling an environment to catalyse private investment into blue carbon projects;
- A clear policy statement regarding Aotearoa NZ's position on Article 6 of the Paris Agreement relating to the sale of credits overseas. This will provide assurances for sellers and buyers; and
- National data sets relating to blue carbon ecosystems and associated carbon storage and sequestration (Section 1.1) and national data sets relating to climatic projections and sea level rise projections. This data is critical to improve efficiencies, provide consistency and credibility for blue carbon methodologies and reduce technical, monitoring, verification and reporting costs for projects.

5.3 Finding 5.3: To create high quality credits that respect Te Tiriti o Waitangi and maximise cultural, ecological and other co-benefits, blue carbon projects in Aotearoa NZ must integrate the core carbon principles of the Integrity Council for the Voluntary Carbon Market and mātauranga Māori approaches and perspectives.

5.3.1 Principles for High Integrity Carbon Markets

Increasing scrutiny is being placed on the integrity of carbon credits used for voluntary offsetting around the world. Buyers of carbon credits are displaying hesitancy due to concerns around the quality of credits being sold and bought in the international marketplace and scepticism of claims made in the market (VCMI, n.d.). There is a strong focus on ensuring that credits from projects represent real, additional and permanent reductions in the concentration of GHGs in the atmosphere.

The ICVCM was formed at COP26 with the ambition to set and enforce global standards for the VCM. The ICVCM aims to overcome the fragmentation and lack of transparency that currently hinders the VCM achieve these aims, the ICVCM has established 10 Core Carbon Principles (Table 5.3) that propose to act as a global benchmark for a high-quality carbon credit (ICVCM, n.d.) by establishing a consistent and standardised guide to assess the quality of carbon credits (ICVCM, n.d. a). These 10 Core Carbon Principles were created considering both the Carbon Offsetting and Reduction Scheme for International Aviation ("CORSIA") and the International Carbon Reduction and Offset Alliance ("ICROA") standards.

Table 5.3. ICVCM core carbon principles and their definition

	ICVCM Core Carbon Principles	Definition
Governance	Effective governance	The carbon-crediting program shall have effective program governance to ensure transparency, accountability, continuous improvement and the overall quality of carbon credits.
	Tracking	The carbon-crediting program shall operate or make use of a registry to uniquely identify, record and track mitigation activities and carbon credits issued to ensure credits can be identified securely and unambiguously.
	Transparency	The carbon-crediting program shall provide comprehensive and transparent information on all credited mitigation activities. The information shall be publicly available in electronic format and shall be accessible to nonspecialised audiences, to enable scrutiny of mitigation activities.

	ICVCM Core Carbon Principles	Definition
	Robust independent third-party validation and verification	The carbon-crediting program shall have program-level requirements for robust independent third-party validation and verification of mitigation activities.
Emissions Impact	Additionality	The GHG emission reductions or removals from the mitigation activity shall be additional, i.e., they would not have occurred in the absence of the incentive created by carbon credit revenues.
	Permanence	The GHG emission reductions or removals from the mitigation activity shall be permanent or, where there is a risk of reversal, there shall be measures in place to address those risks and compensate for reversals.
	Robust quantification of emission reductions and removals	The GHG emission reductions or removals from the mitigation activity shall be robustly quantified, based on conservative approaches, completeness and sound scientific methods.
	No double counting	The GHG emission reductions or removals from the mitigation activity shall not be double counted, i.e., they shall only be counted once towards achieving mitigation targets or goals. Double counting covers double issuance, double claiming, and double use.
Sustainable Development	Sustainable development benefits and safeguards	The carbon-crediting program shall have clear guidance, tools and compliance procedures to ensure mitigation activities conform with or go beyond widely established industry best practices on social and environmental safeguards while delivering positive sustainable development impacts.
	Contribution to net zero transition	The mitigation activity shall avoid locking-in levels of GHG emissions, technologies or carbon-intensive practices that are incompatible with the objective of achieving net zero GHG emissions by mid-century.

In November 2023, the Integrity Council started assessments of Carbon-Crediting Programs and Credit Categories against the Core Carbon Principles Assessment Framework. Gold Standard was the first major program to announce its application (Gold Standard, 2023) followed by Verra submitting an application to have their flagship carbon crediting program—the Verified Carbon Standard (VCS) Program—assessed (Verra, 2023b). The ICVCM has approved the VCM Program in May 2024 (Verra, 2024a) which does not include specific methodologies, these will need to be approved individually in a second step. The list of methodologies that are currently assessed by ICVCM (nd b) does not list any blue carbon related methodology.

As the global number of carbon projects continues to increase, concerns about market fragmentation, carbon credit reliability, and the transparency of project and transaction data are becoming more prominent. Therefore, it is becoming increasingly important for any crediting scheme to undergo certification against the ICVCM Core Carbon Principles. This certification ensures ongoing uptake of their methodologies when developing a project. This would apply to any new standard being developed in Aotearoa NZ or elsewhere. Furthermore, if Aotearoa NZ decides to adopt any existing standards for the development of blue carbon projects within the country, selecting a certified standard by the ICVCM will enhance the value of the project, resulting from improved credibility, transparency, and market access, thereby facilitating potentially increased investment from the private sector.

5.3.2 Other high quality blue carbon principles

In addition to the ICVCM Core Carbon Principles, other principles of high-quality blue carbon projects and markets are developing in the international blue carbon community (Conservation International *et al.* 2022, World Wildlife Fund *et al.* 2020, The Wildlife Trust *et al.* 2023) in response to improving the quality and trustworthiness of carbon or nature credits and markets; thereby maximising the potential value of credits.

These reflect good practice that has evolved from other aspects of biodiversity restoration and offsetting, nature-based solutions and natural capital markets. "*Integrity is the bedrock of nature markets. It means that credits awarded and sold for benefits such as biodiversity, carbon capture or water quality must reflect genuine, lasting and additional environmental*

*improvements, which are robustly verified and transparently documented, with no double counting or room for misleading claims or greenwas*h." (The Wildlife Trust *et al.* 2023).

These principles are aspirational for any approaches Aotearoa NZ may take to develop a blue carbon credit market (whether using an existing standard or new standard).

Safeguard nature

- Conserve, protect and restore ecosystems
- Nature-based solutions
- Adaptive management – especially to climate change
- Do no harm

Empower people

- Inclusive participation and leadership of indigenous people (Māori), local communities and vulnerable or marginalised people
- Grievance and feedback mechanisms
- 'Free Prior and Informed Consent' or FPIC with indigenous peoples
- Respect for traditional customary uses of land and resources, including carbon
- Community benefit sharing

Operate within the local context

- Engage with local partners
- Local treaties. Constitutions, policies and laws (i.e. Te Tiriti)
- Social and environmental context

High quality data and information and integrity regarding carbon accounting

- Best scientific and traditional knowledge
- Local context
- Transparent greenhouse gas accounting methods and protocols
- Accurate baseline data
- Account for additionality and avoid double accounting
- Account for durability of carbon storage and be transparent about the level of uncertainty or risk

High integrity capital

- Contracts to contain fair and transparent pricing and compensation
- Purchasers to set science-based targets for reduction, only offsetting the remaining emissions with high carbon credits

Figure 5.2 High quality blue carbon markets and projects – principles

5.3.3 Integration of Te Tiriti o Waitangi, tikanga Māori and mātauranga Māori

Blue carbon initiatives can offer significant social and indigenous co-benefits. These are particularly pronounced when projects can foster empowerment by recognising ownership or co-ownership rights of local communities and indigenous peoples (Campbell & Wehi, 2020; Moller *et al.* 2017). Additionally, these projects create employment opportunities in areas like project management, monitoring, and sustainable resource utilisation. Increased tourism and development of non-timber forest products can further stimulate economic activity.

Indigenous peoples engagement is recognised in the High Quality Blue Carbon Principles, ACCU, Verra and Plan Vivo. The High Quality Blue Carbon Principles emphasise the importance of Free, Prior and Informed Consent with indigenous peoples, respect for traditional customary uses of land, resources and carbon and to operate within the local legal context, including treaties and constitutions. Some standards, like Plan Vivo, require sharing project benefits with local communities. The Australian ACCU scheme requires projects to facilitate and enable customary harvesting and use of areas entered into the scheme. The Climate, Community and Biodiversity Standards operated under Verra provides a framework for reporting qualitative and quantitative measures that identify projects that simultaneously address climate change, support local communities and smallholders, and conserve biodiversity and as such promote excellence and innovation in project design and implementation. These transparent reporting of project benefits beyond carbon mitigate risk for investors and offset buyers and can increase funding opportunities for project developers.

The Indigenous Carbon Industry Network has just released analysis on indigenous people's participation in blue carbon in Australia and the opportunities, which concludes that indigenous people have been environmental stewards for millennia there are opportunities for active participation and benefit from blue carbon projects and Free, Prior and Informed Consent and engagement should be part of every project (ICIN, 2024).

Benefit measurement focuses heavily on quantifiable social benefits like income, employment and harvesting opportunities. However, there is a growing need to integrate culturally-specific measurements, such as those based on

mātauranga Māori principles like wairua (spiritual well-being), into monitoring, verification and reporting programmes that are developed by Māori for Māori.

By prioritising social and indigenous co-benefits, blue carbon projects can achieve a more holistic approach to environmental protection, fostering a just and sustainable future. An example of this is being developed by the Hinemoana Halo Project (Conservation International, 2023). This is a Māori-led initiative, spearheaded by Conservation International Aotearoa, exemplifies a regional approach that prioritizes partnerships with iwi and Pacific leaders (Conservation International, 2023). It recognizes iwi in their role as kaitiaki (guardians) – emphasising cultural heritage and legacy in blue carbon projects. The initiative aims to develop a bespoke blue carbon economy aligned with traditional values and community aspirations for the Pacific.

Emerging Trends:

- Premium Pricing: Projects demonstrating benefits to indigenous peoples can command higher carbon credit prices, creating financial incentives for stakeholder engagement (Pollination, 2023a).
- Indigenous Credit Systems: Research suggests potential future development of stand-alone indigenous peoples' credits, further empowering them within the carbon market (Pollination, 2023a).
- By prioritising social and indigenous benefits, blue carbon projects can achieve a more holistic approach to environmental protection, fostering a just and sustainable future.
- Partnerships in blue carbon projects, where indigenous peoples are active contributors, project leaders and beneficiaries, are essential for recognising and exercising stewardship / kaitiakitanga.
- In Aotearoa NZ, there are three areas of focus that would be essential elements of a blue carbon method:
- Te Tiriti o Waitangi: Recognition of Māori as treaty partners and the role of iwi/hāpu as kaitiaki.
- Tikanga Māori: The cultural principles and traditional practices such as rāhui and mātaitai.
- Mātauranga Māori: traditional and cultural knowledge and approaches to understanding the world, developed through observation, experience and interactions between people and the environment.

Mātauranga Māori frameworks and assessment tools are prepared by iwi/hapū and are being applied across the motu in various areas of natural resource policy and management (iwi and hapū management plans, Environmental Protection Authority (n.d.), Afoa and Brockbank (n.d.), Taura *et al.* ed. (2017), Marine Cultural Health Programme (2017). The key elements for resource management are that they are developed by local iwi/hapū with local experience and knowledge and the holistic approach encompasses the physical, cultural, social, stewardship and spiritual elements and values. Blue carbon projects should therefore have the ability to apply the principles of tikanga Māori and mātauranga Māori in the identification and measurement of values along-side scientific methods. The challenge is to allow for flexibility for the application of the methodology across the motu by local iwi/hapū, recognising that mātauranga Māori is place specific.

5.4 Finding 5.4: Analysis shows that Aotearoa NZ has several options to adopt existing blue carbon schemes and methodologies or develop a bespoke scheme. One combination, adopting the existing Verra blue carbon methodology with the Climate, Community and Biodiversity Standard, appears to provide multiple benefits for Aotearoa NZ: existing integrity and international reputation, ability to recognise Māori sovereignty and integration of te ao Māori and mātauranga Māori, enable holistic assessment of co-benefits and be applied at various scales.

While blue carbon methodologies applied in Australia require adaptation for application in Aotearoa and international programs such as Verra and SocialCarbon Standard (SocialCarbon, 2023) have high verification costs for the relatively small scale projects in Aotearoa NZ, various approaches for using existing methodologies and standards could be explored depending on the available timeframe and project readiness.

The selection of an appropriate methodology for a project hinge on various considerations such as location, national/regional regulations, project scale, cultural preferences, human resources, financial aspects, and others. Here, the team focussed on two methodologies—Verra's VM0033 (with the inclusion of the Climate Community and Biodiversity Standard to communicate the non-carbon benefits) and the ACCU scheme— for their potential ability to translate to the Aotearoa NZ context. The emerging SocialCarbon Standard also has a mangrove restoration methodology developed to similar specification of Verra which could be of interest, but the Standard has yet to demonstrate alignment with ICVCM core carbon principles, so the team have not focused on it here. Furthermore, each of these standards will accept new

methods or variations to existing methods should it been determined necessary to develop a bespoke methodology for Aotearoa NZ.

This section explores four potential options regarding application of methodologies to Aotearoa NZ:

1. modification of a relevant existing national scheme (e.g. ACCU);
2. uptake of an existing internationally applicable scheme (Verra);
3. uptake of the existing internationally applicable Verra method combined with the Climate, Community and Biodiversity Standards to meet the specific requirements/benefits of Aotearoa NZ; or
4. development of a new bespoke methodology (and scheme) for Aotearoa NZ

Exploration of the feasibility of these options and the relevant considerations are outlined below. It is important to note that the list is not exhaustive and does not replace an in-depth feasibility study, which is imperative to be conducted prior to development of any blue carbon project.

5.4.1 Option 1 Adaptation of the ACCU scheme

While the ACCU scheme itself cannot be applied in Aotearoa NZ because it is a national scheme under Australian legislation, in the following it is discussed whether the "Tidal Restoration of Blue Carbon Ecosystems method" (hereafter referred to as T-Restor) could be adapted for application in Aotearoa NZ[5]. The T-Restor methodology applies to activities that remove or modify tidal restriction mechanisms to reintroduce tidal flow, establishing a coastal wetland ecosystem (e.g. Scenario 2).

To measure the carbon impact, the BlueCAM model is used.

"The net abatement in BlueCAM is estimated based on the difference in carbon stocks and GHG emissions between the existing land use (the business-as-usual baseline) compared to the carbon sequestered and stored in the vegetation (living aboveground and belowground biomass) and the soil, and GHG emissions that occur after tidal introduction. (Phyland *et al.* n.d.)

BlueCAM follows the guidelines from IPCC Wetlands Supplement when calculating the abatement from carbon and GHG sources and sinks arising from coastal wetland restoration through tidal restoration. It uses Australian data, i.e. sequestration rates for blue carbon ecosystems found in Australia. Since coastal wetlands in different climatic regions have varying levels of carbon stocks and fluxes, BlueCAM uses different values of the parameters for each climatic region of Australia, thereby estimating regionally specific abatement when implementing coastal wetland restoration. BlueCAM can be used with national level default values, bringing the advantage that project developers would not need to collect these themselves. This provides also the opportunity for Aotearoa NZ to invest in research that can be leveraged and used to produce default factors, resulting in cost reduction of direct measurement by projects.

While BlueCAM covers various climate regions and plant types and therefore could be useful beyond Australia, it would need verification and development of locally specific data on carbon sequestration and storage for Aotearoa before it could be used with high levels of confidence (Lovelock *et al*. 2022). As a result, using BlueCAM in Aotearoa NZ would require additional research, sensitivity studies, and potentially significant amendments to confidently estimate carbon abatement from coastal wetland in Aotearoa NZ to meet the integrity standards required of the VCM.

Another requirement by T-Restor involves conducting a hydrodynamic assessment, which must detail the projected tidal inundation that will occur because of the proposed blue carbon project. This assessment should consider projected sea level rise, and project operations and maintenance plan, through to the end of the 25-year or 100-year permanence period. Any project being developed in Aotearoa NZ would need to collaborate with a third-party providing the relevant expertise in hydrodynamic modelling tailored to the specific project area and activity. Comprehensive consideration of sea level rise projections is also essential, warranting additional resources and specialized expertise to procure the necessary data

Finally, this scheme is set up for a domestic market and taking a similar approach in Aotearoa NZ limits the exposure to potential buyers. Other methodological requirements are not discussed in detail as these findings alone lead to a conclusion that significant amendments of the T-Restor methodology are required to accurately adapt a similar methodology for Aotearoa NZ.

5.4.2 Option 2 Verra – VM0033 methodology for tidal wetland and seagrass restoration

Verra's VM003 methodology outlines procedures to quantify net GHG emission reductions and removals resulting from project activities implemented to **restore tidal wetlands**. Projects applying this methodology may be developed anywhere in the world. This methodology is applicable to all tidal wetland ecosystems (i.e. tidal forests (such as mangroves), tidal

[5] Another methodology is listed on the ACCU scheme website as under development titled: "Reducing disturbance of coastal and floodplain wetlands by managing ungulates"; however, this could not be assessed as no details are available.

marshes and seagrass meadows). A 'manual' for using VM0033 is available for project developers, describing how to evaluate and set up a potential blue carbon project (Simpson 2015). While this methodology applies primarily to restoration projects (not conservation), eligible project activities include improving water quality such as reducing nutrient loads leading to improved water clarity to expand seagrass meadow, and management practices such as invasive species removal. There are specific applicability conditions to project activities and areas which are required to be met. As these are specific to potential sites and environments, the team refer to the methodology Verra (2023) instead of listing all applicability conditions here.

The 2022 blue carbon project feasibility assessment commissioned by TNC and conducted by Ekos and Cawthron (Weaver *et al.* 2022) discusses in detail the application of VM0033 in Aotearoa NZ, concluding that rewetting tidal salt marsh projects are technically and legally feasible applying VM0033 under certain project design conditions and are the most suitable for blue carbon project development in Aotearoa NZ currently. On the contrary, seagrass conservation blue carbon projects was not considered technically feasible until further data is available (for example) further data to understand the sedimentation impact on seagrass biomass and soil carbon). It is noted, however, that the impact of sea level rise on the ecosystem was not taken into account during the assessment. The VM0033 method requires the project proponent to consider expected relative sea level rise and the potential for expanding the project area landward to account for wetland migration, inundation and erosion and the project proponent must provide a projection of relative sea level rise within the project area. The methodology states that the projection of wetland boundaries within the project area will need to be presented in maps for the start of the project, the end of the project and at 100 years, taking into account sea level rise. This warrants additional resources and specialized expertise to accurate assessments. The use of expert judgment in method selection, data interpretation, and selection of input data to fill gaps in available data is well established in the IPCC 2006 good practice guidance. Seeking well-informed judgements from domain experts regarding the best estimates and uncertainties is integral to several procedures outlined in the VM0033 methodology.

While the VM0033 methodology is applicable for blue carbon projects being developed in Aotearoa NZ, a targeted, field-based feasibility study of a selected project area and coastal wetland ecosystem would provide some valuable insights around the potential challenges of the methodology, which could be transferred to other projects. While the VM0033 methodology can be applied within Aotearoa NZ and a project is technically feasible to be developed, there are additional obstacles that could impede progress, particularly concerning financial feasibility. Notably, the scale of blue carbon projects in Aotearoa NZ remains a limiting factor, inv. To mitigate this challenge, a grouped project could be considered to put forward to Verra. However, as mentioned above, this might add additional complexity.

5.4.3 Option 3 Verra – VM0033 + Climate, Community and Biodiversity Standards

A project that can demonstrate additional benefits beyond carbon sequestration can potentially command higher prices for their carbon credits, reflecting the true social value of these ecosystems and extra costs involved in delivering these co-benefits (Section 6). The Verra Climate, Community and Biodiversity Standards (Verra 2017) enables a project to monitor and account for not only carbon sequestration but also co-benefits such as enhanced biodiversity and community welfare, and cultural activities and value. As such, the most time and cost-effective approach for developing a blue carbon project in Aotearoa NZ would be to use VM0033 in combination with the Climate, Community and Biodiversity Standards. This approach would recognise the unique benefits of blue carbon projects to Aotearoa NZ, including cultural value, traditional management, and biodiversity benefits possible through the restoration/conservation of coastal wetlands. However, additional market research should be conducted to validate the assumption that co-benefit will lead to higher prices for carbon credits, i.e. assessing the cost-benefit of adding a Climate, Community and Biodiversity Standards methodology.

The Climate, Community and Biodiversity Standards are used alongside other standards to certify projects that address climate change while benefitting local communities, supporting smallholders, and conserving biodiversity.

The Climate, Community and Biodiversity Standards can be relevant for Aotearoa NZ for several reasons, including:

- Projects that adhere to Climate, Community and Biodiversity Standards can ensure meaningful partnership and benefits for local community, including iwi, integrating mātauranga Māori approaches and perspectives.
- Projects that adhere to Climate, Community and Biodiversity Standards can help promote projects that not only sequester carbon but also contribute to the conservation of Aotearoa NZ's unique and diverse ecosystems (species and habitats), addressing both climate change and biodiversity loss.
- Adopting Climate, Community and Biodiversity Standards aligns Aotearoa NZ projects with international best practices, enhancing their credibility and making them more competitive in the global VCM.
- The rigorous monitoring and reporting requirements of Climate, Community and Biodiversity Standards ensures that Aotearoa NZ projects maintain high standards of transparency and accountability, fostering trust among stakeholders and participants.

Applying the Verra VM0033 methodology together with the Climate, Community and Biodiversity Standards can provide a robust internationally recognised framework for Aotearoa NZ to develop high-quality carbon offset projects that deliver multiple benefits, enhance market value, and support the country's commitment to sustainable development and iwi rights.

5.4.4 Option 4 Develop a bespoke blue carbon methodology for Aotearoa NZ

Any bespoke blue carbon methodology for coastal ecosystems and restoration/conservation activities relevant to Aotearoa NZ would either:

- Need to be registered with and approved by an international carbon standard, such as Verra or Gold Standard, if it is to be part of the VCM. This is because Aotearoa NZ does not have its own voluntary carbon standard. Instead, Aotearoa NZ relies on international recognised standards to certify their carbon offset projects. Consequently, any bespoke methodology must comply with the requirements of the chosen international carbon standard and, to ensure high integrity, it would also need to align with the ICVSM Core Carbon Principles (refer Section 5.3). The approximate timeframe for the development of a methodology and approval by international programs such as Verra is around 2 years, which needs to be taken into account when deciding on developing a bespoke methodology for Aotearoa NZ.

Or,

- Be integrated into the NZ ETS. As discussed in Section Carbon markets and carbon trading, Complexities relating incorporation of blue carbon the ETS indicate that blue carbon is currently more feasible in a VCM.

Developing a blue carbon methodology involves significant costs, extensive scientific research and considerable time for development and approval, and requires an organisation to host, administer the methodology and register the credits, as evident by the development of the ACCU scheme. However, developing a bespoke methodology has potential to:

- Reduce verification costs, through streamlining the method to the Aotearoa NZ context specifically. For example, enabling scalability to smaller scale projects with multiple land plots and participants/beneficiaries, enabling bundling, or providing proxy values.
- Align with key aspects of the broader Aotearoa NZ policy context and legislation (and integration with the ETS if this became feasible in the future).
- Enable principles important to the Aotearoa NZ context to be integrated such as mātauranga Māori approaches and relevant co-benefits.

5.4.5 Summary of options

The pathways for implementing a blue carbon accounting methodology for projects in Aotearoa NZ include:

1. modification of a relevant existing national scheme (e.g. ACCU),
2. uptake of an existing internationally applicable scheme (e.g. Verra),
3. uptake of the existing internationally applicable Verra method and Climate, Community and Biodiversity Standards to meet the specific requirements/benefits of Aotearoa NZ, or
4. Develop a bespoke methodology for Aotearoa NZ

Given that the ACCU scheme is tailored specifically for Australia and can only be applied in Australia, using the T-Restor method as is, to earn carbon credits in Aotearoa NZ is not possible. Adapting a similar scheme in Aotearoa NZ requires national data sets and values and a host/administrator and would only be available to trade domestically. Conversely, Verra's VM0033 method has no jurisdictional restrictions and therefore offers potential applicability to blue carbon projects in Aotearoa NZ. Using VM0033 together with the Climate, Community and Biodiversity Standards could provide a pathway for application of existing schemes, while valuing community engagement, mātauranga Māori perspectives and biodiversity enhancements. A project demonstrating these additional benefits can potentially secure higher prices for its carbon credits, reflecting the true social value of these ecosystems and the extra costs of delivering these co-benefits. Development of a bespoke blue carbon methodology involves significant costs, extensive scientific research, and considerable time for development and approval.

The strengths and weaknesses of the options explored in this section are summarised in Table 5.4. The analysis found that applying the Verra VM0033 methodology together with the Climate, Community and Biodiversity Standards can provide a robust internationally recognised framework for Aotearoa NZ to develop high-quality carbon offset projects that deliver multiple benefits, enhance market value and support the country's commitment to sustainable development and iwi rights.

Table 5.4 Strengths and weaknesses of options for a blue carbon credit scheme in Aotearoa NZ

	Strengths	Weaknesses
ACCU as a template for Aotearoa NZ	• Carbon sequestration estimates based on BlueCAM which reduces costs associated with monitoring and verification. This may also lead to increased participation (Lovelock *et al.* 2023). • Low administrative burden.	• Carbon sequestration based on BlueCAM estimates are known to be conservative (Lovelock *et al*. 2023). • Would need to be registered with, and approved by, an international carbon standard, such as Verra or Gold Standard, if it is to be part of the VCM resulting in high validation/verification costs and administrative burden.
Verra	• Established framework for tidal wetland restoration. • Streamlined process for validation and verification, as it aligns with internationally recognised standards. • VCS meets the ICVCM Core Carbon Principles.	• Verra fees (required for the methodology and for the Climate, Community and Biodiversity Standards) • High validation/verification costs per project (US$60,000), independent of project area size. • Administrative burden is high, i.e. extensive documentation required such a detailed project description.
Verra and Climate, Community and Biodiversity Standards	In addition to the strengths of using a Verra methodology, the following strengths apply when, additionally, developing a project under the Climate, Community and Biodiversity Standards program: • Ensure meaningful engagement with iwi and location communities. • Account for enhancement in biodiversity. • VCS+Climate, Community and Biodiversity Standards templates are available making it easier to combine the Climate, Community and Biodiversity Standards and the VCS. • More cost effective to combine Climate, Community and Biodiversity Standards and VCS through all stages of project development and implementation.	• Verra fees (required for the methodology and for the Climate, Community and Biodiversity Standards) • High validation/verification costs, independent of project area size. • Administrative burden is high, i.e. extensive documentation required such a detailed project description.
Aotearoa NZ bespoke methodology	• May reduce project verification costs, through streamlining the method to the Aotearoa NZ context specifically. For example, enabling scalability to smaller scale-projects. • Potential to align with key aspects of the Aotearoa NZ policy context and legislation (and integration with the ETS if this became feasible in the future). • Enable principles important to the Aotearoa NZ context to be integrated such as mātauranga Māori approaches and relevant co-benefits (Pontee, pers. comm. 2024).	• Will involve significant costs, extensive scientific research, and considerable time for development and approval, and ongoing management, revisions and maintenance. • Would need to be registered with and approved by an international carbon standard, such as Verra or Gold Standard, if it is to be part of the VCM resulting in associated costs.

5.5 Conclusions and recommendations

Several options for blue carbon schemes and methods have been analysed for applicability in Aotearoa NZ. Combining the VM0033 methodology with the Climate, Community and Biodiversity Standards could provide a pathway to leverage existing schemes and lead to recognition of the full benefits of blue carbon projects in Aotearoa NZ with immediate effect. Tailored approached to measurement and monitoring of non-carbon benefits relevant in the context of Aotearoa NZ are possible under this method. This combination can facilitate iwi/hapū partnerships, incorporate mātauranga Māori perspectives, promote community engagement and acknowledge biodiversity enhancements. This would reflect the "Aotearoa NZ-ness" of a blue carbon project, potentially increasing the value of any credit generated. Of importance is that this pathway is available now. There would be no need to allocate resources and time to develop a bespoke scheme or methodologies. Another benefit is the integrity principles and international reputation of the Verra scheme and Climate, Community and Biodiversity Standards.

Recognising there are already several pilot projects underway, there is a compelling case to conduct new or additional field studies to specifically focus on key enablers:

- Enable integration of coastal wetland blue carbon into the GHG inventory and NDCs through development of a methodology that aligns with the IPCC Wetlands Supplement (refer Section 1.1).
- Investigate the applicability of VM0003 (or other methods) including understanding of the full costs of project development, registration and verification over the lifetime of the project.
- Further test the feasibility and costs of combining VM0033 and Climate, Community and Biodiversity Standards to confirm the approach which best integrates integrity principles, mātauranga Māori approaches, and co-benefits such as biodiversity and resilience.

Further detail on pilot study objectives and opportunities is provided below:

Coastal wetland integration into the GHG inventory and NDC

A pilot coastal wetland project would offer an opportunity to develop a blue carbon methodology that aligns with the 2013 Supplement to the 2006 IPCC Guidelines for National GHG Inventories: Wetlands (IPCC 2014). The project's scope would encompass a single coastal wetland ecosystem, blue carbon project such as 'restoring vegetated wetland' and specific activity such as removing tidal barries or rewetting drained wetlands. A structured pilot project would facilitate the development of a proof-of-concept for incorporating coastal wetland into the national GHG inventory by demonstrating the processes for e.g. gathering activity data, such as accurately determining the area of coastal wetland and determine sequestration rates specific to the ecosystem using field data. This approach would lead to some national data being developed reducing the reliance on default values listed in the IPCC wetland supplement, which are recognised as inappropriate for Australia's coastal wetland ecosystems (Lovelock *et al.* 2023). The outcomes of this pilot study could serve as a crucial step towards enhancing the management and protection of wetlands while also supporting the enhancement of national and international reporting. Furthermore, by aligning the estimation methodology with the GHG inventory and recognising Coastal Wetlands in the NDC, there is potential for government level financial support to become available for the protection and restoration of coastal wetlands.

Coastal wetland project development for participating in the VCM

In addition to aligning the methodological development with the national GHG inventory, the pilot project could pursue a second objective: conducting an in depth investigation of the: (i) applicability of the VM0033 method including the documentation of the challenges encountered, (ii) complexities of a hydrodynamic assessment for the specific project area, including sea level rise projections to understand the implications for the project over its lifetime, (iii) feasibility of using BlueCAM template or equivalent type of method for Aotearoa NZ, and (iv) full costs of project development, registration and verification over the lifetime of the project. This comprehensive cost assessment would provide valuable insights into the economic viability and sustainability of coastal wetland projects within the VCM. Such a pilot project has a high potential for better understanding the complex pathways and requirements involved in initiating a coastal wetland project in Aotearoa NZ, including considerations such as land tenure requirements. By addressing these multifaceted aspects, the aims of the pilot project would provide valuable guidance and support to future project developers navigating the complexities of blue carbon projects in Aotearoa NZ. Additionally, targeted data collection within the pilot project would enhance the possibility of more completely including coastal wetlands in the national GHG inventory aligned with IPCC guidance.

Māori-led study on Māori leadership, rights, participation and benefits from blue carbon projects is recommended. It could take the form of a recent study by the Indigenous Carbon Industry Network completed in Australia (ICIN, 2024) and explore the ways that Māori as kaitiaki, treaty partners, land owners, blue carbon project leaders and participants and owners of customary title and use rights can lead, participate and benefit from blue carbon.

Co-benefits

Co-benefits are the positive outcomes from blue carbon projects beyond carbon sequestration and climate mitigation. Nature-based carbon mitigation has a wide range of co-benefits (Oaten *et al.* 2022; Pollination 2023a, Shindler Murray and Milligan, 2023). Examples from the literature include:

- Socio-economic: gender equity, indigenous peoples' self determination, community empowerment and economic development, employment, social cohesion, training, economic opportunities, tourism, recreation, sense of place, wellbeing, cultural connection and values.
- Biodiversity: increased biomass, increased diversity of species, habitat restoration, species protection, pest and invasive species control.
- Ecosystem services: water quality, coastal protection, erosion and sediment control, control of ocean acidification, mahinga kai and fisheries.

Co-benefits are often separate but complimentary drivers for coastal blue carbon projects. These drivers come with their own set of goals, targets, actions and beneficiaries. For example, in Scenario 1a the drivers are also the coastal resilience and managed retreat opportunities for iwi land owners. In Scenario 2a and b the drivers are also coastal resilience and restoration of local biodiversity. In Scenario 3 the drivers are also healthy river catchments and inshore fisheries.

While the list of potential co-benefits on blue carbon projects is extensive, our research focused on the two most relevant co-benefits for Aotearoa NZ: biodiversity and resilience.

If these co-benefits are identified and valued they can be priced into the carbon credit or as a standalone credit (Figure 6.1). Co-benefits can be quantified as part of the blue carbon methodology and undergo certification to create transparency and provide quality assurances. Alternatively they can be unquantified and the value of benefits 'assumed' by the market on the basis that blue carbon is a nature-based solution to carbon storage and sequestration. Unquantified co-benefits require less monitoring, reporting and verification and are therefore less costly for project proponents. However, robust monitoring, verification and reporting provides more certainty to buyers, reduces the risk of 'greenwashing' and some buyers are willing to pay extra for the certification. There is some evidence and anecdotal reporting that there is currently demand in voluntary markets to pay more for co-benefits (Pollination 2023a). Further market analysis is warranted.

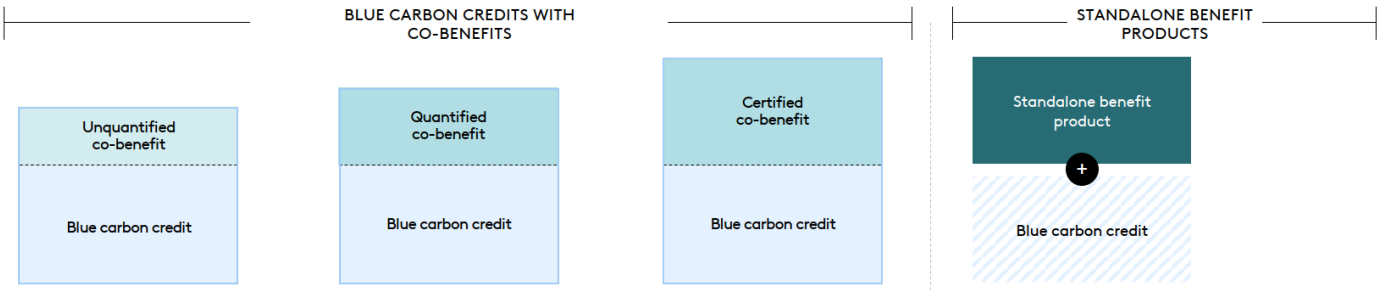

Figure 6.1 Typology of co-benefit verification associated with blue carbon credits. Source: Pollination 2023a

Co-benefits can be 'stacked' upon the carbon credit and may be measured as additional value created on the same project area, additional value created outside the project area but as a result of the project, or additional benefits achieved in a different time period. A key principle of nature-based markets is that benefits should be clearly defined and 'additional' to avoid double-accounting. Additionality requires that payments for carbon or other environmental or social benefits must be for services or benefits that would not have otherwise occurred, or to prevent a harm that would have occurred in the absence of the payment. A project owner cannot therefore be paid more than once for a particular restoration action/outcome. Defining additionality in a blue carbon method and aligning with other stand-alone schemes would provide reassurances to the market that double-accounting risks have been minimised.

Key questions that were investigated as part of this research topic include:

- How could co-benefits of coastal wetland restoration (such as biodiversity and coastal protection) be incorporated into a carbon accounting framework?
- What are the opportunities and challenges of incorporating co-benefits into a blue carbon accounting scheme for Aotearoa NZ?
- What are the best practices for assessing and monitoring the biodiversity benefits of blue carbon projects?

6 Summary of research findings

The key research findings for this topic are summarised here. Analysis and discussion of each finding are provided in the sub-sections below:

Finding 6.1: International Carbon methods include minimum standards or rules for co-benefits. Higher value outcomes for co-benefits are more likely with separate standards.

Finding 6.2: Methods for valuing and measuring biodiversity co-benefits are well-developed, for example the Climate, Community and Biodiversity Standards. Coastal resilience methodologies (e.g. SD Vista Version 1.0) are in development and could be applicable in future and would catalyse investment in nature-based adaptation benefits.

6.1 Finding 6.1: International blue carbon methods only include minimum standards or rules for co-benefits. Higher value co-benefit outcomes are more likely with separate standards that can be stacked or stapled with blue carbon in the market.

Co-benefits are somewhat integrated into existing international blue carbon methods in the format of 'minimum standards' or rules. The ACCU method T-Restor and the Verra scheme provide two examples of how co-benefits are defined and integrated. Verra has minimum requirements for indigenous biodiversity and protects biodiversity through avoiding agricultural land uses. Particular aspects of the ACCU T-Restor have been designed with co-benefits in mind including: requiring regeneration using local native mangrove or saltmarsh species and ensuring customary and traditional uses of natural resources can continue. However there are limitations to both T-Restor and Verra: they do not specifically consider the outcomes for biodiversity condition and significance or explicitly enable or require improvements in ecosystem services. Refer Appendix C for further analysis on how minimum standards for co-benefits are incorporated in the two methodologies.

Regarding resilience, Verra's Sustainable Development Verified Impact Standard ("SD Vista Version 1.0", in development) provides an approach to quantifying the annual flood risk reduction (i.e., resilience) benefits of coastal ecosystems to people. It applies to the restoration and protection of tidal marshes and mangroves and could be expanded to cover restoration and protection of other coastal habitats such as coral reefs, seagrass meadows and oyster reefs in the future. The method quantifies the number of individuals that are experiencing reduced flood risk due to the restoration or protection of coastal ecosystems. In Aotearoa NZ, much of the property and infrastructure at risk of sea level rise and coastal flooding impacts is rural, where there is low concentration of human population. The urban and peri-urban areas with higher population density have few coastal tidal wetlands and low potential for restoration through nature-based solutions. Hence, the opportunity to deliver resilience measures for coastal wetland conservation and coastal ecosystem restoration is low where the benefiting population is high, and high where the benefiting population is low, limiting the applicability of this method to Aotearoa NZ.

Using Scenario 2 to test the Table 6.1 provides analysis of how co-benefit measurement could be applied to Scenario 2, which involves removing tidal barriers in Bay of Plenty, using the ACCU T-Restor methodology.

Table 6.1 Co-benefit analysis for Scenario 2 – Bay of Plenty, applying T-Restor, ACCU methodology

Co-benefit	Pros	Cons
Biodiversity	• Weed control via thinning allowed, with biomass to remain.	• No scale of biodiversity required to be measured and no-minimum area requirements by T-Restor.

Co-benefit	Pros	Cons
	• Scenario 2 does not include the prohibited list. • Local planting will be used which is consistent with T-Restor which will improve biodiversity condition. • Limiting excavation will ensure that there is limited disturbance to remnant areas and will support a more natural soil-plant relationship.	• No requirement to measure the condition and significance of biodiversity. Using local plants, without considering biodiversity outcomes could result in low condition ecosystems (i.e. monoculture) or low significance (i.e. common plants but not rare or threatened species) or reduce the opportunity for cultural benefits (food, fibre, medicinal). • No requirement for fauna, including benthic macroinvertebrates and insects., as part of the ecosystem diversity. Focus on plants only may lead to sub-optimal ecosystem restoration. • No requirement to identify and measure ecosystem services, mahinga kai and other biodiversity values.
Resilience		• No means to identify, measure or report the resilience features of the project. • Limiting excavation to project activities doesn't explicitly allow for any earthworks required to increase resilience and may be a barrier if additional works were required.

Table 6.2 describes the opportunities and challenges associated with the following three options for incorporating biodiversity and resilience co-benefits:

- Unmeasured co-benefit requirements incorporated within the blue carbon method.
- Optional, measured co-benefits incorporated into a blue carbon credit (i.e. SD Vista Version 1.0).
- Separate credits outside of the carbon credit scheme.

A more detailed analysis regarding biodiversity is provided below in Finding 6.2.

Table 6.2 Opportunities and challenges of integrating and stacking co-benefits with blue carbon schemes

Co-benefit	Biodiversity	Resilience
Unmeasured co-benefit requirements incorporated within the blue carbon method	Opportunities: • Set minimum criteria for biodiversity outcomes but allows for flexibility by not being too prescriptive. • Keeps transaction costs lower by not requiring onerous measurements and verification. • Provides the market some assurances that this is a nature-based carbon credit with in-built minimum biodiversity requirements.	Opportunities: • Setting minimum criteria and definitions to demonstrate the project is contributing to coastal resilience (or at least not exacerbating the effects of climate change). • Allows for flexibility depending on the location and the resilience risks and vulnerabilities of the harbour/catchment/coastline. • Coastal blue carbon projects
	Challenges: • Whether minimum criteria are enough to avoid perverse outcomes such as poor condition monocultures. This balance may be challenging.	Challenges: • Defining the requirements and criteria for minimum consideration of resilience, as coastal hazards and resilience

Co-benefit	Biodiversity	Resilience
	• May need to have several codes/methods for different ecosystems, leading to complexity and cost of setting up and managing the scheme. • Requiring high value biodiversity outcomes may create financial barriers to carbon credits for some projects, reducing overall uptake of the blue carbon credit scheme.	considerations my vary widely for different contexts (e.g. urban vs rural settings)
Optional, measured co-benefits incorporated into a blue carbon credit (i.e. SD Vista Version 1.0)	Opportunities: • Price premium potential for measured co-benefits. • Projects can earn income for biodiversity without the need for another/separate scheme. • Co-benefits could be optional, and therefore not be a burden for projects where biodiversity is not a priority. Allows flexibility. • Opportunity to create high value and fully functioning ecosystems.	Opportunities: • Price premium potential for measured co-benefits, particularly from those who are most affected by coastal hazards (e.g. asset owners, local communities, insurance companies, government) • Projects can earn income for resilience without the need for another/separate scheme. • Co-benefits could be optional, and therefore not be a burden for projects where resilience is not a priority. Allows flexibility. • Opportunity to build coastal resilience.
	Challenges: • Could be seen to duplicate Aotearoa NZ biodiversity credits (see below). • A project would need to chose which scheme they prefer to use to account for the biodiversity benefits but could not do both. • Additional monitoring and verification costs may not be met by the carbon price premium, depending on the market.	Challenges: • There is no current certification framework for resilience credits (although a methodology under the SD Vista Version 1.0 program is under development). • The approach under development for SD Vista Version 1.0 applies only to restoration and protection of tidal marshes and mangroves and would need to be expanded to other coastal habitats. • The approach under development for SD Vista Version 1.0 quantifies the number of individuals that are experiencing reduced flood risk due to the restoration or protection of coastal ecosystems, which is suitable for urban settings but not applicable for the primarily rural or low-density coastal populations in Aotearoa NZ.
Separate credits outside of the carbon credit scheme	Opportunities: • DoC and MfE are developing Aotearoa NZ Biodiversity Credits. A specific methodology for coastal wetlands biodiversity credit could be aligned with blue carbon credits to enable stacking and avoid double accounting. • Increases overall quality and condition of coastal wetland ecosystems with the additional credit, rather than just meeting minimum requirements of carbon credit only. • Two or more income streams stacked together may provide additional incentives or overcome financial barriers for projects.	Opportunities: • Increases coastal resilience, as a key project driver, with the additional credit, rather than just meeting minimum requirements of carbon credit only. • Beneficial where coastal resilience is a key project driver. • Two or more income streams stacked together may provide additional incentives or overcome financial barriers for projects.

Co-benefit	Biodiversity	Resilience
	Challenges: • Additional transaction costs for stacking credits may not be cost effective, depending on the markets for both credits. • Specific coastal wetland or seagrass methodologies will be needed, but it is not yet clear whether they will be prioritised in the biodiversity credit scheme.	Challenges: • There is no current certification framework for standalone resilience credits, applicable to Aotearoa NZ.

The challenge for blue carbon methodologies to achieve multiple goals: provide the market with some certainty about the quality of nature-based solutions, enable site-specific flexibility for the project proponent and to minimise transaction costs. The analysis demonstrates that the current practice in international standards is to provide minimum standards for selected co-benefits, typically biodiversity and traditional values and uses. Minimum standards for co-benefits appears to address these multiple goals and reduces the costs and complexity that would otherwise be barriers to developing blue carbon projects. However, this approach also may lead to sub-optimal carbon prices, where premiums are not realised because of a lack of evidence of co-benefits (unmeasured), or the quality or value of co-benefit outcomes are low. Perverse outcomes can occur in circumstances where ecosystem function and diversity are compromised by maximising carbon sequestration and storage.

The minimum standards enable co-benefits to be measured and 'stacked', either through an optional method as part of the blue carbon credit scheme, or as a standalone credit such as biodiversity or resilience credit. Additionality of co-benefits can be measured separately and there is less likelihood of double-accounting. Separate and optional co-benefit measurements and credits provide flexibility to project proponents, allowing them to evaluate the financial costs and benefits and can provide incentives to obtain higher quality co-benefit outcomes.

6.2 Finding 6.2: Methods for valuing and measuring biodiversity co-benefits are well-developed, for example the Climate, Community and Biodiversity Standards. Coastal resilience methodologies (e.g. SD Vista Version 1.0) are in development and could be applicable in future and would catalyse investment in nature-based adaptation benefits.

Biodiversity co-benefits are inherent in most, if not all, nature-based carbon mitigation projects including coastal blue carbon projects. Biodiversity co-benefits can be assumed/estimated or they can be quantified (e.g. 'Climate Community and Biodiversity Standards' (Verra 2017)).

Standalone biodiversity credits are being developed through several schemes, although the markets are nascent. As reported in Pollination (2023a), they vary from government schemes to schemes developed by NGOs and social enterprises:

- Queensland's Land Restoration Fund
- Accounting for Nature, GreenCollar's NaturePlus Credit
- Wallacea Trust
- ClimateTrade and Terrasos
- In development: Plan Vivo's Biodiversity Standard
- In development: Verra's Sustainable Development Verified Impact Standard (SD Vista Version 1.0) (for coastal resilience)

MfE and DoC are currently consulting on a Biodiversity Credit Scheme for Aotearoa NZ. Broad concepts have been presented for comment, such as: the integration of mātauranga Māori, types of ecosystems that they could cover, types of land ownership, types of biodiversity gains and management activities, permanence or duration of the credit, how a scheme could be set up and managed and the role of government. Early outcomes from the biodiversity credit scheme consultation process indicate that monetising biodiversity values in Aotearoa NZ may not be acceptable to some iwi, non-governmental organisations and other parts of the community. Ekos has addressed this concern by explicitly valuing the restoration effort (such as labour, materials) in the price of their 'sustainable development credit'.

A Biodiversity Credit Scheme would be designed to cover a broader spectrum of ecosystem protection and restoration projects across the motu and it is not yet clear whether there will be specific methods for specific ecosystems, or whether generic standards will be applied. In either case, it is likely that a standalone biodiversity credit scheme could be stacked with a blue carbon credit scheme if the additionality could be identified and aligned.

One of the key questions is whether biodiversity co-benefits can be measured and how that can be captured in a blue carbon scheme. There are numerous approaches in a large body of knowledge from ecological impact assessment, environmental impact assessment, strategic environmental and social assessment, biodiversity offsetting, state of the environment monitoring, biodiversity credits and nature-positive accounting (such as taskforce for nature-related disclosures). The principles are universal and well-developed and can be adapted and applied to coastal blue carbon projects and the measurement of biodiversity co-benefits.

A detailed analysis of the body of knowledge on high quality biodiversity co-benefits, their application in Aotearoa NZ, and mātauranga Māori approaches is provided in Appendix D. The analysis demonstrates that there is significant body of knowledge that can be applied to blue carbon biodiversity co-benefits, both in terms of scientific knowledge and local mana whenua knowledge. Specific and standard methods to measure the values and condition of coastal wetlands has not yet been developed in Aotearoa NZ, but can be developed from the existing approaches to measurement such as state of the environment monitoring, existing approaches to condition evaluation through RMA assessments of effects on the environment, from mātauranga Māori and from ecological impact assessment guidelines such as those in development by EIANZ. Separate standards / schemes are likely to have greater biodiversity outcomes because they can be specific to the ecological needs at the location and specific to the goals of the project proponents.

6.3 Conclusions and recommendations

Ensuring biodiversity, climate resilience and social standards are integrated to blue carbon projects, without burdensome costs, is considered a key goal for any blue carbon credit scheme in Aotearoa NZ. Integration principles align with international best practice for blue carbon and with the holistic values embedded in te ao Māori. Based on current international practice, minimum co-benefit standards appear to provide sufficient market certainty of the quality of the nature-based carbon credit while allowing for stacking of co-benefits via separate measurement methods. Further observations on this as the markets mature is recommended.

- When selecting and implementing blue carbon methodology(ies) for use in Aotearoa NZ, as described in Section 5.3, the recommendation is to integrate minimum standards for indigenous biodiversity and coastal resilience co-benefits. This approach avoids complexity and potential for double-accounting by focusing on the key elements only, while still ensuring that projects are fundamentally based on protecting and restoring indigenous natural habitats and ecosystem function.
- Recommend, when developing the minimum indigenous biodiversity standards in the blue carbon methods, to align with the proposed Aotearoa NZ biodiversity credit scheme. The purpose of the collaboration is to identify and manage additionality and double-accounting risks and maximise the ability for projects to stack carbon and biodiversity credits.
- A specific, standard methodology for measuring the biodiversity values and condition of coastal wetlands in Aotearoa NZ is recommended for biodiversity co-benefits. Recommend research and development of a coastal wetland biodiversity method that integrates scientific methodologies and mātauranga Māori. This standard can be developed as an optional method within a blue carbon scheme or as an ecosystem-specific standard for the biodiversity credit scheme. A specific methodology is recommended due to the uniqueness and complexity of the coastal wetland ecosystems.
- Recommend that blue carbon guidelines are prepared that contain specific guidance on stacking and additionality in the Aotearoa NZ context.
- Recommend further research on the potential for other relevant nature-positive benefits to be valued and integrated or stacked with blue carbon, such as water quality and inshore fisheries.

Gaps and limitations of the policy research

The research identified the significant breadth of opportunities, barriers and enablers for blue carbon in Aotearoa NZ based on lessons that are emerging from overseas policies and markets. The analysis presented in this report was limited by the scope of work and availability of relevant research and data.

Cross topic themes

- Blue carbon projects, methodologies, markets, integrity principles and best practice guidance are new and developing rapidly. Much of the research and grey literature reviewed by the team was published within the last two years and some within the time period of this research. The team acknowledge that there will be recent or concurrent research that has not been integrated into this report due to timing.
- The scope of work did not include a full assessment of the aspirations, benefits, opportunities and barriers for Māori, nor provide specific analysis on the integration of te ao Māori (tikanga Māori, mātauranga Māori) into a blue carbon scheme. Iwi engagement was beyond the scope of work. This work is, however, considered critical for the development of blue carbon in Aotearoa NZ and will be necessary in future stages of policy research and analysis.

Greenhouse gas inventories and NDCs

- During the course of this project, Australia has released their updated their National GHG Inventory for 2022 (National Inventory Report 2022, Volume 2) in April 2024. The project team did not review the updated GHG inventory to examine any updates and improvements they might have included with respect to coastal wetlands and as mentioned in their National GHG inventory from 2021.
- A broader consultation with government stakeholders responsible for creating the national GHG inventory and providing the required data and information would be beneficial for a more in-depth discussion on the challenges of including new categories in the inventory.
- The research team did not have an in-depth conversation or engagement with MfE to discuss the government's perspective on including coastal wetlands in the GHG inventory or their views on investing in coastal wetland research to address some of the knowledge gaps identified in this project.

Carbon markets and carbon trading

- It has been difficult to estimate the exact cost of blue carbon projects due to the unavailability of transaction data.
- Carbon trading firms have tended to regard their view on market dynamics as commercial-in-confidence or intellectual property that they have not been willing to share. Therefore, understanding of the nuances of market can be annotatable rather than linked to verifiable data.
- This research analysed the ETS based on past and current management and performance, including commentary from recent consultations, but did not analyse potential changes to the scheme and the implications for blue carbon. If any substantial changes are made to the ETS then new research and analysis would be required.
- This assignment was limited to understanding the market barriers and opportunities but could not address all aspects of market development. Further research and analysis of VCM and ETS is necessary.
- Overall there remains uncertainty as a result of the limited scope of the research, limited access to transaction data, the early stages of blue carbon projects and markets globally and the future of the ETS. Further options analysis is recommended.

Environmental policy and law

- Aotearoa NZ is a party to a range of international treaties and conventions which put pressure on Aotearoa NZ to take action on climate change, including a preference for nature-based solutions. These include:
- Kunming-Montral Global Biodiversity Framework
- Ramsar Convention on Wetlands
- Advisory Opinion from the International Tribunal for the Law of the Sea

This project was limited and could not analyse the barriers and enablers of these frameworks and conventions.

- The team has focussed on key legislation in this assignment and recognise there may be other legislation and regulations that may be barriers or enablers of blue carbon at the project level or at the national level e.g., Queen Elizabeth the Second National Trust Act, 1977 and Soil Conservation and Rivers Control Act 1941.
- The coalition government has signalled that there will be changes to the RMA. There has been no indication that these changes will create barriers or enablers for blue carbon and therefore any commentary would be speculative.
- No detailed assessment of the Fast-track Approvals Bill has been undertaken however it has potential to reduce approvals complexity for blue carbon projects where projects are located on multiple land titles and land below MWHS where numerous statutes such as the Conservation Act 1987 and Wildlife Act 1953 might apply.
- The planning assessment has only considered three discrete districts, based on the scenarios, as a sample of the regional and district planning framework. It is well-understood that plans vary significantly across the regions and districts in Aotearoa NZ and therefore there is no guarantee that the sample is representative. More than one plan may apply to individual sites that are located across district or regional council boundaries. To avoid unnecessary complexity for the Scenario analysis, some overlays have not been considered in detail.

Coastal land tenure and carbon rights

- Given the complexity and historic controversy of customary title and the CMA, and the implementation of the MACA Act, the scope of this study was not able to adequately articulate all of the issues, nor provide clear resolutions.
- **Absence of a dedicated regulatory framework:** Presently, there is no specific regulatory framework for blue carbon rights in Aotearoa NZ. This makes it difficult to ensure consistency and fairness in the allocation of rights, particularly in relation to Māori interests.
- **Unclear legal framework for customary rights and carbon rights:** The current legal framework for land tenure and carbon rights does not adequately recognise or integrate customary title and kaitiakitanga (guardianship) principles. This lack of clarity creates uncertainty for iwi participation in blue carbon projects.
- **Limited guidance on dynamic tidal areas:** The legal implications of shifting coastlines due to erosion, inundation, or climate change on land tenure and carbon rights remain unclear. This lack of guidance poses challenges for long-term blue carbon projects.
- **Uncertainties in applying existing frameworks:** Adapting existing regulatory frameworks, such as the ETS, to accommodate blue carbon raises uncertainties. For instance, the ETS currently only recognizes carbon sequestered on terrestrial trees, and it's unclear how to integrate blue carbon sequestration into this system.
- **Limited consideration of co-management and benefit Sharing:** The current regulatory framework lacks clear mechanisms for co-management of blue carbon projects and equitable benefit sharing with iwi communities. This can be a significant disincentive for iwi participation.
- Due to the limited scope, the team has not included or undertaken an in depth analysis of the law in relation to accretion and erosion and its impact on land tenure rights. However, this is relatively well settled law, with outcomes being dependent on the specific fact/circumstance.

Blue carbon schemes and methodologies

- The research team did not conduct an in-depth investigation into the detailed requirements of the Verra VM0033 methodology. To fully understand the applicability of the Verra methodology and standard, a step-by-step assessment is required for a specific project area. This includes a detailed feasibility study and an evaluation of coastal wetland ecosystem activities to ensure that all aspects of the methodology and standard can be met.
- As stated in Kelleway *et al.* (2020), VCS VM0033 method had been designed for broad implementation, however, may not align with the carbon accounting, reporting and policy requirements of national governments. The research team did not conduct an in-depth investigation into how VM0033 might align (or not) with specific requirements of the Aotearoa NZ government. This is something to be looked into in future and could even be part of the case study.

- The research team did not consider the proposed method "Reducing disturbance of coastal and floodplain wetlands by managing ungulates" which is being developed in the Northern Territory (Australia) by the Northern Australian Indigenous Land and Sea Management Alliance. This method addresses the management of ungulate species that contribute to GHG emissions from coastal and floodplain wetlands through trampling, pugging, rooting, wallowing in wet soils, and grazing of wetland vegetation. Currently, no detailed information about this method is available. However, it could potentially be relevant to Aotearoa NZ and warrants further investigation in the future.
- There are opportunities for blue carbon projects to utilise co-benefit standards such as Climate, Community and Biodiversity Standards, SD Vista Version 1.0 and others to capitalise on the value of their co-benefits. This study looked at Verra and Climate, Community and Biodiversity Standards and concluded this is a valid and proven pathway that could be used in Aotearoa NZ. Other standards may also be valid but were not studied in detail in this research. There is some value in a future research study to look into various co-benefit standards and their link to the market's willingness to pay more for credits with measurable co-benefits.

Co-benefits

- Iwi / hāpu leadership, participation and benefit sharing has been considered an integral part of blue carbon schemes under the analysis of methodologies rather than considered as a 'co-benefit'. The 'indigenous peoples' principles for VCMs have been considered under Section 5.3 and elsewhere in this report where relevant.
- There is a significant body of research on a number of other co-benefits such as water quality, fisheries, socio-economic, community and gender equity that were scoped out of this study. There is potential to examine co-benefits in more detail in future analysis and research on blue carbon methodologies and VCM principles and guidelines.
- The scope of work did not include the analysis of the potential market mechanisms for stacking and stapling of co-benefits.

Recommendations

The policy research has yielded two streams of recommendations, included in Table R.1.

- **Priority recommendations:** Areas of work considered critical to enabling a blue carbon market. These are considered the essential 'building blocks' to enable carbon rights to be granted and traded in a manner that respects Te Titiri o Waitangi and maximises the benefits to land owners, communities and iwi / hapu to benefit from blue carbon projects.
- **Enabling recommendations:** Further actions that are necessary to scale up blue carbon and maximise the conservation, cultural, resilience and social benefits of protecting and restoring coastal wetlands. These can be implemented in parallel to the priority recommendations or are secondary actions that naturally follow the critical actions.

Table R.1 Recommendations from the policy research

Recommendation	Description and links to the findings
Priority Recommendations	
P1 Develop a Blue Carbon Strategy or Road Map for Aotearoa NZ *Responsibility: to be determined.*	Develop a strategy or road map with suggested pathways for developing the various regulatory and non-regulatory elements required for enabling blue carbon projects and at scale. Consider the roles and responsibilities of government, private sector, iwi and non-governmental organisations. This recommendation reflects the outcomes of recent, collaborative work by the emerging coastal wetland blue carbon community of practice and is relevant across all research themes.
P2 Māori-led study into the barriers, opportunities and benefits of blue carbon for Māori. *Responsibility: to be determined.*	There is a clear role for Māori in blue carbon as treaty partners, land owners, kaitiaki and owners of customary title and customary use of coastal marine areas. During stakeholder hui it was acknowledged that it is time to begin engagement with iwi. A Māori-led study is recommended to understand the aspirations, barriers, opportunities and benefits for Māori and how these can be integrated into ongoing research, policy making, tools, markets and projects. The scope would include engagement with iwi across the motu. It is recommended the study also address the partnerships and benefit sharing between iwi and hapū and other blue carbon project partners (land owners, councils, Department of Conservation, community groups). The study would build on the 'Blue carbon futures in Aotearoa NZ: Law, climate, resilience' research by University of Canterbury and te iwi o Ngāi Tahu. Māori sovereignty, kaitiaki and customary use of the coastal marine area is relevant across all research themes. Findings 4.1 and 4.2 identify the importance of te Tiriti o Waitangi, kaitiaki and customary title and use in the granting of carbon rights. Finding 5.3 identified the importance of te Tiriti o Waitangi and te ao Māori in blue carbon methodologies. Finding 5.3 refers to a similar study carried out recently in Australia.
P3: Develop clear guidance and / or regulatory tool to grant carbon rights in the coastal marine area. *Responsibility: Government, Māori* *Engagement: land owners, councils, community groups*	Explore regulatory and non-regulatory options for granting rights to blue carbon created in coastal environments in the context of te Tiriti of Waitangi, Māori customary rights and uses and the absence of land title below mean high water springs. It is also recommended to explore and develop guidance and / or tools for granting of blue carbon rights to land with title above mean high water springs. Some options have been considered in this research project but each requires in depth analysis and potential pathways, and there may be more options and tools to be identified. Pilot projects can be used to test approaches. This work is connected to P2 and will take time as it relates to resource rights in an environment with legal, social, cultural and ecological complexity. An interim step may be to develop guidance and tools for granting carbon rights to non-forestry, nature based sequestration and storage on land with title above mean high water springs.

Recommendation	Description and links to the findings
Priority Recommendations	
	A national approach to granting carbon rights will provide consistency and clarity which is expected to reduce barriers to developing blue carbon projects and provided the integrity assurances to carbon credit purchasers. Finding 4.1 highlights the potential risks and barriers to granting carbon rights to any individual, organisation, iwi or hapū below mean high water springs. Land below the mean high water spring can generally not be owned due to the lack of land title. Land that was previously above the mean high water spring and re-flooded can have title, although this is not guaranteed in perpetuity. Barriers also exist due to the absence of tools to grant carbon rights from other nature-based carbon sequestration that is not forestry. Finding 4.2 highlights the significant importance of Te Tiriti o Waitangi in granting such rights. Findings 2.2 and 5.2 highlight that markets require carbon rights to be clear for credits to be created and traded and give buyers confidence. Findings 4.2, 5.2 and 5.4 highlight the importance of a partnership between government and Māori and the principles of Te Tiriti o Waitangi in preparing suitable carbon methodologies for measuring, owning, trading and benefiting from coastal wetland carbon. This recommendation requires leadership from the government, Māori and communities to work collaboratively and requires further research and analysis into the legal, policy and non-regulatory tools and approaches.
P4: Create an enabling environment for the voluntary market to operate in Aotearoa NZ *Responsibility: Government*	This study concluded that a voluntary carbon market, with access to international trading, is more likely to facilitate the development of blue carbon projects at scale by creating high integrity carbon credits and access to a large pool of credit buyers. There remains uncertainty due to the limited scope of the research, limited access to transaction data, the early stages of blue carbon projects and markets globally and the future of the Emissions Trading Scheme*. The research has identified the potential enabling conditions to enable blue carbon projects to happen successfully at scale in Aotearoa NZ, such as: endorsing best practice guidance relating to high integrity, benefit sharing and equitable approaches and policy clarity with regard to Article 6 and the sale of carbon credits offshore (see P5 below). Further analysis is recommended to build on this initial analysis focusing on the enabling conditions, implementation steps, policy tools, guidelines, roles and responsibilities and costs of international voluntary carbon market. This research can address the role of government and regulation and the implications for achieving blue carbon projects at scale. The analysis could take a staged approach and reduce barriers for blue carbon projects to meet existing international voluntary carbon market requirements and methodologies in the short term while looking at longer term options such as a domestic voluntary carbon market if that is feasible. It would build on the pilot studies and research already underway as discussed in the report. Findings 2.1 and 2.2 indicate that voluntary carbon markets are likely to have greater benefits to projects and to scaling blue carbon compared to the domestic Emissions Trading Scheme. Access to offshore buyers who would be interested in high quality, nature-based credits from Aotearoa NZ would further accelerate the opportunity. **If the Emissions Trading Scheme conditions change then approaches for integrating blue carbon could be considered in future.*
P5 Paris Agreement Article 6 policy clarity. *Responsibility: Ministry for the Environment, Ministry of Foreign Affairs and Trade*	To avoid any confusion or barriers in the ability of blue carbon projects to access offshore markets the government can provide clarity on the country's commitments under the Paris Agreement Article 6 as a key enabler for a voluntary carbon market. Article 6 allows countries to trade their carbon credits but there must be a system in place to enable that to happen and to account for it to avoid double-accounting and to ensure there are no adverse or perverse implications for Nationally Determined Contributions.
Enabling Recommendations	

Recommendation	Description and links to the findings
Priority Recommendations	
E1: Research to prepare and maintain national data sets for emissions factors and detailed habitat mapping. *Collaborators: government, research organisations, councils, iwi, community groups, non-governmental organisations*	If the government prioritises the inclusion of quantitative data on coastal wetlands and blue carbon into the Greenhouse Gas Inventory and Nationally Determined Contributions, further research is recommended to prepare and maintain the emissions factors, activity data and detailed habitat mapping and hydrodynamic modelling required to quantify the net emissions on a national scale. As per Finding 5.2, national approaches to data set development and maintenance will also reduce the barriers to entry, facilitate investment in blue carbon and increase the integrity and consistency of blue carbon projects. There are numerous co-benefits to increasing the scientific knowledge of the location and extent of coastal wetlands and the blue carbon emissions factors in the Aotearoa NZ context (Findings 1.2, 5.2), whether or not the government decides to include the potentially small volume of blue carbon into the Greenhouse Gas Inventory and Nationally Determined Contributions. For example these data sets are valuable for coastal resource management under the Resource Management Act, Conservation Act and future National Adaptation Plans and Emissions Reduction Plans. Furthermore, inventory methods can be gradually refined, by incorporating site-specific data once available to improve the accuracy of emissions estimates from coastal wetlands in Aotearoa NZ. This work requires leadership by the government and collaboration with research organisations, councils, non-government organisations and the broader blue carbon community.
E2: Inclusion of coastal wetlands in the NDC as a qualitative commitment *Responsibility: Ministry for the Environment, Ministry of Foreign Affairs and Trade*	Include qualitative commitments for coastal wetlands in the Aotearoa NZ Nationally Determined Contributions to acknowledge the role as nature based solution for climate change adaptation. This will encourage confidence in the investment in coastal restoration and demonstrate commitments to our Pacific neighbours and the wider international community. The research Finding 1.2 demonstrates the broader benefits of the government signalling coastal wetlands in the Nationally Determined Contributions. This recommendation is a 'no regrets', short term policy action by the government, which aligns with the global trends, and does not commit the government to include quantitative blue carbon emissions reductions in the meantime.
E3: Review and update key parts of the Resource Management Act* regulatory framework *Responsibility: Ministry for the Environment*	Research indicates that the Resource Management Act* has some regulatory barriers that may create unnecessary cost and complexity to blue carbon projects. The Resource Management Act could be a tool to grant carbon rights. Several reviews are recommended: E.1 Conduct a review of the detail of the National Environment Standards for Freshwater Regulations 2020 on three key points: • Whether the purpose of works needs to be expanded to refer to carbon sequestration • Whether the definition of *natural inland wetland* is too narrow, or in fact whether the permitted regulation 38 should simply apply to all wetlands, and • Whether the permitted pathway for maintenance and restoration can be replicated for blue carbon/coastal wetlands below Mean High Water Springs. E3.2: Conduct a review of the National Policy Statement for Freshwater Management and New Zealand Coastal Policy Statement as they relate to blue carbon projects, to provide enabling conditions, drive consistency where possible throughout Aotearoa NZ, and enable scalable replication. E3.3: Review of activity category/consent types in the Resources Management Act relating to blue carbon restoration and protection – to investigate further enabling options including carbon rights. Finding 3.1 is clear that more targeted, enabling policy will reduce the barriers to developing blue carbon projects.

Recommendation	Description and links to the findings
Priority Recommendations	
	**Any future versions of the Resource Management Act can consider similar enabling policies.*
E4: Review the Conservation Act and / or Reserves Act *Responsibility: Department of Conservation*	Recommend a review of the purpose of the Conservation Act and / or Reserves Act to unlock the potential for coastal wetland blue carbon projects located on land managed under the Acts. Blue carbon could be enabled through reforms to those Acts and the scope of the statutory instruments that implement them. Findings 3.1 and 3.2 identified the complexity of the regulatory framework generally, and with the narrow purpose (protection of ecosystem values) of these Acts specifically. To reduce the regulatory barriers to blue carbon, clarity and alignment is required on the purpose of coastal wetland blue carbon projects and any commercial activity or income derived from carbon credits.
E5: Research and mapping customary rights *Responsibility: to be determined.*	Conduct collaborative research, in partnership with iwi and communities, to map the extent and nature of customary rights (and claims) in the coastal marine area in relation to the potential implementation of blue carbon projects. This would provide more clarity on the potential rights to carbon and the nuances of layering of legislation in the coastal marine area across the motu. This could also provide visibility on the potential scale of opportunities for iwi.
E6: Best Practice Guidelines for blue carbon in Aotearoa NZ *Responsibility: to be determined*	Prepare guidance to reduce entry barriers and transaction costs for project proponents when applying international voluntary carbon market methodologies and meet Integrity Council for the Voluntary Carbon Market integrity principles in an Aotearoa NZ context. Topics may include: navigating the regulatory policy and planning frameworks, carbon rights and benefit sharing, stakeholder engagement protocols and other cultural, social and environmental aspects unique to Aotearoa NZ. The purpose is to make it easier for communities, land owners, iwi, councils and other potential project proponents to understand and implement the methodologies, reduce entry barriers and therefore increase the potential for blue carbon at scale. This will also help to build the capability and capacity of the subject matter experts that can support projects such as scientists, legal advisors, planners and engineers.
E7: Pilot studies to inform application of the Verra methodology for specific application in Aotearoa NZ *Responsibility: to be determined.*	There are several pilot projects trialling blue carbon methodologies and potential market development. There is value in using pilot studies to test specific aspects of relevant methodologies, with objectives to build the body of knowledge, better policy and accelerate blue carbon investment: • Enable integration of coastal wetland blue carbon into the Greenhouse Gas Inventory and Nationally Determined Contributions through estimation approaches that align with the Wetlands Supplement to the Intergovernmental Panel on Climate Change Guidelines. • Test the feasibility of the "Verra + Climate, Community and Biodiversity Standards "blue carbon methodology, and confirm an approach which integrates integrity principles, mātauranga Māori approaches, and biodiversity values with minimum standards for co-benefits such as biodiversity and resilience. • Understand the full costs of project development, registration and verification to Verra (or other international voluntary carbon standard) over the lifetime of the project.
E8: Further explore and develop the standards and methodologies to enable the measurement and value capture of co-benefits such as biodiversity and coastal resilience.	E8.1 Collaborate with Ministry for the Environment and Department of Conservation to align blue carbon methods with the proposed Aotearoa NZ biodiversity credit scheme to enable stacking and to manage risks of additionality and double accounting. E8.2: Test/assess emerging co-benefit methodologies such as coastal resilience and otherwise invest in country-specific methodologies if these are not considered appropriate for Aotearoa NZ context.

Recommendation	Description and links to the findings
Priority Recommendations	
Collaborators: government, project developers, emerging coastal wetland blue carbon community of practice members.	E8.3 Conduct further research on the potential for other relevant co-benefits to be valued and could provide additional income such as water quality, fisheries and other nature-positive outcomes and or cultural/social benefits as defined by the participating communities. The rationale is to maximise the opportunities for project proponents to attract additional income or investment and improve the financially feasibility of projects. Additionally, reducing the barriers to co-benefit value capture can accelerate the overall scale and effort of coastal restoration and incentivise higher value outcomes of projects.

References

ACR (2017). Methodology for the Quantification, Monitoring, Reporting and Verification of Greenhouse Gas Emissions Reductions and Removals from the Restoration of California Deltaic and Coastal Wetlands. Version 1.1. ACR for Environmental Resources Trust LLC.

Afoa E., Brockbank, T. (n.d.). *Reflecting Mātauranga Māori in Water Sensitive Urban Design*. Retrieved from https://nuwao.org.nz/wp-content/uploads/2024/05/Attachment-1.pdf

Australian Bureau of Statistics. (2022, November). *National Ocean Account, Experimental Estimates.* ABS. https://www.abs.gov.au/statistics/environment/environmental-management/national-ocean-account-experimental-estimates/latest-release.

Bulmer R.H., Sinclair-Stewart P., Lam-Gordillo O., Mangan S., Schwendenmann L., Lundquist C.J (2024). Spatial Variability in Blue Carbon Habitats in Aotearoa New Zealand – Opportunities for Conservation and Restoration. *Restoration Ecology*, in review.

Campbell, C., and Wehi, P. M. (2020). *Indigenous Rights and Blue Carbon: Navigating the Ethical Landscape*. Ocean Yearbook, 34(1), 369-393.

Carmody (2024). *Blue Carbon Review of State Laws NSW and QLD.* Report No. 2023/19. Sydney. Restore Blue.

CDM (n.d.). *Afforestation and reforestation of degraded mangrove habitats—Version 3.0*. AR-AM0014. Retrieved from https://cdm.unfccc.int/methodologies/DB/KMH6O8T6RL3P5XKNBQE2N359QG7KOE

Claes, J., Hopman, D., Jaegar G., and Rogers, M. (2022). *Blue Carbon: The Potential of Coastal and Oceanic Climate Action.* Report. McKinsey and Company. May. Retrieved from https://www.mckinsey.com/capabilities/sustainability/our-insights/blue-carbon-the-potential-of-coastal-and-oceanic-climate-action#/download/%2F~%2Fmedia%2Fmckinsey%2Fbusiness%20functions%2Fsustainability%2Four%20insights%2Fblue%20carbon%20the%20potential%20of%20coastal%20and%20oceanic%20climate%20action%2Fblue-carbon-the-potential-of-coastal-and-oceanic-climate-action-vf.pdf%3FshouldIndex%3Dfalse

Clean Energy Regulator (2022). *Supplement to the Carbon Credits (Carbon Farming Initiative – Tidal Restoration of Blue Carbon Ecosystems) Methodology Determination 2022*. Retrieved from: https://cer.gov.au/document/supplement-to-2022-blue-carbon-method

Clean Energy Regulator (2024) Tidal Restoration of Blue Carbon Ecosystems Method. https://www.cleanenergyregulator.gov.au/ERF/Choosing-a-project-type/Opportunities-for-the-land-sector/Vegetation-methods/tidal-restoration-of-blue-carbon-ecosystems-method#Project%20activities%20and%20eligibility%20requirements

Clean Energy Regulator (2024a). Quarterly Carbon Market Report December Quarter 2023. Retrieved from: https://cer.gov.au/markets/reports-and-data/quarterly-carbon-market-reports/quarterly-carbon-market-report-december-quarter-2023

Clean Energy Regulator (2024b). Permanence Obligations. https://www.cleanenergyregulator.gov.au/ERF/Choosing-a-project-type/Opportunities-for-the-land-sector/Permanence-obligations

Clean Energy Regulator (2024c) ACCU project and contract register. https://cer.gov.au/markets/reports-and-data/accu-project-and-contract-register?view=Projects

Clean Energy Regulator (2024d) Plan your project. https://cer.gov.au/schemes/australian-carbon-credit-unit-scheme/how-participate/plan-your-project

Clean Energy Regulator (n.d.) Newness, regulatory additionality and government program https://cer.gov.au/schemes/australian-carbon-credit-unit-scheme/how-participate/apply-participate/newness-regulatory

Climate Action Reserve (2022). *Mexico Forest Protocol Version 3.0*. Retrieved from https://www.climateactionreserve.org/how/protocols/ncs/mexico-forest/

Climate Change Commission (2021). *Ināia Tonu Nei a Low Emissions Future for Aotearoa. Advice to the New Zealand Government on its first three emissions budgets and direction for its emissions reduction plan 2022 – 2025*. Retrieved from:

https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-low-emissions-future-for-Aotearoa/Inaia-tonu-nei-a-low-emissions-future-for-Aotearoa.pdf

Climate Change Commission (2023). *Advice on the direction of policy for the Government's second emissions reduction plan*. Retrieved from https://www.climatecommission.govt.nz/

Climate Seed (n.d.). Mangrove Conservation and Restoration in Mexico. https://climateseed.com/mangrove-conservation-and-restoration-in-san-crisanto

Conservation International (2023). Hinemoana Halo Ocean Initiative. https://cicloud.s3.amazonaws.com/docs/default-source/s3-library/publication-pdfs/2023-hh-blueprint.pdf?sfvrsn=20cc4508_2

Conservation International, Friends of the Ocean, World Economic Forum, ORRAA, Salesforce, The Nature Conservancy, Meridian Institute (2022). *High Quality Blue Carbon Principles and Guidance. A Triple Benefit Investment for People, Nature and Climate.*

Crawshaw, J. and Fox, E. (2022). *Potential restoration sites for saltmarsh in a changing climate*. Bay of Plenty Regional Council Environmental Publication 2022/14.

Department of Planning (n.d.). NSW Blue Carbon Strategy 2022 – 2027. Report for the NSW Government. Retrieved from: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Water/Coasts/blue-carbon-strategy-20222027-220450.pdf

DGB Group (2022). Landmark auction of 250 000 tonne Blue Carbon Credits at $27.80 per tonne. December 2022. Retrieved from: https://www.green.earth/news/landmark-auction-of-250-000-tonne-blue-carbon-credits-at-usd-27.80-per-tonne

Duarte, C., Losada, I., Hendriks, I. *et al.* (2013). *The role of coastal plant communities for climate change mitigation and adaptation*. Nature Clim Change 3, 961–968. Retrieved from: https://doi.org/10.1038/nclimate1970

Durie, M. B. (2015). *Mauri ora: Finding Māori resilience in the 21st century*. Bridget Williams Books.

Easdale T., Burge O., Wiser, S., Richardson, S. (2022): *Carbon assessment of wetland vegetation.* Report prepared for the Ministry for the Environment, Contract Report: LC4173.

Environmental Protection Authority (n.d.). Mātauranga Māori Report Companion Guide. https://www.epa.govt.nz/assets/Uploads/Documents/Te-Hautu/Matauranga-Maori-Report_Companion-Guide.pdf

Espejo, A. B., Federici, S., Green, C., Olofsson, P., Sánchez, M. J. S., Waterworth, R., Carter, S., & Herold, M. (2020). *Integrating remote-sensing and ground-based observations for estimation of emissions and removals of greenhouse gases in forests: Methods and Guidance from the Global Forest Observations Initiative. Edition 3.0*. GFOI.

Fair Carbon (2023), Fair Carbon Global Blue Carbon Project Map 2023. Retrieved from: https://www.faircarbon.org/maps/blue-carbon-project-map

Farmers Weekly (2024). *CCC warns of critical ETS oversupply*. 12 March 2024. Retrieved from https://www.farmersweekly.co.nz/news/ccc-warns-of-critical-ets-oversupply/

Forliance (2021). *FORLIANCE is developing a Sustainable Mangrove Management Methodology together with Gold Standard.* 14 September 2021. https://forliance.com/news/2021/09/14/forliance-is-developing-a-sustainable-mangrove-management-methodology-with-gold-standard

Gold Standard (2022). *Methodology for Afforestation / Reforestation (A/R) GHGs Emission Reduction and Sequestration Version 2.0*. Retrieved from: https://globalgoals.goldstandard.org/403-luf-ar-methodology-ghgs-emission-reduction-and-sequestration-methodology/

Gold Standard (2023). *Gold Standard Submits for Programme-Level Assessment by ICVCM, Champions Alignment with the Paris Agreement.* (n.d.). 12 October 2023. https://www.goldstandard.org/news/gold-standard-submits-for-programme-level-assessme

Gold Standard (2024) The Gold Standard Registry. https://registry.goldstandard.org/projects?q=&page=1

Gold Standard (2024a). *Methodology for Sustainable Management of Mangroves Version 1.0*. Retrieved from https://www.goldstandard.org/consultations/methodology-for-sustainable-management-of-mangrove

Granziera, B. *et al,* (2023). Article 6 Explainer: Questions and answers about the COP27 decisions on carbon markets and what they mean for NDCs, nature, and the voluntary markets. The Nature Conservancy. Retrieved from: https://www.nature.org/content/dam/tnc/nature/en/documents/TNC_Article_6_Explainer_260523.pdf

Green C., Lovelock C.E., Sasmito S., Hagger V., & Crooks, S. (2021) *Coastal Wetlands in National Greenhouse Gas Inventories Advice on reporting emissions and removal from management of Blue Carbon ecosystems*. Retrieved from:

https://bluecarbonpartnership.org/wp-content/uploads/2021/11/Coastal-Wetlands-in-National-Greenhouse-Gas-Inventories.pdf

Griscom, B. W., Adams, J., Ellis, P. W., Houghton, R. A., Lomax, G., Miteva, D. A., Schlesinger, W. H., Shoch, D., Siikamäki, J. V., Smith, P., Woodbury, P., Zganjar, C., Blackman, A., Campari, J., Conant, R. T., Delgado, C., Elias, P., Gopalakrishna, T., Hamsik, M. R., Fargione, J. (2017). *Natural climate solutions.* Proceedings of the National Academy of Sciences of the United States of America, 114(44), 11645–11650. Retrieved from https://doi.org/10.1073/pnas.1710465114

Hochard, J., Hamilton, S., Barbier, E. (2019). *Mangroves shelter coastal economic activity from cyclones.* Economic Sciences. June 3, 2019. 116 (25) 12232-12237. Retrieved from: https://doi.org/10.1073/pnas.1820067116

Howard, J., Sutton-Grier, A., Smart, L., Lopes, C., Hamilton, J., Kleypas, J., Simpson, S., McGowan, J., Pessarradona, A., Alleyway, H., Landis, E. (2023). Blue carbon pathways for climate mitigation: Known, emerging and unlikely. *Marine Policy* 156 (2023) 105788. Retrieved from: https://doi.org/10.1016/j.marpol.2023.105788

ICIN, 2024. Blue Carbon in Australia: understanding the opportunities for indigenous people. Indigenous Carbon Industry Network.

ICVCM *(*nd a). *Leading the way to a high integrity Voluntary Carbon Market*. (n.d.). *The Integrity Council for the Voluntary Carbon Market*. Retrieved from https://icvcm.org/

ICVCM (nd b). Assessment Status. https://icvcm.org/assessment-status/

ICVCM, (n.d.). *The Core Carbon Principles. The Integrity Council for the Voluntary Carbon Market*. Retrieved from https://icvcm.org/core-carbon-principles/

International Partnership for Blue Carbon (2020). *Incorporating Coastal Wetlands in Inventories.* Retrieved from: https://bluecarbonpartnership.org/wp-content/uploads/2020/11/IPBC-Wetlands-Lessons-Learned.pdf

IPCC (2006). Guidelines for National Greenhouse Gas Inventories. Retrieved from: https://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html

IPCC (2014) 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands, Retrieved from: https://www.ipcc-nggip.iges.or.jp/public/wetlands/pdf/Wetlands_separate_files/WS_Chp4_Coastal_Wetlands.pdf , last accessed Feb 2024.

Kelleway, J. J., Serrano, O., Baldock, J. A., Burgess, R., Cannard, T., Lavery, P. S., ... & Steven, A. D. (2020). *A national approach to greenhouse gas abatement through blue carbon management.* Global Environmental Change, 63, 102083. Retrieved from https://doi.org/10.1016/j.gloenvcha.2020.102083

Kettles, H., Albot, O., Lalor, K., Nicol, S. (2024). *Coastal Wetland Blue Carbon in Aotearoa New Zealand: Current Projects, Reflections and Recommendations for a Community of Practice*. Wellington: The Nature Conservancy Aotearoa New Zealand and Department of Conservation. 35 p. + appendices.

King, D (2023). *Policy Gaps and Challenges to Implementing Blue Carbon Projects in the Asia-Pacific Region – A Review*. Presentation. Retrieved from: https://www.researchgate.net/publication/375453941_Policy_Gaps_and_Challenges_to_Implementing_Blue_Carbon_Projects_in_the_Asia-Pacific_Region_-_A_Review

Lawrence, G. (2015). *Using satellite imagery and novel low altitude aerial imagery to classify coastal wetland vegetation for change detection at Whatipu Scientific Reserve, Auckland, NZ* [Auckland University of Technology]. https://hdl.handle.net/10292/9774

Lecerf, M., Herr D., Elverum, C., Delrieu, E. and Picourt, L., (2023), *Coastal and marine ecosystems as Nature-based Solutions in new or updated Nationally Determined Contributions.* Report for Ocean & Climate Platform, Conservation International, IUCN, Rare, The Nature Conservancy, Wetlands International and WWF.

Living Water (n.d.). Pūkorokoro-Miranda. https://www.livingwater.net.nz/catchment/pukorokoro-miranda/

Lovelock, C. E., Adame, M. F., Bradley, J., Dittmann, S., Hagger, V., Hickey, S. M., Hutley, L. B., Jones, A., Kelleway, J. J., Lavery, P. S., Macreadie, P. I., Maher, D. T., McGinley, S., McGlashan, A., Perry, S., Mosley, L., Rogers, K., & Sippo, J. Z. (2023). An Australian blue carbon method to estimate climate change mitigation benefits of coastal wetland restoration. *Restoration Ecology*, *31*(7), e13739. Retrieved from https://doi.org/10.1111/rec.13739

Macreadie, P.I., Costa, M.D.P., Atwood, T.B. *et al.* (2021). Blue carbon as a natural climate solution. Nat Rev Earth Environ 2, 826–839 (2021). Retrieved from: https://doi.org/10.1038/s43017-021-00224-1

Marine Cultural Health Programme (2021). https://marineculturalhealth.co.nz/

Ministry for Primary Industries (2023) *Greenhouse Gas Inventory Research Fund 2023/24 Priorities*. Report. Retrieved from: https://www.mpi.govt.nz/dmsdocument/57106-Greenhouse-Gas-Inventory-Research-Fund-2023-24-Priorities

Ministry for the Environment (2020). *National Climate Change Risk Assessment for New Zealand. Arotakenga Tūraru mō te Huringa Āhuarangi o Āotearoa*. Wellington. Ministry for the Environment.

Ministry for the Environment (2022). *Te hau mārohi ki anamata, Towards a productive, sustainable and inclusive economy; Aotearoa New Zealand's First Emissions Reduction Plan*. Wellington. Ministry for the Environment.

Ministry for the Environment (2022b). *Aotearoa New Zealand's first national adaptation plan.* Wellington. Ministry for the Environment. Retrieved from: https://environment.govt.nz/publications/aotearoa-new-zealands-first-national-adaptation-plan/

Ministry for the Environment (2023a) Nationally Determined Contribution, https://environment.govt.nz/what-government-is-doing/areas-of-work/climate-change/nationally-determined-contribution/

Ministry for the Environment (2024a) New Zealand's Greenhouse Gas Inventory. https://environment.govt.nz/facts-and-science/climate-change/measuring-greenhouse-gas-emissions/about-new-zealands-greenhouse-gas-inventory/ , last accessed Feb 2024.

Ministry for the Environment (2024b). Responding to a Changing Climate. The Government's Climate Strategy. Brochure. Ministry for the Environment. Retrieved from: https://environment.govt.nz/assets/J001281-MfE-Climate-strategy-brochure-FF_webV2.pdf

Ministry for the Environment, Department of Conservation, Ministry for Primary Industries, Ministry of Business, Innovation and Employment, Land Information New Zealand, New Zealand Government (2014). *Guidance on Good Practice Biodiversity Offsetting in New Zealand.* Retrieved from https://www.doc.govt.nz/globalassets/documents/our-work/biodiversity-offsets/the-guidance.pdf

Moller, I., Wehi, P. M., Whakataki, T., & Campbell, C. (2017). *Māori and carbon offsetting: Negotiating the landscape of rights, interests, and obligations. Journal* of the Royal Society of New Zealand, 47(4), 283-298.

National Inventory Report Volume I, Australian Government (2023), Department of Climate Change, Energy, the Environment and Water. Retrieved from: https://www.dcceew.gov.au/sites/default/files/documents/national-inventory-report-2021-volume-1.pdf

NDC Partnership (2019). Understanding Blue Carbon Requests in the NDC Partnership, https://ndcpartnership.org/news/understanding-blue-carbon-requests-ndc-partnership

NDC Partnership (2023). "Blue Carbon" Coastal wetland ecosystems: Trends in NDC partnership support. Retrieved from: https://ndcpartnership.org/sites/default/files/2023-11/blue-carboninsight-brief20230.pdf

NIWA (n.d.) Research aims to quantify New Zealand's blue carbon capacity of kelp seaweeds. https://niwa.co.nz/news/research-aims-quantify-new-zealands-blue-carbon-capacity-kelp-seaweeds

Parliamentary Commissioner for the Environment, (2020). *Managing our estuaries.* Wellington. Parliamentary Commissioner for the Environment.

Pattle Delamore Partners (n.d.). *A case study of Wetland detection on the Kapiti Coast, New Zealand.* Retrieved from: https://www.pdp.co.nz/projects/wetland-mapping

Phyland, R., Pontee, N., Simmonds, K. (n.d.) *Blue Carbon – The New Green? An Opportunity Towards Net Zero Emissions.* Retrieved from https://www.waternz.org.nz/Attachment?Action=Download&Attachment_id=5329

Plan Vivo (2020) *Mikoko Pamoja – Kenya*. (2020, June 9). https://www.planvivo.org/mikoko-pamoja

Plan Vivo (2020a) *Tahiry Honko – Madagascar*. (2020, December 7). https://www.planvivo.org/tahiry-honko

Plan Vivo (2020c) *Vanga – Kenya*. (2020, October 26). https://www.planvivo.org/vanga

Plan Vivo (2023). Agriculture and Forestry Carbon Benefit Assessment Methodology V1.0 "PM001". Retrieved from: https://www.planvivo.org/pm001

Plan Vivo (2024) Plan Vivo documentation: https://www.planvivo.org/pv-climate-documentation

Plan Vivo (n.d.) Rarakau New Zealand. https://www.planvivo.org/rarakau

Pollination (2023a). *Financing Blue Carbon in Australia: Private sector perspectives and recommendations to policymakers on financing non-carbon benefits of Blue Carbon in Australia*. August 2023. Retrieved from https://www.bhp.com/-/media/project/bhp1ip/bhp-com-en/documents/sustainability/climate-change/finaldraft-pollinationreport-financingnon-carbonbenefitsofbluecarboninaustralia_hr.pdf.

Raj, N., & Pasfield-Neofitou, S. (2024). Assessment and Prediction of Sea Level and Coastal Wetland Changes in Small Islands Using Remote Sensing and Artificial Intelligence. *Remote Sensing*, *16*(3), Article 3. https://doi.org/10.3390/rs16030551

Ross, F. W. R., Clark, D. E., Albot, O., Berthelsen, A., Bulmer, R., Crawshaw, J., & Macreadie, P. I. (2023). A preliminary estimate of the contribution of coastal blue carbon to climate change mitigation in New Zealand. *New Zealand Journal of Marine and Freshwater Research*, 1–11. Retrieved from https://doi.org/10.1080/00288330.2023.2245770

Schindler Murray, L., and Milligan, B. ed. (2023). *The Blue Carbon handbook: Blue carbon as a nature based solution for climate action and sustainable development*. Report. London: High Level Panel for a Sustainable Ocean Economy.

Simpson, S. 2015. *Coastal Blue Carbon in Practice: A Manual for Using the VCS Methodology for Tidal Wetland and Seagrass Restoration V1.0.* Retrieved from https://nerrssciencecollaborative.org/resource/coastal-blue-carbon-practice-manual-using-vcs-methodology-tidal-wetland-and-seagrass

SocialCarbon (2023) *A holistic standard for nature-based solutions delivering lasting impact.* https://www.socialcarbon.org

Stewart-Sinclair, P. J., Bulmer, R. H., Macpherson, E., & Lundquist, C. J. (2024). *Enabling Coastal Blue Carbon in Aotearoa New Zealand: Opportunities and Challenges.* Frontiers in Marine Science, 11, 1290107. Retrieved from: https://doi.org/10.3389/fmars.2024.1290107

Sustainable Seas Challenge (2024). https://www.sustainableseaschallenge.co.nz/

Taura, Y., Van Schravendijk-Goodman, C., Clarkson, B. ed. (2017). Te Re o te Repo Voice of the Wetland. Retrieved from https://www.landcareresearch.co.nz/assets/Publications/Te-reo-o-te-repo/Te_Reo_o_Te_Repo_Voice_of_the_Wetland_complete_book.pdf

The Blue Carbon Initiative (2023) *Blue Carbon and Nationally Determined Contributions Second Edition*. Retrieved from: https://www.thebluecarboninitiative.org/policy-guidance

The Blue Carbon Initiative and Global Mangrove Alliance (n.d.). *Best-Practice-Guidelines-for-Mangrove-Restoration.* Retrieved from https://www.mangrovealliance.org/wp-content/uploads/2023/12/Best-Practice-Guidelines-for-Mangrove-Restoration_spreadsv5.pdf

The Nature Conservancy, TerraCarbon LLC, University of California Santa Cruz, IH Cantabria, and East Carolina University (2010). *Methodology for Coastal Resilience Benefits from Restoration and Protection of Tidal Wetlands. Sustainable Development Verified Impact Standard.* (SD Vista Version 1.0). Retrieved from: https://verra.org/wp-content/uploads/2021/01/Coastal-Resilience_SD-VISta-Methodology_PublicCommentPeriod-1.pdf

The Wildlife Trust, National Trust, Royal Society for the Protection of Birds, Woodland Trust, Finance Earth, Federated Hermes Ltd. 2023. *Nature Markets Principles. Voluntary Principles for Science-based Investment to create High Integrity Natural Capital Markets in the UK.*

Toitū Envirocare (2023). Toitū Envirocare to transition away from New Zealand Carbon Credits to Align with Global Standards. 23 November 2023. Retrieved from: https://www.toitu.co.nz/news-and-events/news/carbon-credits/press-release-toitu-envirocare-to-transition-away-from-new-zealand-carbon-credits-to-align-with-global-standards

UNDP (2023) *Global Climate Promise: What are NDCs and how do they drive climate action? United Nations Development Program*. Retrieved from: https://climatepromise.undp.org/news-and-stories/NDCs-nationally-determined-contributions-climate-change-what-you-need-to-know

UNEP - (2014). *Coastal Blue Carbon Methods for Assessing Carbon Stocks and Emissions Factors in Mangroves, Tidal Salt Marshes, and Seagrass Meadows*. United Nations Environment Programme. Retrieved from: http://www.unep.org/resources/publication/coastal-blue-carbon-methods-assessing-carbon-stocks-and-emissions-factors

UNFCCC (2021) *Submission under the Paris Agreement New Zealand's first Nationally Determined Contribution, Updated 4 November 2021*. Retrieved from: https://unfccc.int/sites/default/files/NDC/2022-06/New%20Zealand%20NDC%20November%202021.pdf

UNFCCC (2024b) Resource Guide, Module 3: National Greenhouse Gas Inventories for Preparing The National Communications Of Non- Annex I Parties. Retrieved from: https://unfccc.int/files/national_reports/application/pdf/module_3_national_ghg.pdf

VCMI (n.d.). *Aligning Voluntary Carbon Markets with the 1.5°C Paris Agreement Ambition. A Global Consultation Report of the Voluntary Carbon Markets Integrity Initiative (VCMI).* Retrieved from https://vcmintegrity.org/wp-content/uploads/2021/07/VCMI-Consultation-Report.pdf

Verra (2017). Climate, Community & Biodiversity Standards. Retrieved from https://verra.org/wp-content/uploads/CCB-Standards-v3.1_ENG.pdf

Verra (2021). *Demonstration of Additionality of Tidal Wetland Restoration and Conservation Project Activities (ADD-AM).Version 2.0.* Retrieved from https://verra.org/wp-content/uploads/imported/methodologies/VMD0052-Demonstration-of-additionality-of-tidal-wetland-restoration-and-conservation-project-activities-ADD-AM-v2.0.pdf

Verra (2023) VM0033 - *Methodology for Tidal Wetland and Seagrass Restoration, v2.1.* Retrieved from: https://verra.org/wp-content/uploads/2023/09/VM0033-Methodology-for-Tidal-Wetland-and-Seagrass-Restoration-v2.1.pdf

Verra (2023a) Verra Revises Blue Carbon Methodology. 11 July 2023. https://verra.org/verra-revises-blue-carbon-methodology/

Verra (2023b) Statement on Verra's Application for ICVCM Assessment. 21 November 2023. https://verra.org/statement-verra-submission-icvcm/

Verra (2023c). *VM0007 REDD+ Methodology Framework (REDD+MF), v1.7.* Verra. Retrieved from https://verra.org/methodologies/vm0007-redd-methodology-framework-redd-mf-v1-7/

Verra (2023d). VCS Standard version 4.5. Retrieved from https://verra.org/wp-content/uploads/2023/08/VCS-Standard-v4.5-updated-11-Dec-2023.pdf

Verra (2024) The Verra registry: https://registry.verra.org/

Verra (2024a) On Today's ICVCM Approval of Verra's Landmark Verified Carbon Standard Program. 2 May 2024. https://verra.org/on-todays-icvcm-approval-of-verras-landmark-verified-carbon-standard-program/

Verra (n.d.). *VM0024 Methodology for Coastal Wetland Creation, v1.0.* https://verra.org/methodologies/vm0024-methodology-for-coastal-wetland-creation-v1-0/

Weaver, S.A., Berthelsen, A., Schattschneider, J., Bennion, T. (2022). *Feasibility Assessment: Aotearoa New Zealand Blue Carbon Resilience Credit Projects.* Report to The Nature Conservancy, January 2022. Ekos, Cawthron Institute, and Bennion Law.

Wilson, P., and Oliver., M. (2023). *Marine Offsetting and Compensation – Summary of Management Guidance and Policy.* Report for Greater Wellington.

World Bank (2018). *Environmental and Social Framework*. Washington D.C. World Bank.

World Bank (2023). *Unlocking Blue Carbon Development: Investment Readiness Framework for Governments.* Washington, D.C.: World Bank. Retrieved from https://documents1.worldbank.org/curated/en/099092223142013793/pdf/P1803270733769058099a406ce8a40b23e6.pdf

World Wildlife Fund (WWF-US), Environmental Defense Fund (EDF) and Oeko-Institut (2020). *What makes a high-quality carbon credit? Phase 1 of the "Carbon Credit Guidance for Buyers" project: Definition of criteria for assessing the quality of carbon credits*. Retrieved from https://www.worldwildlife.org/publications/what-makes-a-high-quality-carbon-credit

Appendix A: Summary of scenario analysis related to RMA planning documents

A.1 Summary of the key planning documents for the case studies

Regional and District Plans under the RMA determine whether an activity requires resource consent or is exempt from this process. To illustrate the barriers and enablers the research team assessed the scenarios against the regional and district plan[6]. Sections A.1.1 to A.1.3 summarise the regional policy and planning framework for each of the scenarios. Appendix C provides a detailed summary of each case study.

A.1.1 Scenario 1a and 1b Northland mangrove, salt marsh and seagrass

Scenarios 1a and 1b seek to protect, and make space for, mangrove, salt marsh and seagrass migration. The existing environment is considered to be estuarine mudflats draining rural catchments, salt marsh is in decline due to catchment activities and historical land conversion.

Table A.1 Scenario analysis – regional barriers and enablers

	Scenario 1a and 1b
Regional Planning Framework	• Regional Policy Statement for Northland 2016 • Proposed Regional Plan for Northland 2023 • Operative Regional Coastal Plan
Regional Policy Statement	The Regional Policy Statement for Northland includes very limited provisions relating to the use of the coastal environment. The objective and policy framework seeks to protect the indigenous ecosystems and biodiversity and include provision to enhance indigenous ecosystems and biodiversity.
Regional Coastal Plan	The policy framework is generally supportive of initiatives that protect or restore indigenous ecosystems and biodiversity. Objective F1.11 looks to enable activities that improve the natural and physical resources. This would include enabling Scenario's 1a and 1b as blue carbon initiatives. Policy D.5.25 also provides for disturbances on the foreshore and seabed for the purposes of rehabilitating ecological values.
Regional consenting status	No consents are required to convert land or foreshore to mangroves and salt marsh. Weed and pest control is likely to be considered as a permitted activity. **Control of mangroves** Rules C.1.4.1 provides for the removal of mangrove seedlings as a permitted activity provided certain conditions are met including the size, timing, and location. C.1.4.2 provides for minor mangrove removal as a permitted activity to enable listed authorised activities. Mangrove removal is controlled through the Proposed Regional Coastal Plan. While this rule is unlikely to affect a small scale project (scenario 1b) with willing participants, this permissive rule may act as a disincentive for land owners to consider

[6] Only one regional and one district plan was used in this illustration, however in practice it is possible that two or more regional or district plans may be applicable, particularly for harbour or catchment scale projects.

	Scenario 1a and 1b
	being involved in a harbour scale scheme. Enabling mangrove removal is counter-productive to harbour scale blue carbon project aspirations.
District Plan / Proposed District Plan	The policy framework is generally supportive of initiatives the protect or restore indigenous ecosystems and biodiversity. Policy 12.4.4.2 supports the protection and enhancement of beaches, sand dunes, mangrove areas, wetlands, and vegetation. A similar policy (NH-P12) is included in the Proposed District Plan. The policy framework does not implicitly allow for blue carbon initiatives however there does not appear to be any significant barries to enabling blue carbon initiatives.
District consenting status	Permitted activity however auxiliary activities may require consent under the District Plan.
Local bylaws	Far North Control of Earthworks Bylaw 2019 Earthworks Permit would be required under the bylaw if any earthworks were required.
Conservation Act	Commercial element of blue carbon associated with activities and interventions will likely require a concession from the DoC. The Northland Conservation Management Strategy (CMS) does not provide for the protection and restoration coastal wetlands associated with commercial benefits arising from blue carbon credits. Potential barrier in accordance with section 17 U and W of the Conservation Act. Scenario refers to also increasing conservation status of land administered under the Conservation Act, under both the CMS, and potentially elevate status to, for example *ecological area (s21), sanctuary area (s22)* which will improve status in terms of protection in perpetuity.
Marine Reserve Act	Both scenarios take place within a marine reserve. The general presumption is that marine reserves are to be maintained in their natural state. Depending on the detailed conditions of the marine reserve (which may include exemptions for interventions that assist in maintaining the natural state) the marine reserve may not be an issue. And therefore, the existence of the marine reserve protects the area in perpetuity.
MACA Customary use	While there is no ownership or customary claim in this scenario, any iwi, hapū or whānau that exercise kaitiakitanga have a right to be involved in all the above processes (especially Conservation and Marine Reserves Act processes s47 TMA).
Hapū / Iwi Management Plans	Iwi Management Plans are a resource management plan prepared by local iwi, iwi authority, rūnanga or hapū. Iwi Management Plans must be taken into account when preparing or changing regional policy statements, regional and district plans. Individual Iwi Management Plans have not been explored as part of this research but would be relevant to blue carbon projects.

A.1.2 Scenario 2a and 2b Bay of Plenty salt marsh and mangrove

Scenarios 2a and 2b seek to restore salt marsh and convert low productivity farmland to salt marsh and mangroves. The area is currently low productivity farmland which was drained 50-80 years ago.

Table A.2 Scenario analysis – regional barriers and enablers

	Scenario 2a and 2b
Regional Planning Framework	• Bay of Plenty Regional Policy Statement 2014 • Bay of Plenty Regional Coastal Environment Plan
Regional Policy Statement	The Regional Policy Statement includes provisions that encourage the restoration of natural coastal margins. The policies also require adverse effects on salt marsh to be considered. Policy CE 4A encourages the restoration and enhancement of the natural

	Scenario 2a and 2b
	functioning of coastal margins and Policy CE 7B provides a list of criteria that need to be taken into account when managing mangroves. The Regional Policy Statement does not contain rules and is given effect to by the Regional Coastal Plan and District Plan.
Regional Coastal Plan	The objective and policy framework encourages the restoration and enhancement of the coastal environment including providing for the diversion of water where the purpose is for restoring or rehabilitating the coastal environment. The plan provides for biodiversity offsets which must provide a net gain. If the purpose of the project is for biodiversity offsets two issues might arise: 1) blue carbon credits can only be gained for work above and beyond what is required, there will be a need to measure the impact above biodiversity "net gain." 2) The rules provide for restoration and rehabilitation. This may be challenged if the purpose of the project is for commercial reasons or for regulated offsetting which have an effect on another value such as public access. The planning process would need to balance the positive and negative effects on all users. The plan also provides directly for the enhancement of saltmarsh and wetland habitat as an offset to mangrove removal. As in these circumstances you are replacing one blue carbon source for another this may prevent claiming any blue carbon credits as there is no additionality. The diversion of watercourses is provided for when required for the purpose of coastal restoration or enhancement.
Regional consenting status	Consents are anticipated to be required for the following activities: • Disturbance of the foreshore or seabed • Diversion (and take) of freshwater • Discharge of water to coastal water • Earthworks These consents are likely to be bundled and considered as a discretionary activity. Depending on the activity and proposed methodology additional consents may also be required. Both large scale and smaller projects are likely to be considered under the same rules. Larger projects may find the required assessments more economically viable due to economies of scale. Smaller projects, however, will have a smaller area for consideration which might make the process more straight forward. **NES-F** If a part of the scenario includes wetlands that fall within the NPS-FM definition of *natural inland wetland* the maintenance and restoration interventions would also have a permitted pathway under the NES-F. A wetland is considered a natural inland wetland if it is not located in the CMA, […].[7]
District plan	The objectives and policies are supportive of activities that maintain, enhance, and restore the coastal zone. This includes Objective 9.2.1, Policy 9.2.1.3 and 19.2.5.4 which encourage opportunities for restoration, maintenance and enhancement of natural character, and indigenous habitats and ecosystems.
District consenting status	Permitted activity however auxiliary activities may require consent.
Local bylaws	N/A
Conservation Act	N/A
Marine Reserve	N/A
MACA Customary Marine Title claim.	The scenario specifies that there is a live claim for customary marine title that is not yet resolved/determined under the Act. While the customary marine title claim is pending an

[7] Clause 3.21 National Policy Statement for Freshwater

	Scenario 2a and 2b
	applicant for a resource consent must notify the applicant group/s and report to the consent authority on the views obtained from the group/s (s62A). If the customary marine title order is made then whomever applies for resource consents to implement the blue carbon project cannot commence the consent activities until the customary marine title group provides RMA permission right "in accordance with s68 of the Act."
Hapū / Iwi Management Plans	Iwi Management Plans are a resource management plan prepared by local iwi, iwi authority, rūnanga or hapū. Iwi Management Plans must be taken into account when preparing or changing regional policy statements, regional and district plans. Individual Iwi Management Plans have not been explored as part of this research but would be relevant to blue carbon projects.

A.1.3 Scenario 3: Tasman or Nelson seagrass and salt marsh

Scenario 3 provides for the protection of 100 ha of seagrass from further decline. It includes improving water quality upstream to reduce sediment runoff and voluntary water quality improvements. Some provision may be made to undertake reseeding trials.

Table A.3 Scenario analysis – regional barriers and enablers

	Scenario 3
Regional Planning Framework	• Tasman Regional Policy Statement • Tasman Resource Management Plan
Regional Policy Statement	Regional Policy Statement predates the national policy statements and only contains one relevant objective and policy. These seek to preserve natural character of the coastal environment.
Regional Coastal Plan	The objective and policy framework encourages the restoration and enhancement of the coastal environment where it has been degraded. This includes: • Policy 8.2.3.17 To pursue and encourage restoration and enhancement of coastal and riparian areas where natural character has been degraded by past human activities. • Policy 13.1.3.11 (and 23.1.3.7) To promote the maintenance and enhancement of coastal vegetation in areas at risk from coastal erosion. • Policy 21.2.3.17 To promote measures to re-establish natural coastal conditions or processes. There are generally no policy barriers to improving water quality upstream.
Regional consenting status	Generally, the Tasman Resource Management Plan is permissive. Reducing sedimentation and improving water quality are consistent with the purpose of the plan and RMA.
District plan	N/A
District consenting status	N/A
Local bylaws	N/A
Conservation Act	N/A
Marine Reserve	N/A
Takutai Moana Act Customary use	
Hapū / Iwi Management Plans	Iwi Management Plans are a resource management plan prepared by local iwi, iwi authority, rūnanga or hapū. Iwi Management Plans must be taken into account when preparing or changing regional policy statements, regional and district plans. Individual

	Scenario 3
	Iwi Management Plans have not been explored as part of this research but would be relevant to blue carbon projects.

Appendix B: Barriers and enablers to blue carbon project implementation associated with legislation and national policies

Legislation and Policies	Barriers	Enablers
Resource Management Act 1991 (RMA). RMA has a broad purpose of 'sustainable management', and is intended to regulate environmental effects from activities over all aspects of the environment – land, freshwater, soil, air, coastal, marine. The RMA and its instruments will control the activities likely to be undertaken for the restoration and enhancement of coastal wetlands, including reclamation, draining, structures, river and seabed disturbance and the introduction or removal of vegetation. Agencies responsible: MfE, Regional Councils, Territorial Authorities and Unitary Authorities Minister of Conservation	Sequestration of carbon is not specifically managed under the RMA so there are no bespoke tools in the RMA framework. Policies and rules relevant to activities associated with/required for blue carbon sequestration projects have therefore not been applied with blue carbon sequestration in mind. Inconsistent policies from region to region including cross boundary issues. Cross boundary issues above and below MHWS add to complexity and lack of integration including national instruments: NPS-FM, NZCPS, NPS-IB and NES-F. Blue carbon projects require a framework that can provide for permanence. While land use consents can endure in perpetuity, water permits and coastal permits that will be required for blue carbon project, such as removal of tidal barriers, reclamation, draining, diversion, damming, river and seabed disturbance have a finite term. Furthermore, statutory instruments such as Regional Coastal Plans and freshwater planning instruments are required to be reviewed every 10 years. This means that every 10 years there is a potential change to the regulatory environment, which could change the consenting requirements for ongoing works associated with undertaking and maintaining blue carbon sites. For example an activity that might be permitted (lawful without the need for a resource consent) under the current regime, could after a plan review, require resource consent to continue lawfully.	The purpose of the RMA is compatible with blue carbon projects: Part 2 of the RMA contain strong directions to preserve natural character of the coastal environment, protect indigenous flora and fauna and management significant risks of natural hazards. Part 2 also provides for Māori/iwi issues and participation. Adaptive management can be built into consents to provide certain level of flexibility/ability to respond. Coastal permits for aquaculture authorise occupation and commercial use below MHWS. There is potential to use and adapt the coastal permit framework such that it enables sufficient security to attach carbon rights. This is discussed further in Section 4.2.
Conservation Act 1987 Applies to public conservation land, which ends at MHWS. Also specifies	Blue carbon projects will likely require authorisation by way of concessions when projects are located on land managed under the Conservation Act, as it is not one of the activities exempted from the need for a	Section 4 of the Act requires that all decisions under the Act give effect to the principles of the Treaty of Waitangi.

Legislation and Policies	Barriers	Enablers
the DoC administers Acts below MHWS including Marine Reserves Act 1971, Marine Mammals Protection Act 1978, Wildlife Act 1953Statutory purpose is tied to the definition of 'conservation' being *the preservation and protection of natural and historic resources for the purpose of maintaining their intrinsic values, providing for their appreciation and recreational enjoyment by the public, and safeguarding the options of future generations.* Agency responsible: DoC	concession in section 17O. The purpose of the Act not obviously compatible with blue carbon projects, where the purpose of protecting the wetland is to sequester carbon and receive income from credits. Applicable statutory documents including Conservation Management Strategies (CMS) and Plans (CMP), are unlikely to specifically contemplate commercial blue carbon projects. Section 17U prevents granting of concession if an activity is contrary to the purpose of the Act or the purpose for which the land is held. Section 17W prevents granting of concession if there is no conservation management strategy or plan, or an activity is not provided for in the applicable conservation management strategy or plan. Therefore, under current Conservation Act regime there is a material barrier to obtaining concession for a blue carbon project. Note there are Crown Conservation Contracts provided for under s4 of the Climate Change Response Act that are written agreements with the Crown for removal and storage of carbon on post-1989 forest land that is public land administered for conservation purposes. Crown Conservation Contracts also include the concession required. But as the definition is restricted to forest land Crown Conservation Contracts will not currently be required, nor will they enable authorisation, in respect of blue carbon sequestration on land administered under the Conservation Act 1987.	Many if not most of the CMSs and CMPs are overdue for review. They should be reviewed every 10 years if not earlies (s17H). Therefore there could be an opportunity in the future to amend the CMSs and CMPs so that blue carbon projects are contemplated and provided with a streamlined pathway for concessions. Were the government, through the DoC, to undertake/lead a blue carbon project that had multiple purposes including those that more squarely fall within the definition of *conservation* that could be enabled, potentially even without a concession if the actions were deemed to fit entirely with the Departments statutory functions, duties and powers (s17O (3) (d).
Marine and Coastal Area (Takutai Moana) Act 2011 (MACA) The Act allows for recognition of customary rights, interests and customary marine title in the area in the common marine and coastal area. Agencies responsible: Te Arawhiti MPI, Regional Councils, Territorial Authorities and Unitary Authorities Minister of Lands Minister of Conservation	The MACA operates alongside other existing Acts, potentially creating complexities for blue carbon projects. The complexity potentially arises due to the new key mechanisms for recognising Māori interests which themselves are enabling if it is the recipient of the Protected Customary Rights and Customary Marine Title that is the proponent of a blue carbon project. Additional complexity would arise for obtaining of relevant authorisations under the RMA were the proponent of a project not the holder of the above. The implementation of the Act is still in the 'early days' and the Waitangi Tribunal	The MACA establishes two key mechanisms for recognising Māori interests: • Protected Customary Rights: These provide ongoing access and use for specific iwi and hapū. • Customary Marine Title: The highest form of recognition, granting iwi ownership rights over specific MACA areas. • Through these mechanisms there is potential to consider the rights to carbon.

Legislation and Policies	Barriers	Enablers
	continues to refine the interpretation and application of the MACA, particularly regarding Māori rights.	• Supports the integration of mātauranga Māori and scientific approaches.
Marine Reserves Act 1971 Statutory purpose of marine reserves requires that they are for the purpose of preserving for the *scientific study of marine life, areas of New Zealand that contain underwater scenery, natural features, or marine life, of such distinctive quality, or so typical, or beautiful, or unique, that their continued preservation is in the national interest* (s3) Agency responsible: DoC.	Only applies below MHWS. The statutory purpose of marine reserves is not obviously compatible with protecting a coastal wetland for blue carbon sequestration objective. The commercial element of blue carbon projects is also likely to be out of scope of the Marine Reserves Act.	Potential to create new marine reserve to ensure protection of coastal wetland below MHWS in perpetuity.
Reserves Act 1977 Applies to land vested in crown, local authorities or authorised administering bodies. The purpose is to preserve and manage for the benefit and enjoyment of the public, reserve land, protect all indigenous species, and ensure preservation of public access. Agencies responsible: Department of Conservation Territorial Authorities and Regional Councils Administering Bodies	Depending on the classification of a reserve, commercial aspects and physical works associated with blue carbon projects will require authorisation by way of a lease, licence, permit and/or concession. The purpose of the Act is not obviously compatible with a blue carbon project due to the commercial purpose/monetisation element. Reserves are administered pursuant to Conservation Management Strategies, Conservation Management Plans, and reserve management plans, where relevant Reserves that are administered by the Crown present the same barriers as the Conservation Act above, as the same restrictions in terms of granting concessions applies. Other reserves present similar barriers to the issuing of leases, licences and permits.	Section 4.2 discussed the option under the MACA of declaring land to be a reserve, as an option to resolve the issue of how to secure carbon rights to land below the MHWS. This is potentially enabling as long as the barriers referenced in the previous column can be overcome. Were the Administering Body (whether it be the Department of Conservation, a Council or other), to undertake/lead a blue carbon project that had multiple purposes including those that more squarely fall within purpose of the Reserves Act that could significantly assist.
Wildlife Act 1953 The purpose of the Wildlife Act is providing protection to all wildlife including marine species, except the species listed in the Schedules to the Act. The Act enables the establishment of wildlife refuges and reserves, and makes it an offence to catch alive or kill wildlife without written authorisation under s53 of the Act.	The Wildlife Act is a potential barrier if blue carbon project involves inundation of land supporting habitat for (terrestrial) wildlife protected under the Wildlife Act.	Protection of coastal wetlands likely to consistent with and complimentary to the relevant purpose of the Wildlife Act to protect terrestrial, freshwater and marine mammals, including invertebrates.

Legislation and Policies	Barriers	Enablers
Agency responsible: Department of Conservation		
Local Government Act 2002 Provides for democratic and effective local government and includes the mechanisms by which local authorities are to promote social, economic, environmental and cultural well-being of their communities (s3). Agencies responsible: Regional Councils, Territorial Authorities and Unitary Authorities	Relevant when a local authority is a proponent of active protection of coastal wetlands, and responsible for resourcing the same by land acquisition and/or contributing to the cost of active restoration and protection. Local authorities' funding of projects must be specified in Long Term Plans. Long Term Plans endure for a term of 3 years maximum, providing no long term certainty for projects that require continued funding for works, monitoring, etc.	The purpose of the Local Government Act 2002 is generally enabling, particularly where their role can facilitate community-led blue carbon projects and / or lead blue carbon projects with multiple social and environmental co-benefits for their communities.
Soil Conservation and Rivers Control Act 1941 The objects of the Act are promotion of soil conservation, prevention and mitigation of soil erosion, prevention of damage by floods and utilisation of land in such a manner as it contributes to the above objects. Agencies responsible: Minister for the Environment Regional Councils, Territorial Authorities and Unitary Authorities.	The purpose of the Act (referred to as the *object* of the Act in s10) can be considered a barrier, to blue carbon projects. Until the RMA came into force in 1991, the powers under this Act were used in a way that authorised control of rivers and flooding in a way that was contrary to preservation of wetlands. Those provisions enabling such works were repealed prior to the RMA coming into force. Further analysis is required to determine whether this Act creates a barrier to blue carbon projects in areas where there are conflicts between flood management and habitat restoration.	The purpose of the Act can also be considered an enabler where there are flood management co-benefits from blue carbon projects.
New Zealand Coastal Policy Statement (NZCPS) under the s56 of the RMA. The statutory purpose of the NZCPS is to state objectives and policies to achieve the purpose of the RMA in the coastal environment. Agencies responsible: Minister of Conservation Regional Councils, Territorial Authorities and Unitary Authorities	blue carbon projects are not specifically provided for, but they are captured by the policies that enable the restoration and rehabilitation of the coastal environment, the provision of natural defences against coastal hazards and the restoration of biodiversity. If a blue carbon project involved reclamation or inundation of a scale that impacted the habitat of/displaced indigenous species, ecosystems and vegetation types referenced in Policy 11, the direction to *avoid adverse effects could be applied* in a prohibitive way.	The objectives seek to safeguard the coastal environment including to maintain and enhance the natural biological and physical processes, preserving natural character, and encouraging restoration of the coastal environment. blue carbon initiatives can improve biodiversity, provide a natural defence to coastal hazards, and are sympathetic to the coastal environment.
National Policy Statement for Indigenous Biodiversity (NPS-IB)	It does not apply to land covered by water except that provisions that relate to promoting restoration and increasing indigenous vegetation cover extend to include *natural inland wetlands* (cl 1.3 (2)	The overarching Objective of the NPS-IB (clause 2.1) is enabling and consistent with blue carbon projects. The prime objective is to maintain indigenous biodiversity across Aotearoa NZ,

Legislation and Policies	Barriers	Enablers
The purpose of the NPS-IB is to state objectives and policies for matters of national significance in respect of indigenous biodiversity that are relevant to achieving the purpose of the RMA. Agencies responsible: Minister for the Environment Regional Councils, Territorial Authorities and Unitary Authorities.	(c)), above MHWS. Further explanation on *natural inland wetlands* is covered in the row below on the NPS-FM The NPS-IB does not apply below MHWS.	including by protecting and restoring indigenous biodiversity. NPS-IB can influence catchment plans that are integrated into or support blue carbon projects (such as the catchment focus in Scenario 3 seagrass), but not blue carbon projects directly. Policies specify the central role of iwi / hapū exercising kaitiakitanga and in decision making principles generally and requirement to take into account the principles of the Treaty (cl 1.5, policies 1 and 2). Objective and Policies require a balance of adopting a precautionary approach when considering adverse effects on indigenous biodiversity, consideration of the benefits of protecting indigenous biodiversity and providing for the appropriate subdivision, use and development of land, which can indirectly support the quality of water and the amount of sediment that is received by coastal wetlands. High quality terrestrial biodiversity adjacent to coastal wetlands can enhance the overall biodiversity co-benefits of blue carbon projects by providing seed sources, seed spreaders, additional foraging, and essential habitats for wetland birds, reptiles and insects.
National Policy Statement for Freshwater Management (NPS-FM) under the RMA. The purpose of the NPS-FM is to state objectives and policies for matters of national significance in respect of freshwater that are relevant to achieving the purpose of the RMA. Agencies responsible: Minister for the Environment Regional Councils, Territorial Authorities and Unitary Authorities	The NPS-FM only applies to freshwater and the receiving environments (which can include estuaries and the wider coastal marine area). Specific provisions in respect of *natural inland wetlands* do not apply to wetlands in the coastal marine area (cl 3.25). The definition of *natural inland wetlands* is much narrower than the RMA definition, and therefore not all wetlands will benefit from the protective and enabling provisions: NPS-FM definition (clause 3.21) specifies that it relates to wetlands that are above MHWS, along with other qualifications that narrow its application, as follows: *natural inland wetland means a wetland (as defined in the Act) that is not:* *(a) in the coastal marine area; or* *(b) a deliberately constructed wetland, other than a wetland constructed to offset impacts on, or to restore, an existing or former natural inland wetland; or*	The NPS-FM is premised on the concept of Te Mana o te Wai which places, as first priority, the health and well-being of water bodies and freshwater ecosystems. Provisions and policies specify central role of iwi / hapū. Strong focus on integrated management to protect receiving environments from effects upstream and from land, relevant for blue carbon projects with a catchment focus (i.e. Scenario 3). Focuses on improving the health of the waterways which is not inconsistent with blue carbon projects. *Natural inland wetlands* (ie above MHWS) are required to be protected and their restoration *promoted* (policy 6). Regional councils are required to map, monitor and maintain an inventory of all natural inland wetlands and their condition (cl 3.23).

Legislation and Policies	Barriers	Enablers
	(c) a wetland that has developed in or around a deliberately constructed water body, since the construction of the water body; or *(d) a geothermal wetland; or (e) a wetland that:* *(i) is within an area of pasture used for grazing; and* *(ii) has vegetation cover comprising more than 50% exotic pasture species (as identified in the National List of Exotic Pasture Species using the Pasture Exclusion Assessment Methodology (see clause 1.8)); unless* *(iii) the wetland is a location of a habitat of a threatened species identified under clause 3.8 of this National Policy Statement, in which case the exclusion in (e) does not apply* The RMA definition of wetlands applies to all wetlands above and below MHWS (s2) ***wetland** includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions.*	
Resource Management (National Environment Standards for Freshwater) Regulations 2020 (NES-F) under the RMA Agencies responsible: Minister for the Environment Regional Councils, Territorial Authorities and Unitary Authorities	Only applies to *natural inland wetlands* above the MHWS. As above, the definition of *natural inland wetlands* is narrower that the RMA definition, and therefore not all coastal wetland restoration projects will benefit from the enabling rules.	Specified works associated with *wetland maintenance* and wetland *restoration* are permitted in respect of *natural inland wetlands,* subject to complying with conditions (reg 38).
Water Conservation Orders (WCOs) under the RMA Agencies responsible: Minister for the Environment Regional Councils, Territorial Authorities and Unitary Authorities	WCOs cover only freshwater above MHWS	RMA instruments that can provide protection for water bodies above MHWS. Purpose of WCOs includes protecting water bodies that are outstanding for *wild, scenic or other **natural characteristics**, and **scientific and ecological** values*, so purpose is consistent with protecting a wetland that has blue carbon sequestration values. A WCO can endure in perpetuity – they are not subject to regular mandatory reviews.

Appendix C: Crediting schemes that include a blue carbon methodology

Appendix C provides concise overview of the crediting schemes that include a methodology for blue carbon, with details on their attributes summarised in Table 5.1 in the main report.

The Australian Carbon Credit Units (ACCU) scheme

The ACCU Scheme (formerly Emissions Reduction Fund) is Australia's national carbon scheme, incentivising emission reduction through various activities, earning participants Australian Carbon Credit Units ('ACCUs'). The Clean Energy Regulator issues ACCUs, which can be sold to the Australian Government through a carbon abatement contract (through a reverse auction), or the secondary market.

Australia's ACCU scheme has one eligible blue carbon method, the Tidal Restoration of Blue Carbon Ecosystems Method (T-Restor)(Clean Energy Regulator 2024); which came into effect on 2 January 2022. This method covers projects that introduce tidal flows to allow the establishment of coastal wetland ecosystems including supratidal forests, mangroves, saltmarshes and seagrass, through the removal or modification of a tidal restriction mechanism. This results in the rewetting of previously completely or partially drained coastal wetland ecosystems and the conversion of freshwater wetlands to brackish or saline wetlands. These ecosystems are highly effective at sequestering carbon dioxide from the atmosphere and storing it in the sediment and biomass.

A registered blue carbon project must maintain tidal flow to the project area throughout the project permanence period to ensure that the carbon sequestered in the vegetation and soils is maintained. Projects involving the removal of tidal barriers, are subject to rigorous obligations regarding project permanence, reporting, and auditing throughout their duration. For further details on the implementation of blue carbon projects under the ACCU scheme can be found on the Australian Clean Energy Regulator website (https://cer.gov.au/schemes/australian-carbon-credit-unit-scheme/accu-scheme-methods/tidal-restoration-blue-carbon).

Other blue carbon activities such as livestock exclusion through fencing, and managed sea-level retreat, have been proposed to be included in Australia's ACCU scheme.

Currently, there are no blue carbon projects registered under the ACCU scheme. However, two projects are currently with the assessors and should be registered within 2024.

Verra

Verra (https://verra.org/), established in 2007 as a non-profit organisation based in Washington DC, focuses on creating and managing standards, notably the Verified Carbon Standard (VCS) Program. This globally recognized program enables businesses and organisations to quantify and certify their environmental contributions, ensuring credibility and transparency. Verra develops methodologies and protocols for projects, issuing Verified Carbon Units (VCUs) that can be traded on the voluntary carbon market. The VCM is not policy-driven or required under any form of legislation, hence voluntary claims differ from schemes such as the Aotearoa NZ ETS or the ACCU scheme in Australia. The organisation offers specific methodologies for coastal and tidal blue carbon ecosystems, promoting conservation and restoration efforts (Verra 2024), viz:

- REDD+ Methodology Framework (REDD+MF) (VM0007) (Verra 2023c) which will be phased out in the future (McMahon, pers. comm. 2024, Verra 2023a) and therefore should not be used for any future blue carbon project.
- Methodology for Tidal Wetland and Seagrass Restoration (VM0033) (Verra 2023).
- Methodology for Coastal Wetland Creation (VM0024) (Verra, n.d.), which was only applicable in the United States of America. Since there was no uptake of this methodology it was inactivated in September 2023. This method had notable features and accomplishments such as the use of a Performance Standard for additionality and enabled aggregation so that a mosaic of small projects could still be feasible.

Verra will revise their VM0007 and VM0033 methodologies and consolidate the requirements for blue carbon projects within a single accepted methodology, VM0033 (Verra 2023a).

Verra's contributions enhance the transparency of the carbon offset market through databases like the Voluntary Registry Offsets Database. Currently there are several blue carbon projects under development and due for assessment and registration with Verra. However, as of 1 February 2024, only one blue carbon project using the VM0033 methodology has been officially registered and is listed in the registry.

Plan Vivo

Plan Vivo, originating in 1994, is a certification standard for forestry, agricultural, and other land-use projects that promotes community-based sustainable development. It focuses on enhancing livelihoods and conserving ecosystems in developing countries. The framework emphasizes the participation of local communities, ensuring they receive fair compensation for their environmental stewardship efforts. Projects under Plan Vivo aim to sequester carbon dioxide while simultaneously addressing socio-economic challenges like poverty and biodiversity loss.

The Plan Vivo Foundation certifies and issues both "ex-ante" (forward crediting) and "ex-post" (post-sequestration) offsets called 'Plan Vivo Certificates'. These certificates can be issued even before third-party verification, after submitting an annual report. The Foundation assesses and registers projects according with the Plan Vivo Standard (Plan Vivo 2024). It annually issues Plan Vivo Certificates upon the receipt and approval of each project's annual report. The Plan Vivo Standard is periodically revised in collaboration with the Technical Advisory Committee and Stakeholder Groups.

In contrast to Verra and the ACCU scheme, which require projects to be quantified using their own published methodologies, the Plan Vivo Foundation permits mangrove projects to use the AR-AM0014 methodology (CDM n.d.) published by the UNFCCC CDM program. However, Plan Vivo is currently developing a new blue carbon methodology, specifically with marine and coastal projects in mind and informed by the knowledge and learning from pioneering blue carbon projects. This method will initially be focussed on the quantification of carbon in mangrove forests and later include seagrass ecosystems as development continues. There is no mentioning on the release date of the methodology.

Plan Vivo-certified blue carbon projects include: Mikoko Pamoja (Plan Vivo 2020), coordinated by the Association for Coastal Ecosystem Services and in collaboration with The Mikoko Pamoja Community Organisation, Tahiry Honko (Plan Vivo, 2020a), coordinated by Blue Ventures and the Velondraike Association, and Vanga Blue Forest (Plan Vivo, 2020b), also coordinated by the Association for Coastal Ecosystem Services in partnership with the Vanga, Jimbo, and Kiwegu Community Forest Association.

Gold Standard

Gold Standard was established in 2003 by World Wildlife Fund and other international non-governmental organisations and is an international voluntary carbon offset program, ensuring that projects not only reduce carbon emissions and are featured the highest levels of environmental integrity, but also contribute to the sustainable development goals. The Gold Standard project registry (Gold Standard 2024), containing all projects implemented through the standard, was launched in 2018. Projects seeking certification undergo a thorough assessment process to verify their environmental integrity, additionality, and contribution to local communities.

The credits received from the Gold Standard are called Gold Standard carbon credits or Gold Standard Verified Emission Reductions ('GS-VERs'), representing the reduction or removal of one tonne of carbon dioxide equivalent (tCO_2e), plus the United Nations Sustainable Development Goals benefits associated with the project from which they are issued. These credits are recognized internationally for their high environmental integrity and contribution to sustainable development goals.

Gold Standard has an approved methodology for the certification of mangrove afforestation/reforestation projects since 2013, which is based on the much broader Gold Standard A/R Requirements - Methodology for afforestation/reforestation (A/R) GHG emission reduction and sequestration ("Gold Standard A/R Methodology") (Gold Standard 2022). The Gold Standard has no specific methodology to include other types of blue carbon ecosystems. However, Gold Standard, together with Forliance, are currently in the process of developing a new methodology for blue carbon projects: the Sustainable Mangrove Management Methodology. This methodology will integrate advancements in remote sensing and geographic information technologies to address sustainable management of mangrove ecosystems. This innovative methodology will incorporate alternative monitoring and reporting approaches aiming to mitigate the challenges and uncertainties linked with on-ground monitoring (The Blue Carbon Initiative and The Mangrove Alliance, n.d.).

Currently the uptake of using the Gold Standard A/R Methodology for mangrove projects is low and no certified mangrove project could be found in the Gold Standard registry (Gold Standard 2024).

Other coastal and marine blue carbon standards

There are two location-specific methodologies that were developed for restoring blue carbon ecosystems including:

- Restoration of California Deltaic and Coastal Wetlands Version 1.1, which is listed under the America Carbon Registry (ACR 2017)
- The Mexico Forest Protocol Version 3.0 , which is listed under the Climate Action Reserve (Climate Action Reserve, 2022)

The Manglares San Crisanto/San Crisanto Mangroves project (Climate Seed n.d.) was the first of its kind project in Mexico, registered with the Climate Action Reserve under the Mexico Forest Protocol v1.5 in 2018. The project focuses on the conservation and sustainable management of mangrove ecosystems in the San Crisanto region.

Furthermore, there is only one project registered under the America Carbon Registry that has applied the restoration methodology within California. Consequently, it's evident that both the America Carbon Registry and Climate Action Reserve play a minor role in the carbon market and facilitation of blue carbon projects.

Globally, two primary types of The Blue Carbon Initiative projects are active and issuing carbon credits: i) the conservation and restoration of mangrove forests and ii) the restoration of wetlands, such as peatlands. Moving beyond mangroves and wetland projects is proving challenging. The main challenge of creating methodologies for carbon projects such as kelp and seaweed farming, and seabed management lies in the measurement of the carbon removed and stored in the marine ecosystem. Understanding a project's additionality as well as permanence, two main core principles of carbon markets, could also be challenging. Methods for seaweed and kelp are being developed and various research are currently underway, ensuring the robustness of any methodology that is being developed. Within NZ, a research project co-led by blue carbon Services and NIWA is currently underway (NIWA n.d.). This project aims to provide Aotearoa NZ's first national estimate of natural kelp-carbon sequestration in the marine environment which potentially could support the NZ's move towards net zero emissions by providing data required to include kelp-sequestered carbon into national carbon budgets and potentially for inclusion in carbon markets.

Appendix D: Additional analysis on co-benefits

D.1 Biodiversity and resilience co-benefits in ACCU T-Restor and Verra

Table D.1 How biodiversity and resilience co-benefits are incorporated in existing blue carbon accounting methods ACCU T-Restor and Verra

Co-benefit	ACCU Method: Tidal Restoration of blue carbon Ecosystems (T-Restor)	Verra
Biodiversity	+/- <5% of biomass thinning to allow for weed control. However, unless required by law, biomass must not be removed which in some cases may not meet the requirements of persistent weed control (for example seed removal is not allowed unless it is part of a legal requirements). - restoration planting is not required or mandated, therefore could create a blue carbon project focussed on sediment and not on diverse plantings. up to 5% of vegetation thinning is allowed, which may restrict weed control in some instances where weeds are dominant). + planting or seeding of plants of indigenous / local coastal wetland plants + excavation is limited to eligible activities only. + mosquito management plan required where necessary and proponent and landowner agree to implementation. + no crops, grazing livestock, aquaculture, or fertiliser.	+ Project activities are expected to generate GHG emission reductions and removals through: • Increased biomass • Increased autochthonous soil organic carbon • Reduced methane and/or nitrous oxide emissions due to increased salinity or changing land use • Reduced carbon dioxide emissions due to avoided soil carbon loss + applicable to a wide range of project activities aimed at restoring and creating tidal wetlands, and emission reductions and removals + area cannot be cleared of native ecosystems in the 10year period prior to the project start date. + no crops, grazing livestock, aquaculture, or fertiliser in the project scenario. - existing seagrass meadows (unless <5% of the total project area) must be excluded, limiting the diversity of ecosystems / communities that can be accounted in the scheme.
Resilience	+ excavation is limited to eligible activities only.	+ Since biomass may be lost due to subsidence following sea level rise, restoration projects involving afforestation or reforestation may account for long-term carbon storage in wood products where trees are harvested before dieback. + includes modelling and risk assessment of climate change impacts (e.g. sea level rise/erosion) on the project.

D.2 Methods for measuring biodiversity benefits

Table D.2 Measuring biodiversity benefits based on scientific knowledge and mātauranga Māori

Principles of high quality biodiversity conservation and restoration		Relevant best practice from biodiversity measurement body of knowledge*. Contemporary application of principles in Aotearoa NZ.	Mātauranga Māori
Baseline	Measuring the condition and value of the coastal wetland prior to the project interventions.	General practice is to assess the condition and values at the time immediately prior to the project commencement, in other words 'contemporary' values and condition. Sometimes historic values or condition may be described where they are significant (such as documenting a local extinction). Resource consent applications under the RMA require a description of the baseline environmental and social context.	Mana whenua may refer to 'pre-colonial' conditions and values or other forms of historical values that may be the same or may have changed over time. These conditions may be different to the current/contemporary conditions.
Without project scenario	Estimating / foretelling the condition and values of the coastal wetland if the blue carbon project did not go ahead. This captures the potential for improvement or decline based on contemporary and future stressors and interventions.	Assessing a range of natural and human-induced stressors (pollution, development, climate change), policy and legal interventions (or lack thereof), and using modelling, expert analysis and scenario-building, the future state is estimated.	
Additionality	All benefits that will be accounted must be additional to what would have been done anyway. For example: • required by law. • has funding and other resources planned / allocated. • is an existing project.	Additionality is a key function of carbon credits, nature positive accounting, biodiversity and biodiversity offsetting. Methodologies specifically define additionality. The NZ Biodiversity Offsetting Good Practice Guidelines (Ministry for the Environment *et al.* 2014) provide specific guidance on public land, land that is already protected and existing council / government run programmes. This is relevant for coastal wetland blue carbon, where there is potential within land administered by DoC or Council.	

Principles of high quality biodiversity conservation and restoration		Relevant best practice from biodiversity measurement body of knowledge*. Contemporary application of principles in Aotearoa NZ.	Mātauranga Māori
Standardised measurement, verification and reporting, and transparency.	Approaches are standardised, published and peer reviewed to provide surety of certification/registration to sellers and buyers, accuracy, comparisons within and between schemes and cost effectiveness. Standardisation and transparent and robust verification processes can reduce the perception of greenwashing. There is a trade-off between detailed measurement and verification for certainty and accuracy and the cost and level of effort required to receive a carbon credit or achieve an offset. There is also a balance between standardisation and flexibility for site specific environmental and social context.	There are a number of standardised methods for collecting and analysing qualitative and quantitative data to assess biodiversity in the literature, and used by DoC, regional councils, NIWA and practitioners across the motu. This science can contribute relevant indicators and methodologies for biodiversity co-benefit measurement for blue carbon. An ecological impact assessment method for coastal areas is being developed by EIANZ (www.eianz.org), pending publication in 2024 and may provide some further guidance. Some Aotearoa NZ guidance already enables / integrates the scientific and the mātauranga Māori approaches (Environmental Protection Authority n.d., Wilson and Oliver 2023) for the purposes of resource management or for consents and approvals under the RMA or Environmental Protection Authority processes.	Mātauranga Māori methods are developed by mana whenua and are most often specific to a rohe (area). A national standardised approach may not be relevant or appropriate. Traditional knowledge is kept by mana whenua: environmental (taonga tuku iho, mātauranga o te taiao) and cultural practices, such as healing and medicines (rongoā), fishing (hī ika) and cultivation (mahinga kai). It is possible to capture this knowledge in a framework and collect quantitative and qualitative data that can be reassessed and remeasured over time by mana whenua. Examples include the Marine Cultural Health Programme www.marineculturalhealth.co.nz
Stakeholder engagement and participation in decision making.	This includes access to information, consultation, participation in decision making and implementation, free prior and informed consent for indigenous peoples and the use of feedback and grievance redress. Timely and adequate, in a manner that is understood by all parties (language, communication methods etc.). This principle recognises that there are many stakeholders in blue carbon projects and there are likely to be different perspectives regarding the values, benefits and impacts of coastal wetland restoration, including the type	Engagement and participation has been embedded into the RMA and Local Government Act for decades in NZ. Mana whenua are treaty partners which extends this concept beyond 'stakeholder engagement and into 'partnerships'. (see also next row). For biodiversity assessments and measurement this is most relevant to understanding and incorporating the various values of the ecosystems, including ecosystems services. Consultative and participatory methods are well understood and practiced across the motu. Guidance is provided by MfE and others (www.qualityplanning.org.nz) and these approaches can be suitably applied to blue carbon projects.	Mātauranga Māori practices are holistic and based on whakakotahitanga or consensus, 'togetherness' and participatory inclusion and decision making. 'Grievance' processes or 'whakaoranga' are discursive and engagement.

Principles of high quality biodiversity conservation and restoration		Relevant best practice from biodiversity measurement body of knowledge*. Contemporary application of principles in Aotearoa NZ.	Mātauranga Māori
	and quality of co-benefits such as biodiversity or access for cultural purposes. A focus on including the vulnerable or disenfranchised and recognises the importance of inclusive practices for gender, age, ethnicity and minority peoples. Anti-discrimination and harassment.		
Respecting legal and customary rights.	Respecting the legal status of land and seabed, the rights of land owners, and the traditional or customary use and communal use of land and coastal marine area.	For biodiversity assessments and measurement this principle is closely related to stakeholder engagement and iwi partnerships and understanding and incorporating the various values of the ecosystems, including ecosystems services. The body of knowledge is consistent in this requirement to ensure property owners, resource users and customary rights are recognised and respected. Te Tiriti o Waitangi and Waitangi Tribunal decisions such as Te Tumu mō Te Pae Tawhiti Wai262 recognise mana whenua relationships and customary uses of the land and sea is enshrined in several pieces of legislation. Wai262 recognise the obligation of iwi and hapū as the kaitiaki (cultural guardians). Blue carbon scheme will need to reflect the recommendations of the Waitangi Tribunal for Wai 262 claim, and the Government response. The RMA requires the taking into account of the principles of the Treaty of Waitangi (Section 8) and recognition of the relationship of Māori and their culture and traditions (Section 6c) and protection of protected customary rights. The MACA is the most recent legislation to recognise customary and traditional uses. The legal status of the foreshore and seabed has been controversial in	Tikanga Māori regarding traditional and customary uses is at the core of Kaitiakitanga and mātauranga Māori and how mana whenua develop frameworks for biodiversity / natural resource management.

Principles of high quality biodiversity conservation and restoration		Relevant best practice from biodiversity measurement body of knowledge*. Contemporary application of principles in Aotearoa NZ.	Mātauranga Māori
		Aotearoa NZ and the implementation of the MACA is in the early stages. For blue carbon this is a key issue regarding the rights to using the CMA for carbon, restoring habitats and allocation of carbon rights (as discussed in Section Coastal land tenure and carbon rights).	
Equitable outcomes / social and community benefits, participation by indigenous peoples and local communities.	This principle is 'pro-poor' and has come from the concept of sharing the benefits with those that are traditionally unable to access project benefits or may otherwise be adversely affected and assumes a powerful project proponent such as private sector or government. It recognises the importance of benefit sharing, rather than benefit capture by project proponent, especially in the use of common resources such as marine areas or forests.	Equitable outcomes and community benefits are less common in the biodiversity body of knowledge, however participation is a key principle as discussed above. Mostly this has been framed in terms of 'managing impacts' and doing no harm but is changing (as evidenced in the globally-relevant World Bank ESS6 Biodiversity Conservation Standard (World Bank, 2018).	
Management of leakage, permanence and reversals	The principle ensures that 1) there are no impacts beyond the project that were directly or indirectly caused by the project, or if there are, that they are accounted for and 2) there is no degradation or loss, over time, of the benefits, unless they are accounted for. Methodologies are required for describing project boundaries (spatial and temporal).	This is a key concept of carbon accounting, biodiversity offsetting and Climate, Community and Biodiversity Standards. These methodologies for identifying and managing leakage, permanence and reversals can be applied / adapted to blue carbon co-benefits.	
Biodiversity benefits	Benefits / gains / values are recognised in terms of the **spatial extent, condition or quality and significance**.	The body of knowledge applies these principles with reasonably consistent and standardised methodologies. Indicators are used to provide a	Mana whenua hold knowledge of the biodiversity condition, values, concepts and significance. Within a mātauranga Māori framework this knowledge is used to measure and monitor change over time.

Principles of high quality biodiversity conservation and restoration		Relevant best practice from biodiversity measurement body of knowledge*. Contemporary application of principles in Aotearoa NZ.	Mātauranga Māori
	The principles apply across all ecosystems but require ecosystem-specific parameters, indicators or metrics. Biodiversity parameters are measured and assessed over time to identify change (net gain, loss, stability, resilience). Most accurate and meaningful are methods based on estimating and measuring 'outcomes'.	proxy for an assessment of condition, quality and significance. International organisations (e.g., the Taskforce on Nature Markets, World Economic Forum – Financing for Nature Global Initiative, the International Union for the Conservation of Nature – Global Standard for Nature-based Solutions) as well as governments (e.g., Australia) are working to develop a best practice for MVR. Most of these approaches have a strong focus on outcomes. EIANZ are updating the ecological impact assessment guidelines for Australia and New Zealand to include the coastal marine area (pending 2024). Regional Councils have parameters and indicators for state of the environment monitoring. SDVista methodologies include a 'nature stewardship' credit, acknowledging where ecosystems have been protected by indigenous customary methods or traditions. For biodiversity benefits to be captured in blue carbon, specific coastal wetland parameters should be included in a methodology.	To be discussed is whether a national framework is appropriate and possible for biodiversity co-benefits, and / or how to weave in local frameworks.
Scientific and traditional knowledge	The principles acknowledge that many sources of knowledge are needed to understand and manage biodiversity outcomes.	The body of knowledge is dominated by well-understood scientific approaches to field measurement and data analysis. Digital data capture and analysis techniques are routinely used such as geospatial techniques, remote sensing and modelling. Advances in technology using DnA and artificial intelligence are improving accuracy and saving time/labour.	Traditional knowledge is kept by mana whenua: environmental (taonga tuku iho, mātauranga o te taiao) and cultural practices, such as healing and medicines (rongoā), fishing (hī ika) and cultivation (mahinga kai). Concepts such as wairua, wāhi taonga and ki uta ki tai apply to how biodiversity values and conditions are assessed. Within a mātauranga Māori framework this knowledge is used to measure and monitor change over time. To be discussed is whether a national framework is appropriate and possible for biodiversity co-benefits, and / or how to weave in local frameworks.

Principles of high quality biodiversity conservation and restoration		Relevant best practice from biodiversity measurement body of knowledge*. Contemporary application of principles in Aotearoa NZ.	Mātauranga Māori
Additional principles as lessons from TNFD, UK Carbon Code and NZ ETS implementation.			
Scalability and cost-effective while remaining robust/accountable	The methodologies should contribute to accurate and reliable evidence of baseline condition and future state to give all parties reassurances and avoid greenwashing, but not be so cumbersome or expensive that they become barriers in and of themselves.	The body of knowledge mostly addresses this by having standardised methodologies following the principles above that can be adapted, scaled and applied to site specific projects. There remains a conflict between affordability and quality data and analysis. A prescriptive methodology that is generally accepted by all parties (regulators, proponents, practitioners, stakeholders, mana whenua), such as national guidelines, is useful for reducing the risks of poor science and / or greenwashing.	
Adaptive management	The principle of measuring, monitoring and adapting project methodologies to respond to the results. This is useful when not all the information is known at the start of the project to be confident of the management approaches, with dynamic ecosystems that can be affected by multiple stressors (by the project or separate to the project).	Adaptive management is more common in the body of knowledge, particularly ESIA and biodiversity offsetting. Where measurement, monitoring and decision pathways for adaptive management are clear (such as in consent conditions or environmental management plans), then it has been an acceptable process for managing biodiversity outcomes.	Mātauranga Māori is a dynamic and evolving knowledge form that represents more than the past, it adapts and changes but does not lose its integrity nor sense of origin (Afoa and Brockbank). A mātauranga Māori framework incorporates the idea of adaptability in response to change.