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NORTHERN TERRITORY ENVIRONMENT PROTECTION AUTHORITY
PROJECT REFERRAL
BLUE CARBON RESTORATION - RESEARCH PILOT PROJECT
NORTHERN TERRITORY PORTION 2433- KANGAROO ISLAND
BLUE CARBON S2C PTY LTD

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Notice

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GLOSSARY OF TERMS

Term	*Meaning / Definition*
ACCU's	Australian Carbon Credit Units
AFSL	Australian Financial Services Licence
ALRA	*Aboriginal Land Rights Act 1976*
BCE	Blue Carbon Ecosystems
BCER	Blue Carbon Ecosystem Restoration
BC-OC	BlueCarbon OnCountry
BC-S2C	Blue Carbon S2C Pty Ltd
BMMP	Biosecurity Monitoring & Management Plan
BMPs	Best Management Practices
CEA	Carbon Estimation Area
CER	Clean Energy Regulator
CFI Act	*Carbon Credits (Carbon Farming Initiative) Act 2011*
CH_4	Methane gas
CLA	*Crown Lands Act 1992*
CO_2	Carbon dioxide
CP-ILUA	Carbon Project Indigenous Land Use Agreement
DCCEEW	Department of Climate Change Energy Environment and Water
DEPWS	Department of Environment Parks & Water Security
DIPL	Department of Infrastructure Planning and Logistics
DO	Dissolved Oxygen
EMS	Environmental Management System
EP Act	*Environment Protection Act 2019*
EPBC Act	*Environment Protection Biodiversity Conservation Act 1999*
ERF	Emissions Reduction Fund
ESCP	Erosion Sedimentation Control Plan
GHG	Greenhouse Gas
GoC	Gulf of Carpentaria
ha	hectares
IPA	Indigenous Protected Area
IAPP	International Association for Public Participation's
ILUA	Indigenous Land Use Agreement
IMS	Information Management System
IPCC	International Panel on Climate Change
km	kilometres

Term	*Meaning / Definition*
m	metres
m^2	metres square
ML	Megalitres
MRV	Monitoring, Reporting and Verification
N/A	Not Applicable
N_2O	Nitrous oxide gas
NAERH	Northern Australia Environmental Resources Hub
NESP	National Environmental Science Program
NLC	Northern Land Council
NT	Northern Territory
NTA	*Native Title Act 1993*
NT EPA	Norther Territory Environment Protection Authority
ORP	Oxidation Reduction Potential
PAA	Pastoral Access Arrangement
PLA	*Pastoral Lands Act 1992*
POMP	Project Operation Management Plan
REMP	Restoration Environment Management Plan
RPP	Research Pilot Project
S2C-I	Sequestration 2 Credits Institute
TDS	Total Dissolved Solids
The Proponent	BC-S2C
The Proposal	Blue Carbon Restoration in the Northern Territory Gulf of Carpentaria
ToC	Table of Contents
VCS	Verified Carbon Standard - An internationally recognised standard for measuring and verifying carbon offsets from offset projects
VCU	Verified Carbon Unit
VERRA	VERRA manages the issue of VCS Units under the VCS Program
WMP	Water Management Plan

Abstract

Sea grasses, mangroves, salt marshes and supratidal forests are also known as Blue Carbon Ecosystems. They have been degraded by human development or adversely impacted by natural events for many decades. These negative impacts reduce their ability to act as one of the world's most secure and reliable carbon sinks. If managed properly, Blue Carbon Ecosystems can help meet climate change, net zero and decarbonisation objectives under government and industry targets. They also have the potential to deliver significant environmental, social, and economic co-benefits over several generations.

The Proponent for this Referral is Blue Carbon S2C Pty Ltd (BC-S2C). The subject of BC-S2C's Referral is to trial and research blue carbon ecosystem restoration within six hectares on Northern Territory Portion 2433 (Kangaroo Island) using the Voluntary Carbon Standard Verra Methodology VM0033 – Methodology for Tidal Wetland and Seagrass Restoration. The Referral also seeks approval to construct and operate a training and blue carbon research institute near Black Rock Landing, north of King Ash Bay, also located in the Gulf of Carpentaria.

BC-S2C has been engaging with traditional custodians of Kangaroo Island and Black Rock Landing to seek their in-principal agreement to conducting blue carbon ecosystem research.

The Pilot Project will form Phase I of three phases for blue carbon restoration proposed by BC-S2C in the NT Gulf of Carpentaria. Project Eligibility studies for two other sites in the Northern Territory Gulf of Carpentaria using the Australian Government Blue Carbon methodology form part of Phase I and, they will occur in parallel to the Pilot Project. The other two project sites will be referred to the NT Environment Protection Authority separately.

The results of Phase I will determine the scope of a separate project referral for Phase II (1,000 hectares on Kangaroo Island). If the proposal advances to Phase II and the scope of that project is approved, then the results of Phase II will be used to define the scope of a separate referral for Phase III (up to 39,000 hectares along the Gulf of Carpentaria). This Referral document will be used by the NT Environment Protection Authority to determine an appropriate level of assessment for the Phase I proposal.

Declaration

I, Richard Phillips, declare that I am authorised to refer this proposed action/strategic proposal on behalf of Blue Carbon S2C Pty Ltd, and further declare that:

- the attached environmental impact assessment documents have been prepared in accordance with the Northern Territory *Environment Protection Act 2019* (**EP Act**) and Environment Protection Regulations 2020; and
- the attached environmental impact assessment is true; and
- the attached environmental impact assessment documents do not provide false or misleading information and I know it is an offence to provide false and misleading information, noting the penalties under section 260 of the EP Act, and section 119 of the *Criminal Code Act 1983*; and
- the proponent fully understands that referral under the EP Act does not limit, in any way, the requirements of the proponent to ensure approvals under any other regulatory regime are applied for, and adhered to; and
- the proponent has fulfilled its general duty in accordance with section 43 of the EP Act.

Publication Statement

Referral report author:	Mr. Richard Phillips
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Author's signature	
Date:	09/05/2023
Reviewer's signature	
Date	09/05/2023
Approvers signature	
Date:	09/05/2023

Executive Summary

INTRODUCTION

Blue Carbon and Blue Carbon Ecosystems are terms that refer to the carbon sequestered in coastal ecosystems that comprise sea grasses, mangroves, salt marshes and supratidal forests. Large areas of these ecosystems in the Northern Territory have been deforested or degraded by both human and natural activities. This reduces their ability to act as one of the most secure and reliable carbon sinks that can help meet climate change, net zero and decarbonisation objectives under various international, national, territory/state policies and targets.

Blue Carbon ecosystems will continue to be placed under pressure and suffer losses due to catastrophic natural disasters, changes to sea levels and human development that impact natural hydrology. Blue Carbon ecosystem restoration projects can bring significant environmental, social, and economic co-benefits. Strategies and techniques involving natural re-wetting to prevent mangrove loss, restore and conserve these important ecosystems have successfully been implemented globally.

STATUTORY FRAMEWORK

This Referral has been prepared in line with Section 43 and 48 of the NT *Environment Protection Act 2019*. The Proposal will be referred to the Australian Government Department of Climate Change Energy Environment and Water under the *Environment Protection Biodiversity Conservation Act 1999* in order to determine an appropriate level of environmental approval.

THE REFFERAL – PHASE I RESEARCH PILOT PROJECT

Blue Carbon S2C Pty Ltd (**"BC-S2C"** or **the** "**Proponent"**) purpose is to achieve real action on climate change at a landscape scale. We intend to achieve this over three phases in the Northern Territory Gulf of Carpentaria and across three program areas; Gulf of Carpentaria South, Gulf of Carpentaria Central and Gulf of Carpentaria North.

Phase I of our business is the proposed 6 hectare research pilot project and focus of this Referral. Therefore, the Proposal seeks NT EPA approval for:

- A blue carbon ecosystem restoration research pilot project across six hectares in Gulf of Carpentaria South on Northern Territory Portion 2433 using a Voluntary Carbon Standard named Verra Methodology (VM0033) - Methodology for Tidal Wetland and Seagrass Restoration.
- Construction and operation of a blue carbon research institute named the S2C Institute. Subject to ongoing engagement and good faith negotiations with traditional custodians, it is hoped it could be located near Black Rock Landing just north of King Ash Bay.

Separate to this Referral, Phase I of our business will also involve two separate NT EPA and Commonwealth Referrals for blue carbon ecosystem restoration projects in the Gulf of Carpentaria Central and North regions. These are explained below.

Gulf of Carpentaria - Central

A potential project within the Mule Creek catchment of the Gulf of Carpentaria has been identified by BC-S2C. It is currently under good faith negotiation with the land title owners. Subject to the outcomes of that engagement, that project will be the subject of a separate referral to the Northern Territory and Commonwealth governments. The timeframe for that referral is June 2023.

Gulf of Carpentaria - North

A third project located in the Roper River catchment has been identified by BC-S2C. It requires significant stakeholder engagement, engineering and environmental feasibility studies before a referral can be lodged to the Northern Territory and Commonwealth governments. The timeframe for that referral is quarter 3, 2023.

FUTURE DEVELOPMENT – Phase II and Phase III

Phase II on Kangaroo Island NT Portion 2433

The results of Phase I will be incorporated into Phase II. If Phase I proves successful, BC-S2C will submit a separate NT EPA and Commonwealth referral in April 2024 with the aim of restoring declining mangrove and wetland habitats across Kangaroo Island covering 1,000 hectares.

Phase III – blue carbon restoration across all three program areas in the NT Gulf of Carpentaria

BC-S2C propose landscape scale blue carbon restoration commencing in GoC South (15,500 hectares), followed by GoC North (total 23,500 hectares) with a combined total of 39,000 hectares.

PROPOSAL DESCRIPTION & RESTORATION ACTIVITIES

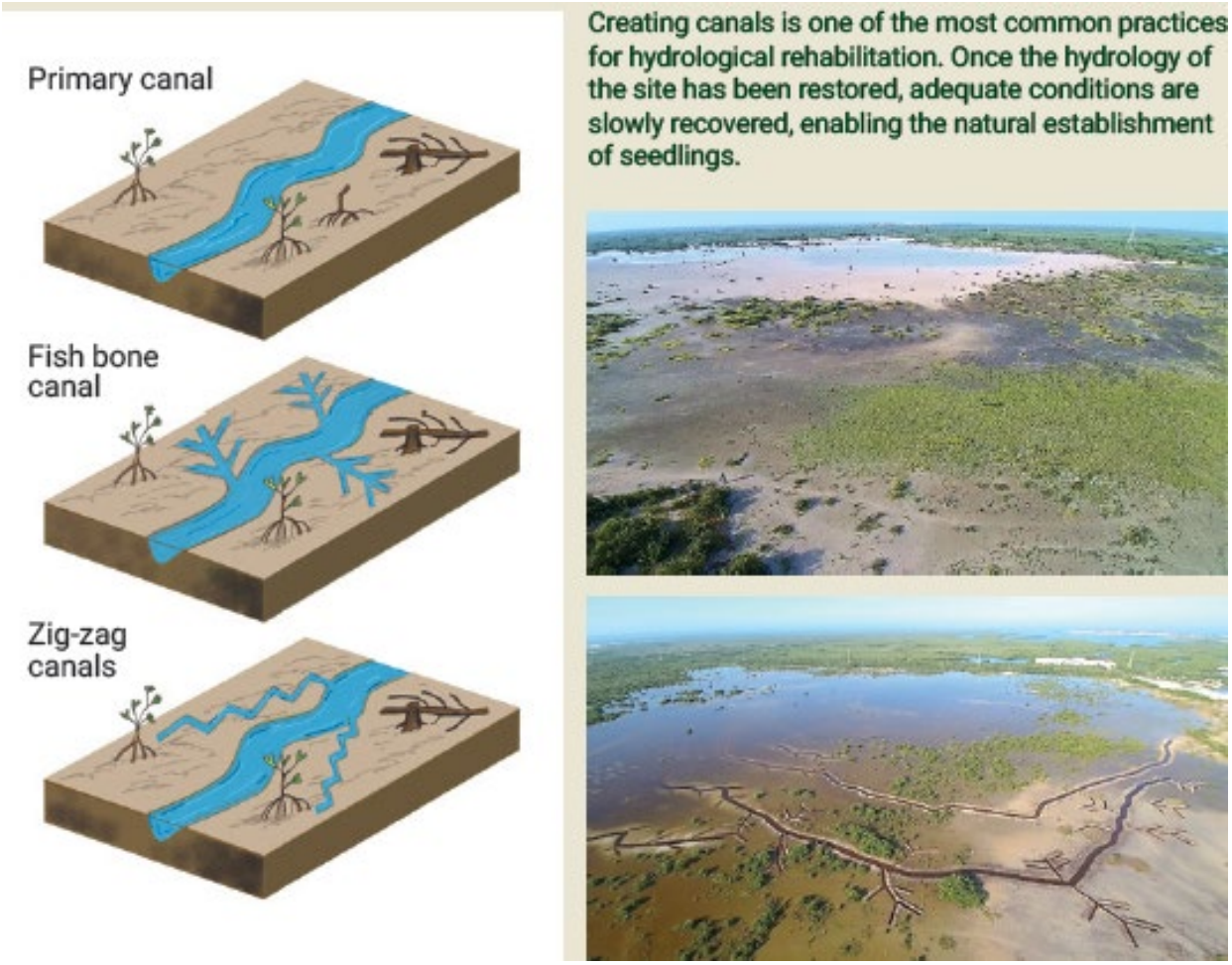
Various Blue Carbon Ecosystem Restoration techniques will be trialed in Phase I to support hydrological rehabilitation that restores the hydrology by reconnecting intertidal water flows. Our project restoration actions are not planting mangroves and saltmarsh necessarily, they are focused on restoring conditions for these habitats to grow and survive.

The proponent will follow techniques and actions that have been successfully implemented in Pakistan[1] Central America and the wider Caribbean[2] and multiple global projects supported by significant monitoring and independent peer review / auditing[3] that involve:

- **Hydrological restoration** – that restores hydrology by reconnecting water flows like de-silting existing drainage lines and the creation of new drainage lines that mimic the existing natural environment.

[1] *Delta Blue Carbon – 1 – The Indus Delta Mangrove Restoration Project Phase I*
[2] *Manual for the ecological restoration of mangroves in the Mesoamerican Reef System and the Wider Caribbean.*
[3] *Delta Blue Carbon – 1 First Monitoring Report March 2022*

- **Topographical restoration**– that modifies the field level to restore adequate flooding levels for the establishment of plants like sediment redistribution (e.g., lowering topography). This activity involves reusing soft sediments and mud generated by drainage/channeling works. Dispersal centers (raising topography) will be trialed during trialed during Phase I.
- **Reforestation –** only where baseline studies deem it appropriate, hydrological restoration may require the planting of mangrove and saltmarsh species to assist and accelerate natural regeneration.



Examples of restoration options on the elft that will be undertaken in the research pilot project. On the right, exaples of similar techniques used in the Gulf of Mexico.

ASSESSMENT OF ENVIRONMENT RISK

This Referral has examined and assessed the potential for environmental impacts (positive, neutral, or negative) in line with the NT EPA's environmental values, factors, and objectives. The Referral will be used by the NT EPA to determine an appropriate level of assessment for developing, implementing, and operating blue carbon ecosystem Phase I Research Pilot Project. The environmental values assessed in this Proposal are land, water, sea, air, freshwater systems, and people. The Proposal has accounted for the key principles of environment protection and management by addressing avoidance, minimisation, environmental management, and a changing climate. The assessment identified the potential for environmental risk triggered by some of the proposed restoration activities. As a result of proposed restoration actions, the Referral identifies the following risks:

- Disturbing acid sulphate soils.
- Offsite erosion and sedimentation.
- Greenhouse gas emissions.
- Disturbing coastal aquatic ecosystems.
- Potential introduction of exotic weed species.

The possibility of negative effects was assessed and determined to be short-lived, non-hazardous, and readily controlled through conventional environmental management practices during restoration and operation phases.

RISK MANAGEMENT

To control risks, the proponent has prepared the following management plans in support of the Referral:

- A Project Environmental Management Plan that contains these sub-plans or guidelines:
    - Permanence Plan.
    - Project Operations and Maintenance Plan.
    - Acid Sulphate Soils Plan of Management Framework.
    - Sediment and Erosion Control Guideline.
    - Biodiversity Management Plan.
    - Biosecurity Monitoring and Management Plan.
    - Biting Insects Management Plan.
    - Aboriginal Heritage Protection Plan.
    - Emergency Preparedness and Response Plan.
    - Waste Management Plan.
    - Safety Management Plan.

MONITORING, REPORTING & VERIFICATION

Integrity and transparency of operational performance against environmental baseline conditions and modelling is called Monitoring, Reporting & Verification (**"MRV"**). The Proponent will use its project platform using block-chain technology, which facilitates increased transparency, accountability, integrity through project development and operations and to record MRV data and make it available to regulators, credit auditors and buyers of its credits. The MRV process is integral to validating and verifying carbon sequestration, carbon abatement and greenhouse gas emission reductions.

Project measurements will be measured quantitatively at three reference areas (Reference A- a good condition site, Reference B- degraded (poor) condition site, and Reference area C = area to be restored.) In addition, the Proponent will monitor:

- environmental co-benefit indicators (e.g., hydrology, natural regeneration, biological plant structure and composition, macroinvertebrates and vertebrates and physicochemical properties); and
- social economic co-benefit indicators (e.g., collaborative engagement, social valuation of the ecosystem, economic impact, public policies).

This approach will ensure social engagement continues and ensures the building of trust with key stakeholders and interested parties.

FUTURE BENEFITS

The benefits of Blue Carbon Ecosystems have been studied for decades. Their ability to sequester and retain carbon whilst simultaneously providing broader environmental and socio-economic co-benefits are internationally and nationally recognised. When implemented, the Proposal can bring out the following benefits :

Carbon sequestration

- Protect and restore existing blue carbon ecosystems (carbon sink) at the research project site.
- If Phase I is successful, create carbon sinks at scale that can help meet climate change, net zero and decarbonisation objectives under various industry, state and territory, national and international targets.
- Protect Indigenous peoples' intergenerational cultural heritage.
- Provide jobs and supporting business opportunities to enhance community's abilities to stay on-country.

Cultural heritage

- Protect Indigenous peoples' intergenerational cultural heritage.
- Provide jobs and supporting business opportunities to enhance communities abilities to stay on-country.
- Encourage and embed traditional land management practices and associated training, education and capacity building activities and programs.
- Enhance food security in remote areas.

Environmental

- Repair degraded landscapes enhancing biodiversity values and benefits.
- Conservation of blue, teal & green ecosystems.
- Improve storm surge, flood mitigation and rising sea level resilience.
- Improve water quality.
- Meet international, national & local sustainability policies and best practice.

Social economic

- Support local economies e.g., eco-tourism, fisheries, aquaculture.
- Protecting shorelines, coastal property and infrastructure.
- Create long term jobs in remote and regional communities.
- Generate wealth (wages, taxes, suppliers, carbon royalties).

- Meet several UN SDG and Environment Sustainable Governance indicators objectives.

CONCLUSION

Blue Carbon Ecosystems are one of the most secure and reliable carbon sinks, help meet climate change, net zero and decarbonisation objectives under various industry, state and territory, national and international targets. They also have significant environmental, social, and economic co-benefits. However, these ecosystems have faced and will continue to experience decline.

To counteract the ongoing degradation or sudden loss of blue carbon ecosystems in the Northern Territory Gulf of Carpentaria, BC-S2C plans to employ the Verified Carbon Standard methodology for tidal wetland and seagrass restoration (VM0033). This effort aims to achieve blue carbon restoration at the selected site on Kangaroo Island.

The reasons ample justification for Blue Carbon S2C Pty Ltd to fund and develop the Proposal, thereby promoting long-term socio-economic and environmental benefits.

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1 Introduction

1.1 Background

BCE are comprised of seagrass, mangrove, saltmarsh and supratidal / littoral forests

Blue Carbon Ecosystems ("**BCE"**) are environments that include seagrass, mangroves, saltmarsh, and supratidal forests. Blue carbon is carbon captured by marine and coastal ecosystems. As carbon dioxide and greenhouse gases increase in the atmosphere causing negative impacts on the planet, blue carbon provides a natural way of capturing and locking carbon back into marine plants and sediments.

Blue carbon restoration projects introduce nature-based solutions via actions like hydrological rehabilitation that restores the hydrology by reconnecting water flows. Nature based solutions to BCE restoration ("**BCER"**) are used globally and nationally.

BCE in the Northern Territory (**"NT"**) have been deforested or degraded by both human and natural activities. Losses due to natural events including sea level fluctuations, ocean warming, cyclones, flooding, droughts, and disease are likely to continue. These factors impact their ability to act as one of the most secure and reliable carbon sinks which can help meet climate change, net zero and decarbonisation objectives under various industry, state and territory, national and international targets.

BCE can bring significant environmental, social, and economic co-benefits. Strategies and techniques to prevent mangrove loss, restore and conserve these important ecosystems is now being recognised as a tool in managing and adapting to a changing climate because, they are recognised as being one of the most effective tools in their ability to absorb (sequester) carbon dioxide from the atmosphere.

This Project Referral provides information on proposed BCER Research Pilot Project (**RPP**) at a site on Kangaroo Island, NT Portion 2433 (refer to Figure 1-1) and, the construction and operation of a blue carbo research and training institute are Black Rock Landing

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Regional Site Location for Blue Carbon Research Pilot Project

Figure:

1-1

661,600 661,700 661,800 661,900 662,000 662,100

8,239,500 8,239,400 8,239,300 8,239,200

Legend

Proposed S2C Institute

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Proposed Blue Carbon Institute – Estimated Location

Figure:

1-2

1.2 Objectives

Objectives of the research pilot project are to:

- Demonstrate VM0033's scalable, replicable, and cost-effective benefits for the natural environment and community.
- Directly measure temporal changes and net emissions, including biomass and soil organic carbon stocks, methane, and nitrous oxide emissions, to determine abatement provided by proposed restoration.
- Improve blue carbon ecosystem restoration policy and guidelines in the Northern Territory.
- Investigate and implement low-cost technologies and computational tools for measuring blue carbon sequestration, such as telemetry sensors and artificial intelligence.
- Incorporate indigenous knowledge and values to improve stewardship.
- Partner with local businesses to maximize blue carbon restoration opportunities.
- Explore ways to incorporate project co-benefits in BC-S2C through financial and accounting platforms.
- Measure, report and verify baseline, eco-hydrology, and socio-economic indicators.

1.3 What is blue carbon?

According to the Blue Carbon Lab's (Deakin University):

- Coastal wetlands are the world's most secure and reliable carbon sink.
- They are recognised as a nature-based solution for countries to help meet climate change and commitments under the Paris Agreement.
- Coastal wetlands capture carbon dioxide 30-50 times faster than terrestrial forests.
- 80% of the carbon stored in below ground sediments. In contrast, "green" forests store most of their carbon above ground (e.g., branches, trunks, leaves) where its more vulnerable to degradation (e.g., fire, logging, drought, disease) Carbon is locked away for centuries to millennia (geological time).
- Significant co-benefits (e.g., environmental, social, cultural, and economic), but also significant threats to these ecosystems.

A blue carbon project achieves carbon abatement by increasing the carbon stored in soils and in leaf litter, and by avoiding emissions from soils as they are rewetted, or from freshwater wetlands being returned to saline wetlands.

The sequestration of carbon and avoidance in emissions allows project proponents to generate carbon credits so long as tidal flows are maintained to the project area that is defined under the project's registered Carbon Estimation Area (**"CEA**") and its registration period, otherwise referred to as the "permanence period".

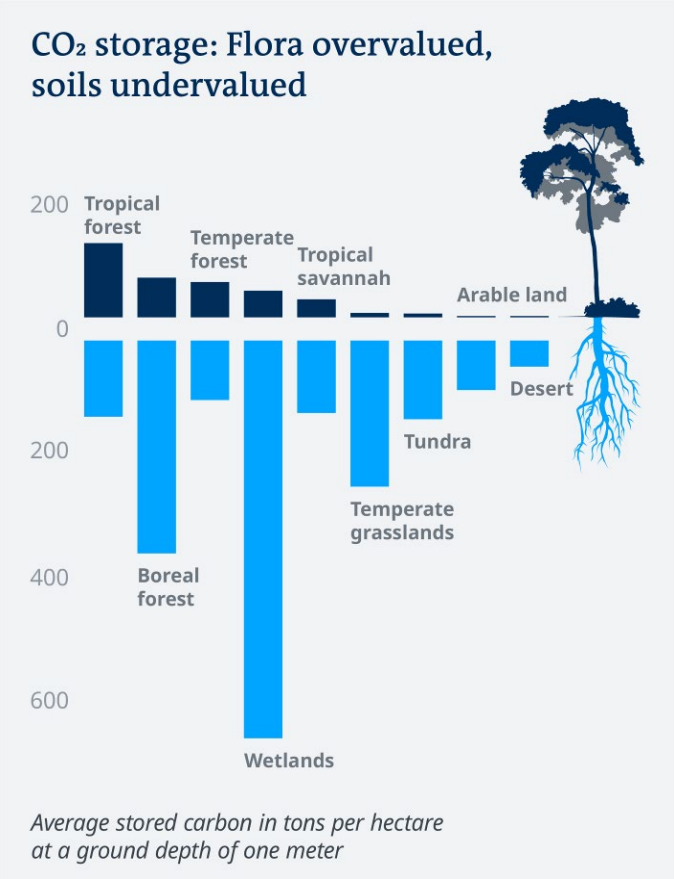


Figure 1-3 Average stored carbon in tonnes per hectare at a ground depth of one metre

Figure source (World Climate Council [IPCC])

1.4 International context

A carbon sink is a forest, ocean, or other natural environment (e.g., blue carbon ecosystem) viewed in terms of its ability to absorb carbon dioxide from the atmosphere. BCE's can be both a carbon sink (restored and pristine BCE's) and a carbon source (degraded BCE's).

BCE has experienced significant losses due to human exploitation, coastal development, or natural disasters such as die back and cyclones (Duke, 2017). Consequently, significant volumes of carbon have being emitted back into our biosphere. However, BCE have an exceptional ability to sequester carbon above and below ground (Lovelock & Duarte, 2019).

To address climate change impacts and climate change targets set by the Paris Accord in 2015 and more recently, at the United Nations Framework Convention on Climate Change (COP 27 in November 2022), the Proponent is researching proposed restoration techniques with the aim of improving carbon sequestration in a declining blue carbon ecosystem. When implemented, the Proposal can generate net negative greenhouse gas emissions by:

- **avoiding the release of mostly carbon dioxide ("CO_2")** by decreasing the oxidation of soil organic carbon ("avoided losses" or "stop-loss"); and/or;

- **increasing the uptake of mostly CO_2** by increasing carbon sequestration in soils and plants through enhanced protection, restoration, or habitat creation in the mapped research pilot project site.

Note the greenhouse gases that are reported under the NGER Scheme include carbon dioxide (CO_2), methane (**CH_4**), nitrous oxide (**N_2O**). A carbon dioxide equivalent or CO_2 equivalent (CO_2-e) is a metric measure used to compare the emissions from various greenhouse gases (**"GHG"**) based on their global-warming potential (GWP), by converting amounts of other gases to the equivalent amount of carbon dioxide with the same global warming potential. BNC-S2C looks at the sequestration of CO_2-e, which is mainly CO_2, but also CH_4 and N_2O. The International Panel on Climate Change (**IPCC**) recognises the importance of BCE in their schematic that compares carbon storage in terrestrial forests to wetland ecosystems.

1.5 National context

In January 2022, the Australian Government released its method for Blue Carbon restoration titled "Tidal restoration of blue carbon ecosystems method". It is also supporting several small-scale projects related to blue carbon ecosystems through the National Environmental Science Program (**"NESP")**. The NESP is also researching a large-scale mangrove dieback event that occurred in the GoC (2015). Several universities around Australia are leading research into BCE and assisting in the development of national guidance and method development. The Proponent has and will continue to reach out to these institutions as it develops its own BCER programs and projects across the NT and Australia.

1.6 Regional context

BCE in the NT's GoC have their own pressures. They have and will continue to suffer losses under development including changing land use like agricultural, mining, aquaculture (e.g., shrimp farms), urban sprawl causing deforestation and drainage of wetlands, exotic plants, and animals, introduced structures (roads, culverts) that impact natural hydrology and natural events including sea level fluctuations (sea level rise or fall), ocean warming, cyclones, flooding, droughts, fires and disease. Sea level fall has caused some of the most significant losses to regional blue carbon ecosystems in the Gulf of Carpentaria (Figure 1-4).

1.6.1 Sea level fluctuations

The Northern Australia Environmental Resources Hub (**"NAERH"**) website states that significant die back of mangroves occurred in 1982 and again in 2015 due to a drop in sea levels and a corresponding sever El Nino. Sea levels dropped between 0.4 metres (**"m"**) and 0.5 m between April and October in 2015. As a result of the natural event, approximately 39.4 million trees died in 7,650 hectares (**"ha"**) area and, across approximately 2,000 kilometres (**"km"**) of GoC coastline.

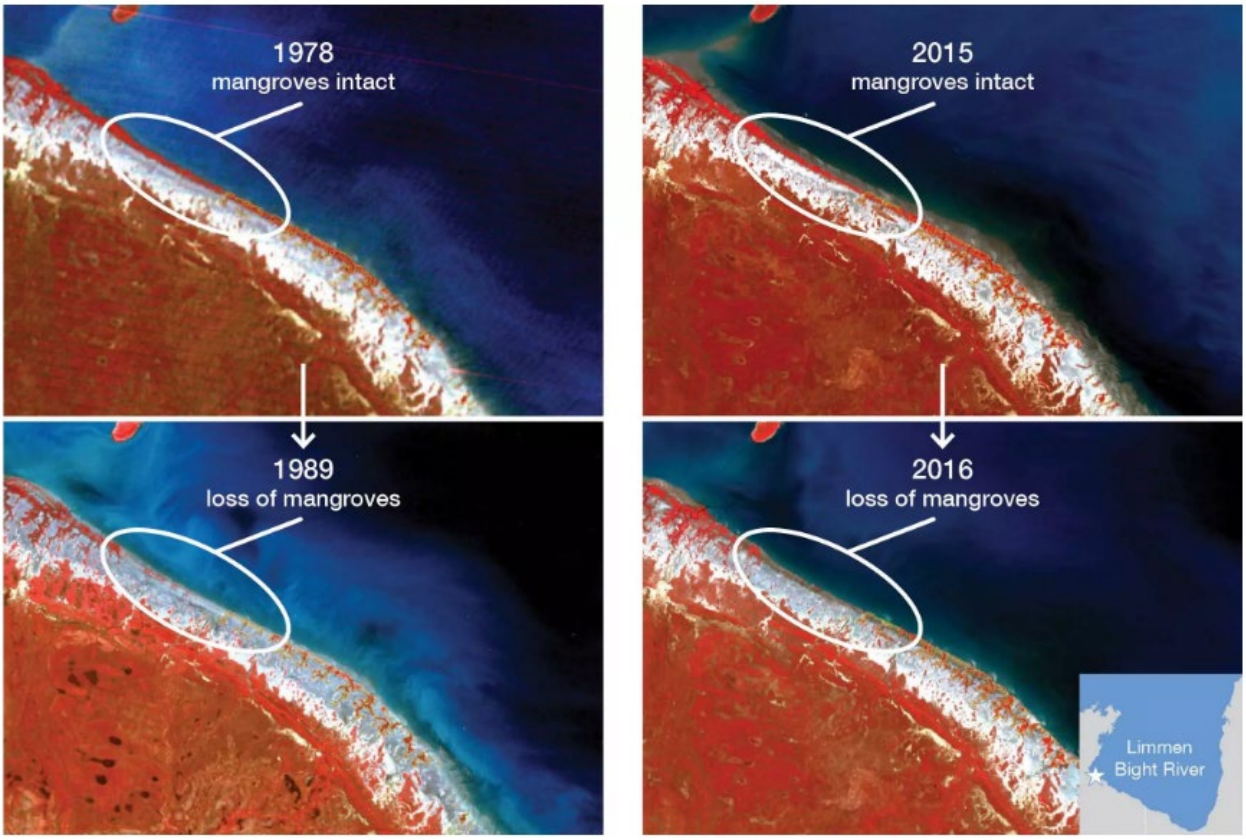


Figure 1-4 Time series comparison of mangrove losses in the NT GoC Limmen Bight River

Figure source: https://nesplandscapes.edu.au/projects/nesp/gulf-mangrove-dieback/

According to the NAERH, this natural event released and estimated 820,895 tonnes of carbon into our atmosphere. This is the equivalent of 3,009,948 tons of CO_2 equivalent. Using the United States Environment Protection Authority (**"EPA"**) online carbon calculator[4], this "natural loss of carbon" is also the equivalent to greenhouse gas emissions from:

- 648,551 petrol powered passenger vehicles driven for one year.
- 11,954,096,784 km driven by an average passenger vehicle.

It is equivalent to CO_2 emissions from:

- 1,282,085,504 litres of petrol consumed.
- 1,119,243,013 litres of diesel consumed.
- 1,510,569,003 of kilograms of coal burned.
- 379,142 homes' electricity use for one year.
- 1,370,364,775 kilograms of coal burned in a year.
- 6,968,667 barrels of oil consumed.

More importantly, if this natural event could be monitored and pro-actively managed so either the negative impact was less severe, or even avoided, this would be equivalent to greenhouse gas emissions avoided by:

[4] https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

- 1,041,505 tonnes of waste recycled to landfill in a year; or
- 818 wind turbines running for a year.

Finally, it would be equivalent to carbon sequestered by 49,769,754 tree seedlings grown for 10 years.

1.7 Challenges facing blue carbon restoration

In the Proponent's considered opinion, the challenges facing BCER projects are:

- Natural events such as sea level fluctuations, cyclones, and floods.
- Acid sulfate soils.
- Coastal dynamics.
- Remoteness.
- Legislation and policy.
- Stakeholder engagement - multiple groups over the project term.
- Approvals and tenure - can be complex, time-consuming, and costly.
- Funding - access to low-cost patient funding is a challenge.
- Revenue from credits - in many cases, is not enough to cover costs for small projects.
- Time taken - long payback period for small projects.
- Costs of restoration - depending on the method used for restoration, costs can be high.

1.8 Project development and timeframes

1.8.1 Phase II

If Phase I is successful, BC-S2C will submit a separate project referral in April 2024 to the NT EPA for Phase II. Phase II will involve completing 1,000 hectares of blue carbon ecosystem restoration on NT Portion 2433 using VM0033. The location is yet to be determined but, may extend east and northeast from the Phase I site.

1.8.2 Phase III

If Phase II is successful, a separate project referral would be submitted to the NT EPA and Commonwealth for Phase III. Phase III would involve using VM0033 to create BCER at a landscape scale and up to 39,000 hectares across project sites in GoC South and North.

2 Legislative requirements

2.1 Summary

The Proponent has completed a Referral Form in line with the NT *Environmental Protection Act 2019* (Appendix A). A summary of statutory communications and requirements that may apply to the Proposal are in Table 2-1.

Table 2-1 Legislative framework for the Proposal

Legislation	Legislative requirement	Agency
NT legislation		
Section 48 NT Environment Protection Act (**"EP Act"**)	NT EPA Referral Report	Department Environment, Parks, & Water Security (**"DEPWS"**)
Section 43 NT EP Act	NT EPA Referral checklist.	DEPWS
Section 48 NT EP Act	NT EPA determination on the level of environmental assessment.	DEPWS
Aboriginal Land Rights Act 1976 (**"ALRA"**)	Section 11A and Section 19 Agreements	Northern Land Council (**"NLC"**)
Pastoral Lands Act 1992 (**"PLA"**)	Pastoral Access Arrangement	Department of Infrastructure, Planning & Logistics (**"DIPL"**)
Crown Lands Act (**"CLA"**)	Crown licence and/or Occupation lease	DIPL
Territory Parks and Wildlife Conservation Act 1976	To study, protect, conserve, and ensure sustainable utilisation of wildlife.	DEPWS
Fisheries Act 1988	To provide for the ecological sustainable management of aquatic resources for the Territory, including ecosystems.	Department of Primary Industries and Fisheries
Commonwealth legislation		
Environment Protection Biodiversity Conservation Act 1999 (**"EPBC Act 1999"**)	Commonwealth Referral	Department of Climate Change Energy Environment and Water (**"DCCEEW"**)
Native Title Act 1993 **("NTA")**	Indigenous Land Use Agreement (**"ILUA"**)	National Native Title Tribunal
Carbon Credits (Carbon Farming Initiative) Act 2011	• Removing greenhouse gases from the atmosphere. • Avoiding emissions of greenhouse gases. • Incentives to carry on certain offset projects	Clean Energy Regulator
Climate Change Act 2022	Reducing Australia's net greenhouse gas emissions to 43% below 2005 levels by 2030 and, to zero by 2050 in a manner consistent with the Paris Agreement and Australia's nationally determined contribution.	Climate Change Authority

2.2 NT *Environment Protection Act 2019*

Under Section 48 of the NT EP Act, a proponent must refer a proposal to the NT Environment Protection Authority ("**NT EPA"**) if it has the potential to have a significant impact on the environment. In determining whether a proposal can have a significant impact on the environment, the NT EPA may have regard to matters such as:

1. Section 3 of the EP Act or other NT environmental legislation.
2. Values (e.g., effects on environmental factors and objectives), sensitivity and quality of the environment which is likely to be impacted.
3. Extent (intensity, duration, magnitude, frequency, and geographic footprint) of likely impacts.
4. Consequence of likely impacts (or change).
5. Resilience of the environment to cope with the impacts or change.
6. Cumulative impact with other proposals.
7. Principles of ecologically sustainable development, including Part 2, Division 1 of the EP Act.
8. Connections and interactions between parts of the environment to inform a holistic view of impacts to the environment.
9. Level of confidence in the prediction of impacts and the success of proposed mitigation.

Accordingly, this Referral has considered the above matters and BC-S2C has self-assessed the potential impacts (negative and positive) associated with implementing the Proposal. The NT EPA with advice from the NT DEWPS to determine what level of environmental assessment is appropriate for the Proposal.

2.3 NT *Aboriginal Land Rights Act 1976*

Section 11A and 19 of the ALRA applies to the Proposal because, where Aboriginal Land Claims exists, the Proponent must reach an agreement with the NLC and Traditional Owners. Section 11A and 19 Agreements do not apply to the research pilot project area.

2.4 NT *Pastoral Lands Act 1992*

Where Perpetual Pastoral Leaseholds or Pastoral Leaseholds occur, the Proponent must reach a private agreement with the pastoralist. Under the PLA this is a Pastoral Access Arrangement (**"PAA"**). Prior and informed consent must be achieved before a PAA can be agreed and signed. A Pastoral Access Arrangement does not apply to the research pilot project area .

2.5 NT *Crown Lands Act 1992*

Where the Proponent's proposed BCER activities intercept with Crown Land under a Perpetual Crown Lease or, a Crown Lease, the Proponent must obtain a Crown Licence under the NT Usage of Vacant Crown Land Policy 2020. A Permit may be required from Crown Lands Estate for the research pilot project.

2.6 *Environment Protection Biodiversity Conservation Act 1999*

Under the Commonwealth EPBC Act, the Proponent has submitted a referral to the DCCEEW because of matters of national environmental significance. Based on the baseline work undertaken to date and reported in Section 5, a Controlled Action may not be required. BC-S2C will refer the Proposal to DCCEEW to determine the appropriate regulatory pathway.

2.7 *Native Title Act 1993*

Native Title does not exist over the RPP area. Accordingly, the NTA is not triggered for the Proposal.

2.8 Commonwealth *Carbon Credits (Carbon Farming Initiative) Act 2011*

The Commonwealth *Carbon Credits (Carbon Farming Initiative) Act 2011* (the **"CFI Act"**) objectives include:

- Removing greenhouse gases from the atmosphere.
- Avoiding emissions of greenhouse gases.

To meet Australia's obligations under various international agreements. Additionally, it creates incentives for people to carry on certain offset projects. Finally, its third objective is to increase carbon abatement in a manner that:

a) Is consistent with the project of Australia's natural environment; and

b) Improves resilience to the effects of climate change.

Section 3 of the Referral compares VM0033 to the CFI Act. However, the Proposal will not trigger any further approvals under the CFI Act.

2.9 *Climate Change Act 2022*

This Act sets out Australia's greenhouse gas emissions reduction targets for 2030 and 2050. The Proposal's activities are expected to generate greenhouse gas emission reductions and removals through:

- Increased plant biomass.
- Increased endemic 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.

The Proposal will measure the above points through its monitoring, reporting and verification of the proposed restoration activities.

2.10 Indigenous Protected Area

NT Portion 2433 falls under the Yanyuwa Indigenous Protected Area (**IPA**). The IPA is governed by the Yanyuwa Indigenous Protected Area and Parks Advisory Committee (**YIPPAC**).

Development within an IPA in the NT is not entirely prohibited, but it is subject to strict regulations and guidelines. IPAs are established on Indigenous-owned lands and waters, and they are voluntarily designated by Traditional Owners to conserve and protect their cultural and natural heritage. IPAs are managed in accordance with the principles of the International Union for Conservation of Nature.

Development activities within IPAs must be compatible with the conservation objectives outlined in the management plan for the specific IPA. These management plans are developed by the Traditional Owners in collaboration with government agencies and other stakeholders, and they outline the priorities, strategies, and activities for managing the area.

The Proposal must undergo an assessment and approval process, which considers the potential impacts on cultural and natural values, as well as the social and economic well-being of the Indigenous communities. The Traditional Owners and Custodians play a crucial role in this process, as their consent is required for any development activities to proceed. Refer to Section 7.5 for more information on the status of consultation for the research pilot project site.

3 Proposal description – key components

3.1 Key component summary table

The key components of the Proposal are listed in Table 3-1.

Table 3-1 Key components summary table

Details	Component	Size | Capacity | Term
Proponent name:	Blue Carbon S2C	
Proponent address:	Level 29 | 2 Chifley Plaza | Sydney | NSW | 2000	
Proponent ACN:	657 919 330	
Proposal name:	Blue Carbon Ecosystem Restoration Research Pilot Project and S2C Institute	
Proposal tenure:	Crown Land and Aboriginal Freehold Land	
Proposal term	Blue Carbon Ecosystem Restoration	
Proposal area	Kangaroo Island NT Portion 2433	6 hectares
Proposal lifespan:	Approval / licence period	25 years
Proposal infrastructure:	• Desilting existing primary drainage channels that have lost hydraulic connectivity and, the creation of new secondary drainage channels linked to primary channels. • S2C Institute (demountable buildings for temporary accommodation, training, research and, a local nursery to support blue carbon restoration activities).	
Water requirements	Natural re-wetting and improving wetland tidal exchange capacity.	
Proposal milestone:	To commence restoration activities before the end of the dry season in 2023 and report outcomes against project objectives at the end of the wet season in 2024.	
Proposal objectives:		

3.2 Proposal locations

Figure 1-1 shows the location of NT Portion 2433 and the 6 ha research site while Figure 1-2 shows the location of the proposed S2C-Institute.

3.3 Summary of key components

The Proponent will research two restoration techniques under VM0033 utilising:

1. Hydrological restoration; and
2. Topographical restoration.

All the above activities will be underpinned by a robust MRV program and independently reviewed by an experienced Technical Committee established by the Proponent to include International and National experts.

3.3.1 Step 1 - Site identification

By utilising publicly available spatial data and reports in combination with the Proponents own ground truthing supported by site photos (aerial and terrestrial) and survey where desired, it can identify areas that have been degraded, or are in decline, or at risk of future habitat loss. This initial step is critical because it allows the Proponent to understanding what the issue is, and what is the problem. It also allows identification of a reference site (i.e., a site in pristine condition).

Once all aspects of Step 1 have been achieved, reported, and recorded within its cloud-based block-cain ledger, the Proponent can advance to Step 2 – eco-hydrology investigations.

3.3.1.1 Identification and site description of Kangaroo Island – Phase I Pilot Project

Kangaroo Island (as it is known to many local people) and is recorded as NT Portion 2433, is also listed as a Nationally important wetland system, and is named the Port McArthur Tidal Wetlands System – NT008. The report states Kangaroo Island has an area of 119,000 ha and listed for having the following wetland types:

- A1 - Marine waters; permanent shallow waters less than 6 m deep at low tide; includes sea bays, straits
- A2 - Subtidal aquatic beds; includes kelp beds, seagrasses, tropical marine meadows.
- A6 - Estuarine waters; permanent waters of estuaries and estuarine systems of deltas.
- A7 - Tidal mud, sand, or salt flats; intertidal or supratidal.
- A8 - Tidal marshes; includes intertidal or supratidal saltmarshes, salt meadows, brackish and freshwater marshes.
- A9 - Tidal forested wetlands; includes intertidal or supratidal mangrove swamps, nipa/palm swamps, freshwater swamp forests
- B5 - Permanent freshwater lakes (> 8 ha); includes large oxbow lakes.

The criteria for inclusion as a Nationally important wetland relates to numbers 1,2,3,4 and 5. The key site-specific items will be assessed in identifying project locations for the research and pilot studies:

- Native title and land tenure.
- Health and safety requirements.

Key features of the site and surrounds including:

- Existing development and uses.
- Surrounding development and uses.
- Important site features including (as relevant):
- Health and safety.
- Soil carbon stocks.

- Coastal biogeography processes.
- Topography.
- Hydrology.
- Scenic and culturally important landscapes

3.3.2 Step 2 - Eco-hydrology studies

Step 2 is effectively determining project eligibility. The Proponent has adopted the term "eco-hydrology" studies to determine project eligibility, and which focus on site characterisation across several key environmental criteria. The same criteria are called "values" and "factors" by the NT EPA.

Every restoration project must begin with a diagnostic that allows for the identification of the cause or causes of mangrove degradation or loss and determine the current environmental conditions of the site. Eco-hydrology is defined as the current and historical ecological and physical characterisation of a site required to diagnose the causes of mangrove degradation or loss, determine the current environmental conditions of the site, to determine specific restoration actions. The analysis of two reference sites (good and poor condition) must be considered and compared with the site to be restored). Table 3-2 summarises the criteria BC-S2C will use to undertake its eco-hydrology investigations to support the research pilot project.

Importantly, the Proponent commits to undertaking its environmental assessment for project registration by completing the items of work detailed in sections 3.3.2.1 to 3.3.2.5

Table 3-2 Summary of site-specific eco-hydrology investigation

Variable	Characterisation or diagnosis criteria
Landscape analysis (topography)	• Historic air photo and satellite imagery interpretation. • Plant cover, fragmentation, flow of organic matter and nutrients. • Topographical level (higher and lower elevations).
Hydrology	• Hydroperiod – the flooding level, duration, time, and frequency. • Water source (marine and/or freshwater). Hydroperiod – the level, duration, and frequency. • Water source (marine and/or freshwater).
Physical-chemical characteristics of surface and groundwater water.	pH, Oxidation Reduction Potential (**ORP**), salinity, redox potential, temperature, Dissolved Oxygen (**DO**), conductivity, Total Dissolved Solid (**TDS**), turbidity, temperature, nutrients.
Physical-chemical characteristics of sediments (includes carbon stock)	Bulk density, organic matter in soil, nutrients (total nitrogen, total phosphorus), total carbon stock (above and below ground), soil thickness, texture, colour.
Biological – vegetation (flora)	• Plant structure and composition (density, height, diameter, basal area, plant cover, abundance, diversity of mostly key mangrove species). • Regeneration (recruitment, survival rate, composition).
Biological - macro invertebrates and vertebrates (fauna)	• Macro invertebrates and vertebrates (presence/absence of functional groups such as fish, birds, mollusks, abundance, density, diversity.

3.3.2.1 Landscape analysis (topography)

a. Historic air photo and satellite imagery interpretation
    i. Temporal and spatial assessment of land use change.
    ii. Temporal and spatial assessment of changes to coastal landform.
    iii. Identification of reference sites (i.e., Reference area A = good condition site; Reference area B = poor condition site and Reference area C = site to be restored.
    iv. Plant cover, fragmentation, flow of organic matter and nutrients.

b. Topography
    v. Qualitative description.
    vi. Quantitative assessment will be undertaken using LiDAR mapping and relevant ground truth survey where required.
    vii. Diagnose cause of habitat deterioration. For example, it could be the construction of a new road that may have led to the impediment of natural tidal flow and increasing salinity above 100 g/kg and a reduction of sediment supply.

c. Report and record findings of assessment for upload into the Project's IMS.

3.3.2.2 Hydrology

a. Complete using pressure sensors across the inter-tidal zone to include elevated sediment zones and low-lying scour basins. Measurements will be recorded over tidal periods and for a period of 30 to 40 days. When the study site progresses to a project site, the sensors must be left in place for continuous recording of restoration actions.
b. If pressure sensors are not available, piezometers can be installed and measured regularly for water levels using telemetry.
c. All pressure sensors and/or gauge boards to be GPS and mapped using a GIS.
d. Tidal limits and boundaries
e. Tidal inundation dynamics
f. Preliminary tidal ecological restoration potential
g. Basis for ecological restoration options
h. Hydrodynamic modelling of restoration options
i. Report and record findings of assessment for upload into the Project's Information Management System (**"IMS"**).

3.3.2.3 Physical chemical characteristics of water (mostly surface)

b. In-field measurements of surface water, and where appropriate groundwater samples, that are indicative of organic matter decomposition and storage of organic carbon via transect based sampling representing the inter-tidal zone. Hand-held water quality meters will be used (S2C HORIBA or similar) to measure the following parameters:
    i. **pH** (pH 0 to 14).

ii. **ORP** with a range between -2000 mV to 2000 mV.
iii. **Salinity** with a range from 0 to 70 Parts Per Trillion (**"PPT"**).
iv. **DO** with a range from 0 to 50 mg/L and salinity conversion from 0 to 70 PPT).
v. **Conductivity** with a range from 0 to 10 S/m or 0 to 100 mS/cm
vi. **TDS** with a range from 0 to 100 g/L.
vii. **Seawater specific gravity** with a range from 0 to 50.
viii. **Temperature** with a range from -10 to 55 Celsius.
ix. **Turbidity** with a range from 0 to 800 NTU.

c. **Inorganic nutrients –** including bulk density, organic matter, nitrates, nitrites, ammonia, phosphates, silicates & sulfides (related to water quality and land use management).
d. Report and record findings of assessment for upload into the Project's IMS.

3.3.2.4 Physical chemical characteristics of sediment (including carbon stock)

a. Appropriate sediment analysis to assist describe ecological characteristics required mangroves.
b. Sampling regime to advise on suitability of the successful establishment of seedlings. Field observations include:
   i. Classification
   ii. Colour;
   iii. Organic matter; and
   iv. Thickness.
c. Three (3) samples across the inter-tidal zone (and replicates) along a transect that focuses on recording:
   i. Reference area A = good condition site.
   ii. Reference area B = poor condition site.
   iii. Reference area C = site to be restored.
d. Sediment cores sampled using a 100 mm auger and, to a depth of 1 m (few cores up to 3 m).
e. During Phase I, 100 m x 100 m grid with bulk samples taken every 25 m across the inter-tidal area.
f. Sample integrity and analysis.
g. Keep samples refrigerated until sent to the lab for analysis.
h. Send samples, duplicates, and triplicates to NATA accredited laboratory.
i. Lab analyses to include:
   i. Bulk density;
   ii. Organic matter content;
   iii. Carbon;
   iv. Nitrogen; and
   v. Total phosphorus.
j. Carbon stock analysis:
   vi. Carbon stock analysis in carbon estimation area ("**CEA"**).
   vii. Calculate carbon emissions & risk of reversal buffer in CEA.

k. Report and record findings of assessment for upload into the Project's IMS.

3.3.2.5 Biological – vegetation (flora)

a. Using satellite data combined with necessary field work across the inter-tidal zone, record the following:
    i. Plant structure (good or poor condition).
    ii. Plant species (composition).
    iii. Percentage cover of mangrove / saltmarsh plants (density).
    iv. Species richness.
    v. Approximate height of mangroves.
    vi. Approximate trunk diameter at breast height.
    vii. Regeneration and survival rate)
b. Remote sensing technologies to be used to support mangrove habitat / density estimates etc.
c. GIS mapping and associated metadata.
d. Relationship between the local tidal regime and intertidal vegetation habitats
e. Report and record findings of assessment for upload into the Project's IMS.

3.3.2.6 Biological - macro invertebrates and vertebrates (fauna)

f. Survey macro invertebrates and vertebrates (presence/absence of fish, birds, mollusk's, abundance, diversity etc.)
g. Report and record findings of assessment for upload into the Project's IMS.

3.4 Restoration actions

3.4.1 Summary

BC-S2C believe that the key aspects to successful blue carbon ecosystem restoration can be summarised as:

- Actions under VM0033 aim to recover the environmental, hydrological, and physicochemical conditions that enable the establishment and growth of vegetation (mangroves), to recover the structure and function of blue carbon ecosystems.
- Through eco-hydrology studies, we assess, diagnose, and characterise, the disturbance or impact on the blue carbon ecosystem.
- The designed strategy for implementing restoration actions is based on the eco-hydrology study outcomes, where a site-specific action plan is determined according to the topographic, hydrological, physicochemical, and biological characteristics of the site.
- The action plan includes monitoring the restoration to assess if the implemented actions are working, or if changes must be implemented through an adaptive management approach. The monitoring includes analysis of two reference sites (good and poor condition) which are compared with the restored site.
- Action plans are divided into hydrology restoration and topography rehabilitation, preventative management restoration and/or reforestation.

3.4.2 Hydrological restoration

Hydrological rehabilitation and restoration will include de-silting existing (natural) channels and, where appropriate, creating new channels that mimic the surrounding environment. The hypothesis is that once hydrology has been restored, and water levels and salinity levels are maintained to an appropriate level, adequate conditions are slowly recovered, enabling the natural establishment of mangroves and salt marshes from the seedlings and wildlings from the existing neighboring BCE populations. An example of this technique is shown in Figure 3-1.

With succession, a greater volume of organic matter is deposited leading to an increased potential for carbon sequestration. In both instances, the channels will carry tidal water into the BCE where saltwater has been identified by BC-S2C and its independent consultants as having the potential to exist or did exist. Our project restoration actions are not planting mangroves necessarily, its restoring conditions for these trees to grow.

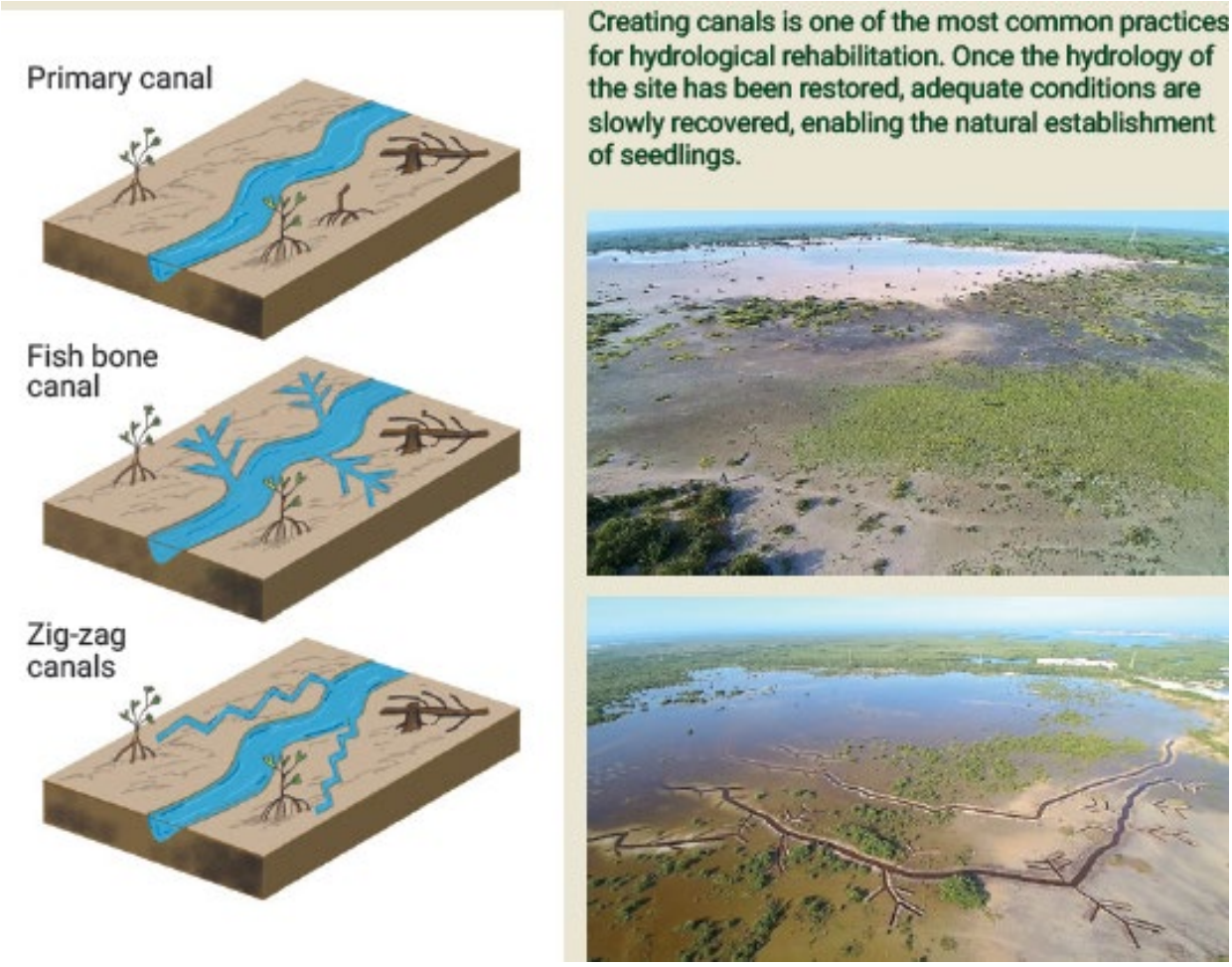


Figure 3-1 Hydrological rehabilitation techniques that will be trialled during Phase I and II works.

FIGURE SOURCE: *Manual for the ecological restoration of mangroves in the Mesoamerican Reef System and the Wider Caribbean.*

3.4.2.1 Wetland drainage designs

Hydrological rehabilitation is aimed at addressing factors that may have previously led to the degradation or loss of mangrove species and supporting habitat. Phase I and Phase II will experiment, examine, and assess the de-silting of existing channels and the creation of new drainage channels (Figure 3-2).

Over 40 Mesoamerican projects have successfully implemented passive restoration techniques and therefore, BC-S2C will examine using similar hydrological restoration actions in Phase I and Phase II:

1. Primary channel only.
2. Primary channel with fish bone channels (as shown in Figure 3-2).
3. Primary channel with herringbone / zig zag channels.

The Proponent is planning for most channels to have an inclination of approximately 30-45º and with a depth of approximately 1 meter and 0.5 meters in very shallow soils. Only if these trials prove successful will these techniques be carried into Phase III.

Final specifications for new channels will depend on further eco-hydrology work. Any new channel depth and width will vary and depend on site specific conditions.

The creation of new channels will support desilting existing channels. This will be undertaken to ensure a continuous supply of tidal water flow over the permanency period within the mapped CEA. Associated environmental risks and hazards associated with proposed wetland drainage works are explained in section 8.3.1. Proposed environmental controls and management of identified risks and hazards are detailed in section 8.4.

3.4.2.2 Creating new channels

Creating new channels must be considered when the desilting of natural channels is not enough to restore the hydrology of a site to support mangrove and saltmarsh habitats. The objective of creating new channels is to ensure continuous water flow with inlets and outlets as shown in Figure 3-2. The canal network is established using information collected from eco-hydrological studies. The building of canals requires hand tools or, if necessary, heavy machinery, such as excavators, but it will depend on the characteristics of the site and the size and resources of the project.

3.4.2.3 Primary and secondary channel specification

Final specifications for new channels will depend on further eco-hydrology work. Any new channel depth and width will vary and depends on site specific conditions. Table 3-1 details the current assumptions for planning purposes. The creation of new channels will support desilting existing channels. This will be undertaken to ensure a continuous supply of tidal water flow over the 100-year permanency period within the mapped CEA.

3.4.2.4 Sediment from creating new channels and de-silting existing channels

The sediment removed from the excavator bucket will not be left on the canal banks as this prevents the influence of the canal from spreading beyond its edges. The Proponent will use equipment (like blowers) to spread the sediment when excavating, or have it used for other complementary actions, such as filling sites with a lower topographic level (topographical restoration).

3.4.2.5 Plant and equipment

BCER activities will involve amphibious excavators of different dimensions and weight. Some of these will have the capacity to create V and U-shaped channels up to 3 m deep and 1.5 m wide.

Figure 3-2 Steps to create new channels that enable degraded sites to restore their hydrology.

FIGURE SOURCE: *Manual for the ecological restoration of mangroves in the Mesoamerican Reef System and the Wider Caribbean.*

Table 3-3 Proposed specifications for channel restoration under VM0033

Channels	Primary channel specification	Secondary channel specification
Top width	Up to 4 m	Up to 2 m
Bottom width	1.0 m	0.60 m
Depth	1.25 m	0.75 m
Incline	~30 to 45°	~30 to 45°
Angle to the sea / river / creek / channel	Right angle (perpendicular)	Not applicable
Angle to the main primary channel	Not applicable	Right angle (perpendicular)
Distance between side channels	75 m	Not applicable
Distance between side channels	Not applicable	Up to 10 m

3.4.3 Topographical restoration

Sediment is used to modify a site's natural topography to form mounds or raising the natural topography by installing sediment traps. The key outcome of this technique is to encourage adequate flooding conditions for the successful establishment of seedlings.

This action takes place when the topography of the area to be restored presents changes compared to the reference site in good condition. The topographical changes in the degraded site impact the hydrology of the site, eroding the sediment or altering flooding levels and frequency. Therefore, it does not enable the establishment of mangroves, which is when sediment must be removed. There can also be permanently flooded areas (> 1 m) due to the sinking of sediment because of decayed organic material, thus increasing the flooding level, and preventing mangrove seedlings or seeds from establishing, in which case the topography needs to be elevated.

A heterogeneous ecosystem will favour the replenishment with different species, giving way to a secondary succession process and providing better chances of withstanding or recovering from a negative impact, as compared to a homogenous system, such as reforestation using a single mangrove or saltmarsh species.

3.4.4 Reforestation

Active reforestation has historically been the most used technique globally for mangrove restoration projects. However, based on lessons learnt over the decades, the most sustainable results have been obtained through hydrological and topographical restoration actions focused on restoring conditions for these trees to grow. Where our eco-hydrological studies deem it appropriate, hydrological restoration may also require the planting of mangrove and saltmarsh species to assist and accelerate natural regeneration.

Unsuccessful reforestations projects root cause is due to improper eco-hydrological studies of the environmental conditions in which the site is found and planting the wrong species in the wrong place or the right species in the wrong space. This results in a waste of resources and effort and an unsuccessful endeavor. When reforestation is chosen as an action to take, the site to be restored will have the proper environmental conditions (hydrological and physicochemical) for the establishment of plant material (seeds, seedlings, and propagules). If conditions are not suitable, the corresponding restoration actions will be carried out before planting, and seedlings will be previously acclimated to the salinity, soil, and light exposure of the restoration sites. The reforestation we implement will foster environmental heterogeneity (multiple native species planted) referencing good condition neighboring mangroves, which provides a higher resilience to the system.

- **Seed collection and origin** - the seeds used in restoration will come from mostly preserved areas close to the site and will consider its composition for species selection. We plan to collect seed from different trees which promotes genetic diversity of propagules to be planted. We will use contracted seed collectors and our own seed collectors. We intend involving local ranger groups and aboriginal communities who are familiar with local fruiting season, trained to distinguish if seeds or propagules are healthy, mature, and disease-free and are familiar with the local environmental risks in these remote sites.
- **Biosecurity plan –** the Proposal would include a Biosecurity Monitoring & Management Plan (**"BMMP"**) to control the threat of introducing invasive species across the Site. The Nursery Facility will be a separate area to the Research and Training Facility and will have appropriate bio-security controls.
- **Species collection -** Reforestation must consider the species autecology, as well as the species found in the reference site. Reforestation species will be selected based on those recorded in the preserved or reference site.
- **Plant nurseries-** The Proponent will use a contracted nursery/nurseries and our own nursery at the S2C-I to store seed, pot, grow, manage and package ready for transport the mangrove and salt marsh species ready for reforestation. The S2C-I nursery seedlings will be acclimatised to field conditions using similar salinity, soil and light conditions of the restoration sites. The nursery design will allow for plants to undergo periodical flooding and have access to fresh and salt water. This way they are accustomed to local conditions to reduce stress at planting.
- **Planting techniques –** The Proponent will experiment with both mechanical (drone and helicopter) and hand planting of seed and seedlings. We intend involving local ranger groups and aboriginal

communities who are trained to plant and are familiar with the local environmental risks in these remote sites.

- **Plant spacing –** for planning purposes, the Proponent assume the mangroves will be spaced at three meter spacings parallel to either the desilted channels or the newly created channels. Phase I and Phase II will experiment with different direct planting techniques to monitor and record its success in conjunction with nature-based re-wetting actions.

3.4.5 Monitoring, reporting and verification

The ongoing project MRV underpins transparency of project information and integrity. The project MRV provides the validation and verification of GHG emission reductions or removals used by carbon credit certifiers allowing for them to issue credits.

By using our own block-chain technology, the Proponent will facilitate increased transparency, accountability, integrity, and pricing of its Carbon credits. All BCER projects will be registered and audited under the qualifying method statements and auditors (VERRA, Gold Standard or ERF).

Monitoring - BC-S2C will need to monitor certain events during the blue carbon projects and keep records of information, including:

- Monitoring the establishment of BCERZ during the crediting period of our project, including the year and location in which it was establish.
- Monitoring natural disturbances in our project area during the permanence period of our project.
- Keeping records of the type and quantity of fuel used when undertaking project activities in each reporting period.
- Keeping records of the area of land (in hectares) disturbed by excavation activities in each reporting period.
- Information used to inform the preparation or revision of a project operations and maintenance plan.

Offset reporting - BC-S2C will need to prepare offsets reports when claiming carbon credits.

- The offset report - details our project's progress, including the net abatement amount.
- The reporting frequency - could be between one and five years and is chosen by the proponent.
- Defining CEA – we will provide our project area boundaries when we register our project and before we prepare each offsets report.
- Calculating carbon abatement- The Blue carbon Accounting Model (BlueCAM) is freely available to enable the calculation of abatement under the method. No sampling is necessary to participate in this method.

Verification or auditing of our project - our project needs to be audited to align with legislative requirements. The number of audits required over the crediting period will depend on the project size and the

forward abatement estimate. We assume we will require three audits including one with the first report. Each audit report is submitted at the same time we apply for carbon credits. The ERF issues detailed rules and requirements associated with monitoring, as outlined on ERF's website.

Carbon project proponents develop a project description using the VCS Project Description (VCS PD) template. The MRV under the VERRA method shares similar objectives but has material differences to the ERF method.

Reporting and validation - once the monitoring report is completed, BC-S2C will select a validation/verification body to verify the emission reductions generated and reported. VERRA issues detailed rules and requirements associated with monitoring, as outlined in their VCS Standard on VERRA's website.

Additional BC-S2C MRV

Monitoring allows for the restoration progress to be evaluated against the objectives set for phases I to III. BC-S2C's monitoring will evaluate success criteria through a systematic follow-up and analysis of key indicators. Success will be measured quantitatively by choosing a site in good condition (reference site) against an area(s) that is/are in a degraded condition. In addition to the hydro-ecological monitoring,

BC-S2C will monitor environmental and socio-economic indicators. This approach will ensure social engagement continues and helps build trust with key stakeholders and interested parties. Evaluation criteria that will be considered across all phases is listed in Table 3-4.

• Socio-economic					• Environmental (eco-hydrology)						
Cultural heritage, sacred site protection, local community investment program, local business development program	Project alignment with international, national, and local objectives, policies, plans, UN SDG & ESG criteria	Workforce development and employment (direct & indirect) – local, indigenous, diversity indicators	Economic impact (wages, goods and services, suppliers, taxes & royalties) – local, indigenous, NT, interstate	Flow on co-benefits (strategic, cultural capacity building)	Protect and restore carbon sinks (GHG emissions & sequestration)	Landscape analysis (topography), improved land management (storm surge, flood mitigation and rising sea level resilience)	Hydrology	Surface and ground water quality	Soil chemistry and soil carbon	Biodiversity restoration & conservation – mangrove and saltmarsh cover (flora). Control of weeds & introduced species	Biodiversity restoration & conservation - macro invertebrates and vertebrates (fauna). Control of feral animals.

Table 3-4 Project monitoring indicators proposed by BC-S2C

3.5 Proposed S2C Institute

BC-S2C wishes to develop a project Institute at Black Rock Landing just north of King Ash Bay (refer to Figure 3-4). S2C-I will provide products and services geared towards remote project sites and to maximise local environmental, community and Indigenous co-benefits and opportunities.

BlueCarbon OnCountry (**BC-OC**) will be the primary provider of operation and maintenance services at the S2C-I that would also supply staff, project management, training, and stakeholder engagement resources. BC-OC is jointly owned by BC-S2C and Indigenous shareholders.

The S2C-I will have approximately 14 demountable buildings (dongas) and a nursery on an approximately 3 ha footprint. The S2C-I will include reception /induction/meeting/ first aid room, research facility and project office, training room and training office, male and female amenities, laundry/ storeroom, temporary accommodation rooms (male & female), kitchen (self-catering), mess/ entertainment area, nursery office, garage/ storage/ workshop and some shipping containers for storage. The nursery facility will have enclosed greenhouses (seeding & cuttings) and an open nursery area, part of the nursery will experience tidal fluctuations used to acclimatize the plants to field conditions using similar salinity, soil, and light of the restoration sites.

Some additional community related demountable buildings may also be developed near the S2C-I. S2C-I products and services include:

- **Research facility** - Test the latest innovative technologies from around the world aimed at improving the quality and efficiency of on-county blue, teal and green carbon restoration, credit generation and project and credit measurement, reporting and verification.
- **Carbon MRV lab** - A carbon MRV lab will be used for our ongoing carbon and co-benefit MRV.
- **Training Facility** - For practical training for Indigenous peoples and local stakeholders as carbon rangers involved in on-country project restoration, nursery staff, ongoing MRV staff and rotating corporate/field staff. Limited short stay accommodation may be available.
- **Nursery Facility** - For local-provenance native plants and indigenous plants suited for ecosystem restoration in local areas.
- **Nursery Lab** - For our own and project community nurseries biosecurity, genetics, soil carbon content and water quality etc.
- **Community Nurseries Support -** Closer to the remote project sites and will also help provide the thousands of seeds and plants over the life of the projects and local jobs.
- **Mobile Camps and Marine Services** - Includes a mobile accommodation, kitchen, mess, toilets, showers, laundry, power, communications, first aid etc. for the field crews during planning, restoration (initial and follow up) and ongoing measurement, reporting and verification (MRV). Includes a fleet of small barges, boats and equipment for remote project site access and restoration from the water side and a jetty. For blue and teal carbon ecosystem restoration projects, the marine services team and the remote camp team will work closely together.

- **Restoration Services** – blue carbon rangers doing in field work (hydrological rehabilitation, topographical rehabilitation, preventative management restoration and reforestation). Includes a fleet of excavators (floating, tracked) and small dredging equipment.

The BC-OC team will also be responsible for on-country stakeholder engagement and finding ways to maximise indigenous training, jobs, business, and local community investment opportunities.

Figure 3-3 Artist impression of the proposed S2C Institute

3.6 Phase I logistics

The Proposal would involve a combination of:

- Establishment of the proposed S2C-I.
- Transporting equipment and supplies either via road and boat direct to the S2C-I or flying into Borroloola and then road to the S2C-I.
- Transporting plant required for BCER activities from S2C-I via boat.
- Transporting mangrove/salt marsh plants from the S2C-I commercial nursery supplier(s) by boat and road to S2C-I.
- Flying into Borroloola from Darwin for program, project, and stakeholder meetings.

3.7 Phase I utilities and infrastructure requirements

The S2C-I will be the hub to service the projects and will have most of the infrastructure and utilities within a 2-3 ha area. The research pilot project is likely to install an Automated Weather Station (**AWS**) and monitoring / telemetry equipment which is expected to be the only permanent piece of infrastructure at the site.

3.7.1 Power

S2C-I power requirement (<1 MW) is designed for a maximum of 20 people and will be a combination of solar, battery and diesel backup. The independent and remote power supply will be on a section 19 land. Further information on the S2C-I is contained in section 3.4. The Proposal is not reliant on power from the grid.

3.7.2 Water supply

S2C-I's potable water supply for restoration workers and employees in the S2C-I will be harnessed via rainwater and/or groundwater of a quality that meets drinking water standards.

3.7.3 Sewer

- S2C-I will have a separate stand-alone sewer requirement in line with Australian Standards and relevant NT guidelines.
- Proposal activities do not require the development or implementation of sewer infrastructure.

3.7.4 Plant

Mobile plant and equipment required to undertake restoration activities will be kept at S2C-I (when not being used for BCER projects) and will only be in the BCER project for the active restoration period only (days, weeks depending on requirements). Plant and equipment required is likely to include:

- Research facility – mostly handheld or IT related equipment used for analysis of landscapes (topography), hydrology, physical-chemical characteristics of water (mostly surface), physical-chemical characteristics of sediments (includes carbon stock), biological – vegetation (flora), macro invertebrates and vertebrates (fauna).
- Training facility and temporary accommodation- field and MRV training equipment.
- Nursery facility – mostly seedling, potting, growing, irrigation, biosecurity, and plant delivery equipment.
- Carbon lab (MRV equipment) and nursery lab – relevant research facility equipment.
- Marine services - support vessel (with onboard accommodation), trailer mounted boats and barges.
- Mobile camps –and remote camping equipment.
- Excavators (some amphibious, some tracked) and small channel dredging equipment.
- Vehicles – light vehicles (4x4's), small trucks, tractors, bobcats, and forklifts.
- Workshop facility – general repair and maintenance equipment.

Plant and equipment required permanently in the field is likely to include the automated weather station and monitoring, reporting and verification equipment with telemetry functions.

3.8 Phase I resources

The Proposal would require approximately several dozen full time equivalents and assume a multiplier of 2.5 times that for indirect jobs. At key periods we may require an additional 60 part time equivalents for seed collection and planting.

3.9 Uncertainties and future refinements

Lessons learned from Phase I will be used to refine wetland restoration design and approach for Phase II. The focus of design refinement will likely come from further site specific coastal geomorphological processes and their interaction inside BCE tidal limits, hydrology, sedimentation, terrestrial and aquatic ecosystems, and habitats.

4 Proposal description – location and regional context

4.1 Introduction

Wetlands are diverse and complex ecosystems that provide essential ecological functions and services, such as water purification, carbon sequestration, and habitat provision for numerous species. However, due to increasing human demands and climate change, many wetland systems in the NT GoC are experiencing significant water level losses and reduced hydraulic connectivity, which in turn leads to a multitude of detrimental impacts.

The research pilot project site lies within the Gulf of Carpentaria basin which is in the Australian Northern Shelf Province provincial bioregion. It is characterised by soft sediments and water varying in depth from around 45 to 80 metres (DCCEEW, 2022). The tidal range in the GoC is between 2 and 3 metres and occurs twice a day. The Gulf was dry land at the peak of the last ice age 18,000 years ago when global sea level was around 120 metres below its present position. At that time a large, shallow lake occupied the centre of what is now the GoC. Sediment types differ across the basin from sandy muds which are found on the western side, to muddy sands which are mostly located on the eastern side.

The waters in the Gulf of Carpentaria mix a little with waters of the Arafura and Coral seas so that they form a distinct semi-enclosed system with limited inputs from either oceanographic or terrestrial sources (DCEEW, 2022). Blue carbon restoration across the Gulf of Carpentaria are vast in area and span several hundred kilometres.

4.2 Existing environment

4.2.1 Regional context

The site is on the northwestern side of Kangaroo Island and adjacent to the Carrington Channel. Water supply in the area is primarily from tidal sources and inflows from the Carrington Channel. Environmental values surrounding the site include a diverse range of aquatic and terrestrial flora and fauna, including several mangrove and bird species. The site is not constrained or limited by any matters of national environmental significance, threatened or endangered species (Figure 4-1).

Culturally, Kangaroo Island is home to Aboriginal people, with sacred sites none of which occur within the research pilot project site. Land tenure on Kangaroo Island (i.e., NT Portion 2433) was once under Aboriginal freehold but is now under the Administration of the NT Commissioner for Consumer Affairs. Current land use includes nature conservation, Aboriginal usage, commercial fishing, and recreation.

Disturbances and threats to the area include degradation of wetland vegetation by feral animals, cyclones, and potential heavy metal pollution from a nearby zinc concentrate barge loading facility. Conservation measures taken include a NT Government development proposal from 1991 that may still be relevant to the site.

The environmental values across the Site are shown in Figure 4-1.

4.2.2 Regional context - socio-economic context

4.2.2.1 Demographics and human settlements

The Site does not support human settlement.

4.2.2.2 Economic activities

The Site does not currently support any notable economic activity.

4.2.2.3 Land ownership and tenure

Kangaroo Island is currently under Administration by the NT Commissioner for Consumer Affairs. It was formerly under control of the Yanwula Aboriginal Land Trust. Any commercial activity such as blue carbon restoration would require a permit under the NT Crown Lands Act 1992. Where applicable, BCER may also require other Agreements that are summarised in Table 4-1.

Table 4-1 Summary of land tenure pertinent to the proposal

Land title	Approval required
Native Title Lands	Native Title does not exist over NT Portion 2433 and therefore, is not required.
Aboriginal Land Claim Areas	Section 11A agreement under the *Aboriginal Land Rights Act 1976* (ALRA) may be required.
Aboriginal Freehold Land	Section 19 Agreement may be required under the ALRA.
Crown Land	A Licence may be required under the NT *Usage of Vacant Crown Land Policy 2020*.

4.2.2.4 Cultural heritage

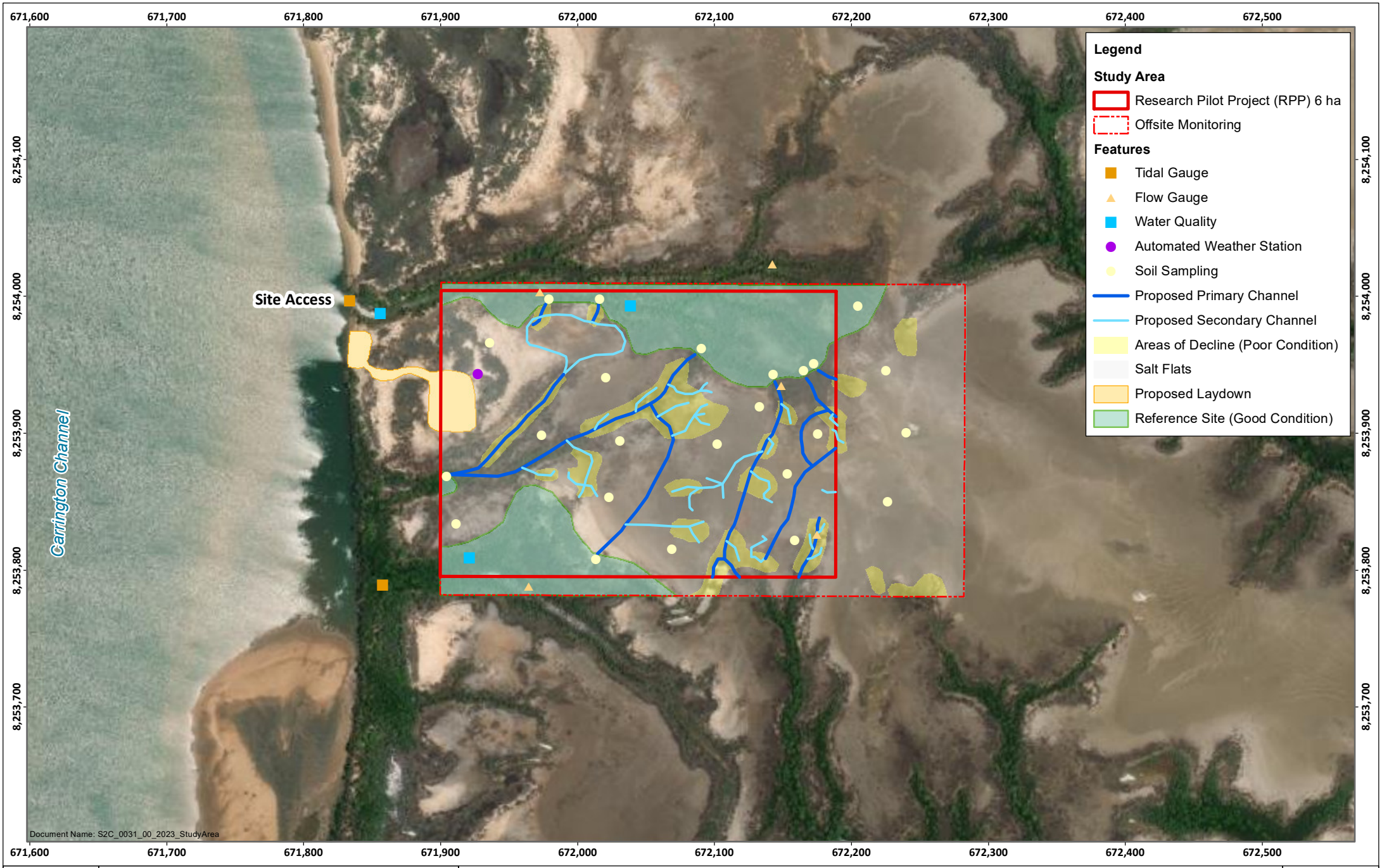
Sacred sites and their locations are known to BC-S2C through engagement with the NT Aboriginal Areas Protection Authority and, Traditional Custodians (refer to Appendix F - Aboriginal Heritage Protection Plan). Based on engagement with Traditional Custodians and other academic experts linked to the region, these sites are however, an essential part of the Yanyuwa people's cultural, spiritual, and social identity. They hold stories and cultural knowledge that have been passed down through generations.

The Yanyuwa people and communities living near the Site possess a deep understanding of the local ecosystems and their resources. The traditional ecological knowledge has been passed down through generations and plays a crucial role in the sustainable management of the Site and region.

The Yanyuwa language is an essential part of the cultural heritage of the region. As one of the few Indigenous Australian languages with a distinct linguistic gender system, the Yanyuwa language embodies the cultural knowledge and identity of its speakers.

4.2.2.5 Infrastructure and public services

The site does not support any built infrastructure or public services.



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Proposed Blue Carbon Ecosystem Restoration – Research Pilot Project VM0033

Figure:

4-1

4.2.3 Social values, public perception, and stakeholder concerns

The social values and public perception of the Site and region have been observed, identified, and recorded through BC-S2C's community engagement (August 2022 to present). The more common perspectives observed and recorded are:

- **Cultural importance:** People hold a strong belief that the Yanyuwa region is culturally significant with important sacred sites, traditional ecological knowledge, and unique linguistic features.
- **Natural beauty and biodiversity:** Including coastal wetlands and the diverse flora and fauna.
- **Conservation:** Relating to the conservation and preservation of the Yanyuwa culture.
- **Limited awareness:** Most Australian people might not be aware of the Yanyuwa region's cultures and ecological significance due to its remote location and limited exposure. Increasing public awareness of the region and its importance can help promote understanding and appreciation of its unique values.

BC-S2C's broad stakeholder engagement (June 2022 to present) has included the Commonwealth, Northern Territory and Local Shire governments, non-government bodies including the Yanyuwa Indigenous Protected Area Coordinating Committee (YIPPAC) and Sea Rangers, landowners, and the local community of Borroloola.

Recent feedback from the community of Borroloola and the YIPPAC and Sea Rangers indicates BC-S2C should focus less on meeting with individuals and small groups but instead, focus on consulting more closely and regularly with the YIPPAC and Sea Rangers. This criticism was well received by BC-S2C and will adjust their future consultation efforts in and surrounding the community of Borroloola.

By involving the YIPACC and Sea Ranger, the Traditional Custodians' knowledge, values, and practices linked to Kangaroo Island will be respected and integrated into the conservation and management of the Yanyuwa IPA.

4.2.4 Site context - physical environment

4.2.4.1 Topography and geomorphology

The topography of the Site is reflective of many wetlands in this region of the Gulf of Carpentaria. It features small tidal channels that support mangrove and intertidal saltmarsh. Extensive mudflats exhibit remnants of disconnected drainage channels, no longer hydraulicly linked to the intertidal channels. Consequently, the site exhibits evidence of mangrove and intertidal saltmarsh dieback at the edges of primary channels and in some mud flat areas.

4.2.4.2 Climate and meteorology

The climate in the Gulf of Carpentaria region is characterised by a tropical monsoon climate, with distinct wet and dry seasons. The wet season typically occurs from December to March, with heavy rainfall and humidity. There are up to six seasons in the region, but the dry season spans from April to November, featuring lower rainfall, lower humidity, and more moderate temperatures. Cyclones can also occur, particularly during the wet season.

Based on consultation with Traditional Custodian's, the Site experiences prevailing winds form the southeast during the dry season and northwest during the wet season. These wind patterns are thought to help disperse any potential pollutants and maintain clear air conditions.

4.2.4.3 Hydrology and water resources

Water sources: Water supply to the Site is primarily from tidal sources and inflows from the McArthur River, Carrington Channel, Batten Creek, and several shorter unidentified / unnamed creeks.

Watershed and catchment area: The Site is gently sloping to the western boundary of the study area and flattens out to the east. The catchment / watershed of the study site is bounded by elevated areas to the north and south of the Study site.

Intertidal water supply and demand: For the Site to better support mangrove and intertidal saltmarsh development, tidal water supply and demand will be modelled and factored into proposed restoration options linked to de-silting exiting channels and reconnecting former wetland channels.

Hydrological processes: Evaporation rates within this region of the Gulf are relatively high. The region experiences a tropical monsoon climate with high temperatures and strong solar radiation throughout the year, leading to high evaporation rates. These rates are typically high during the dry season (April to November), when humidity is lower and less cloud cover.

Transpiration rates can be high, particularly during the wet season when is abundant moisture and vegetation growth is more active. During this period, plants uptake more water form the soil and transpire it into the atmosphere.

The site is influenced by tidal action which maintains soil moisture in areas that are well drained. Therefore, infiltration rates in these areas of the Site are high. Where sediment input appears high (i.e., alluvial, fluvial, aeolian or, all these combined), there are obvious topographical changes across the site which may have resulted in temporal and spatial mangrove and intertidal marsh decline. The dependency on groundwater recharge is unknown at this stage. Further stratigraphic site-specific investigations are planned to determine the nature of this natural process during the research pilot project.

Water quality: Baseline water quality analysis across the Site has begun. This work will continue during the research pilot project to determine a site-specific baseline. BC-S2C intend to develop site-specific trigger and threshold values for water quality parameters and water resources management that will be monitored as part of its Project Operational Management Plan (a mandatory requirement of the Verra (and ERF) project methodology registration process. The specific values and metrics that will be captured by BC-S2C will include but not be limited to:

- Volume / standing water levels.
- Flow rates.
- Tidal fluxes.
- Seasonal variations (this will include consultation with the local Land and Sea Ranger Group).
- Climate change factors.
- If appropriate, changes to surrounding land use management.
- Extraction of groundwater for any other purposes (e.g., agriculture).

Water quantity: At this stage, the potential water available in terms of volume, flow rates and seasons variations (through tidal prisms) is not well understood. These aspects will be researched and recorded during the pilot project.

Built water infrastructure: The Site lacks any distinct water infrastructure including any dams, reservoirs, or pipelines. Consequently, the Site does not qualify for blue carbon restoration under the Australian ERF methodology.

Water management: There are no known water management or water resource strategies applicable to the Site that are linked to the Commonwealth or NT Government.

Plate 4-1 Evidence of mangrove dieback at the research pilot project site (BC-S2C April 16, 2023)

Climate change impacts: The potential impacts of sea level fluctuations in this region have been modelled. The potential impacts of climate change on the Site's hydrology and water management requirements, including changes in precipitation patterns, temperature, evaporation rates, and extreme events (e.g., drought dominated, and flood dominated regimes).

Challenges and opportunities: Like most BCE in the NT GoC, the Site is highly dynamic and will indefinitely continue to be so. Understanding the Site's geomorphological dynamics is a key challenge for the research pilot project. A better understanding of this aspect and natural sea level fluctuations cycles will be a key focus for the Proposal.

By addressing these aspects in a structured and coherent manner throughout the RPP, a comprehensive understanding of the Site's hydrological processes, water quality and potential climate change impacts can be achieved.

4.2.4.4 Soil characteristics

Desktop and initial fieldwork indicates the soil types at the Site are:

- **Saline:** Due to the influence of tidal exchange and high evaporation, salts accumulate. Field measurements have been taken to determine the concentrations of soluble salts, which can affect (positively or negatively) plant growth and distribution across the Site.

- **Organic:** The Site supports organic soils because of the observed high organic content from partial plant decay in waterlogged conditions. Subject to pending laboratory results, these soils are expected to be acidic, nutrient poor and supportive of the plant species recorded.

- **Hydromorphic:** Initial field investigation confirmed desktop research that the Site displays areas of poor drainage and/or areas that remain under waterlogged conditions for extended periods. These areas are likely to exhibit reduced aeration, potentially high organic matter, and distinct chemical properties. These aspects will be further investigated during the RPP. Field observations did conclude these areas as reference sites (see Figure 5-2) because they supported wetland vegetation, including mangroves, grasses, sedges and other hydrophytic plants.

- **Alluvial:** Most likely formed by the deposition of sediment from rivers, streams, and other water bodies. They are silty clays, and sands (Plate 4-1) which support diverse vegetation types including mangroves and intertidal marsh plants.

Plate 4-2Typical silty clay and sandy soils dominate the research pilot project site (BC-S2C April 16, 2023)

4.2.4.5 Air quality and noise levels

Air quality in this region is considered good due to the region's low population density, limited industrial activities and, vast natural landscapes. There are some natural factors that may adversely impact air quality across the Site and region. These include:

- Seasonal bushfires.
- Dust storms (dry season based).

Noise levels are minimal at the Site. The most common noise emitted within close proximity to the Site comes from passing recreational boats.

4.2.5 Site context - biological environment

4.2.5.1 Flora and fauna

The area's marine and estuarine habitats support hundreds of fish species, Turtles, including the Flatback Turtle, are found on most of the islands to the north and are known to breed in the region. The site is a major migration stop-over and possibly an over-wintering area for shorebirds, as well as a breeding area for prawns and feeding area for Dugongs. Environmental values include a diverse range of flora and fauna, including several mangroves and bird species.

4.2.5.2 Ecosystems and habitats

The primary ecosystems and terrestrial habitats at the Site include:

- Intertidal wetlands – referred to in Figure 5-2 as a Reference Site.

- Mangroves – as above.
- Intertidal saltmarsh – as above.
- Intertidal mudflats
- Dry saltpans – identified in Figure 5-2.
- Terrestrial habitats (particularly raised areas that may support native or migratory birds).

4.2.5.3 Conservation areas and protected zones

The Site is part of an Indigenous Protected Area (IPA). IPAs play a crucial role in the region's ecosystems, biodiversity, and cultural heritage. IPAs are commonly managed by Indigenous communities in partnership with the Australian government, using a combination of traditional knowledge and modern conservation practices.

The IPA linked to the Site is the Yanyuwa (Sea Country) IPA. It is managed by the Yanyuwa people on collaboration with the NLC. Together, they work to conserve the rich biodiversity and cultural heritage of the region.

4.2.6 What are the issues?

4.2.6.1 Wetland hydraulics and hydrology

Analysis of historic aerial photos dating back to 1985 has shown a gradual reduction of hydraulic connectivity from primary changes and secondary channels. The impacts of climate change include water level losses and reduced hydraulic connectivity. These influences have led to negative impacts on wetland hydrology in the region of the proposed research pilot project as shown in Figure 4-2. Hydraulic connectivity is a critical component that determines the overall health and functioning of the site (and many other sites to the north and northeast on Kangaroo Island).

Water level losses and reduced hydraulic connectivity appears to have caused alterations in the site's hydrological regime, leading to changes in inundation patterns, water residence time, and quite possibly, groundwater-surface water interactions. Consequently, these alterations may have triggered a cascade of negative effects at the proposed research pilot project site on wetland biogeochemical processes, vegetation dynamics, and wildlife habitat suitability, particularly since 2009.

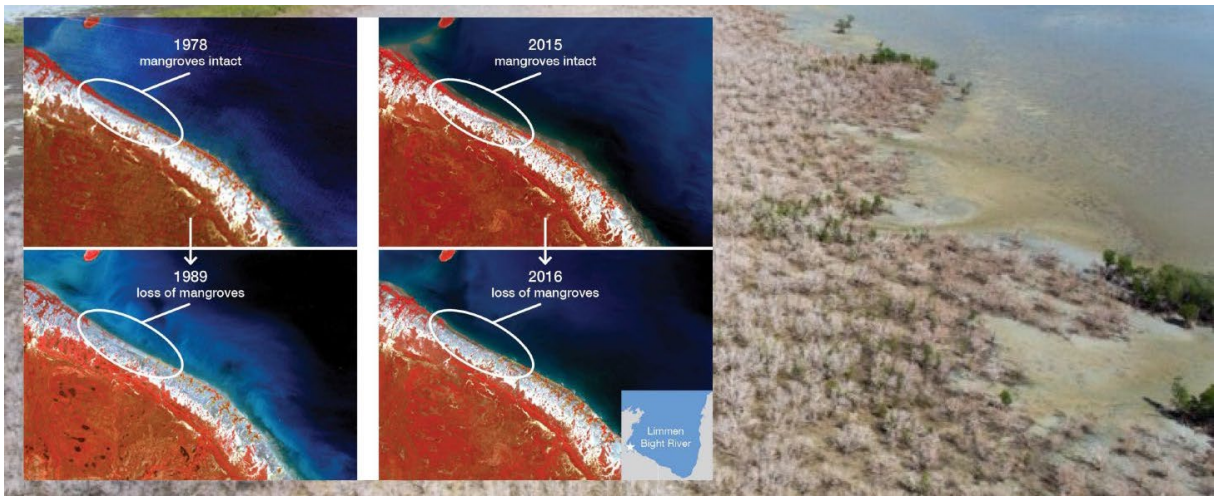

Figure 4-2 Significant natural mangrove dieback events in the NT Gulf of Carpentaria

4.2.6.2 Spatial heterogeneity

The impacts of water level losses and reduced hydraulic connectivity can vary significantly across different spatial scales within wetland systems. The analysis of historic aerial photography and consultation with traditional custodians of Kangaroo Island suggest this is true at the site and beyond it. For instance, small scale disturbances appear to have led to the formation of isolated wetland patches, while large-scale changes has resulted in habitat fragmentation and loss.

4.2.6.3 Temporal dynamics

The detrimental effects of water level losses and reduced hydraulic connectivity can manifest over various temporal scales, ranging from short-term hydrological fluctuations to long-term ecosystem degradation. In the short term, these changes can cause shifts in wetland plant communities, as they respond to alterations in hydrological conditions. This does appear to be the case at the site with a net loss of mangrove species. Over the long term, these shifts appear to have led to the establishment of alternative stable states, resulting in the loss of critical wetland functions and services.

4.2.6.4 Biogeochemical processes

Water level losses and reduced hydraulic connectivity can significantly impact wetland biogeochemical processes, such as nutrient cycling and carbon storage. Lower water levels can cause increased oxygen availability, promoting aerobic decomposition and the release of greenhouse gases, such as CO2 and CH4. Additionally, altered hydrology can lead to changes in nutrient retention and export, potentially exacerbating water quality issues in downstream aquatic systems. The extent of this potential negative impact will be investigated at the site.

4.2.6.5 Vegetation dynamics

Wetland plants are adapted to specific hydrological conditions, and water level losses can result in shifts in plant community composition and structure. As water levels decrease, obligate wetland species may be replaced by more drought-tolerant species, ultimately reducing the wetland's overall biodiversity. Furthermore, the encroachment of invasive species can exacerbate these impacts, leading to even greater losses in native wetland flora. Initial rapid assessment field work suggests plant community composition and structure is largely homogenous with some invasive species present.

4.2.6.6 Wildlife habitat

Wetlands provide essential habitat for a diverse array of wildlife species, including many that are endangered or of conservation concern. Water level losses and reduced hydraulic connectivity can negatively impact wildlife by altering the availability and quality of nesting, breeding, and foraging habitat.

Initial rapid assessment field work suggests there remains some areas of suitable habitat for breeding and/or migratory birds. However, a continued loss of water supply and hydraulic connectivity, particularly in low flow conditions, will see habitat suitability decline. Consequently, fauna populations across the site may experience population declines, increased competition, and reduced genetic diversity. These factors will be investigated as part of the research pilot project.

4.2.7 What is the problem?

If pro-active water and topographical management measures under VM0033 are not researched at the research pilot project site, the detrimental impacts of water level losses and reduced hydraulic connectivity on wetland systems described above, may continue to result in spatial and temporal decline of critical blue carbon ecosystem. Over the last 25 years, the research pilot project site has suffered a gradual loss of mangrove and saltmarsh habitat due to water level losses and reduced hydraulic connectivity.

4.2.8 What are we researching as a possible solution to the issues and problem?

To ensure the long-term persistence of the site's functioning blue carbon ecosystem BC-S2C seek approval to develop and implement wetland restoration and conservation strategies that address a decline of hydraulic connectivity and biodiversity decline by implementing restoration techniques outlined in Verra methodology 0033.

5 Proposal description – site selection and alternatives

5.1 Site selection

Desktop analysis involving the review of historic aerial photography and satellite imagery dating back several decades was the principal method for determining potential restoration sites. This was supported by a review of Australian and international research papers. Desktop analysis has been supported by direct consultation with traditional custodians and, site reconnaissance. The results of work to date have led to the establishment of the research pilot project site boundaries.

5.2 Project alternatives

The consideration of alternatives by the Proponent included four options (A to D):

A. Do nothing.

Not undertaking habitat creation projects in wetland systems can result in several missed opportunities, including:

Loss of Biodiversity: Wetlands are very productive ecosystems providing habitat for a vast array of plant and animal species. By not restoring or creating habitats in wetlands under VM0033, the loss of biodiversity can occur. Many wetland species are threatened or endangered, and their habitats are crucial to their survival.

Reduced Ecosystem Services: Wetlands are critical ecosystems that provide numerous ecosystem services, including flood mitigation, water filtration, carbon sequestration, and recreation opportunities. By not restoring habitats in wetlands, these essential services can be reduced or lost entirely.

Decline in Water Quality: Wetlands are natural filters that remove pollutants and excess nutrients from water. By not restoring habitats in wetlands, the water quality of the surrounding area may decline, resulting in reduced aquatic life, decreased recreational opportunities, and increased health risks.

Missed Economic Opportunities: Wetlands can provide economic benefits, such as ecotourism, recreation, and commercial activities such as fishing and hunting. By not restoring habitats in wetlands, these economic opportunities can be missed, resulting in a loss of revenue for local communities.

Vulnerability to Climate Change: Wetlands are particularly vulnerable to climate change, with rising temperatures and changing precipitation patterns affecting their function and health. By not restoring habitats in wetlands, the ability of these ecosystems to adapt to climate change may be reduced, resulting in further ecological and economic impacts.

In summary, not undertaking blue carbon restoration projects in wetland systems can result in significant missed opportunities, including loss of biodiversity, reduced ecosystem services, decline in water quality, missed economic opportunities, and vulnerability to climate change.

B. Do something on a small scale (i.e., Phase 1 - research pilot study (Kangaroo Island) .

The subject of this referral

C. Do something at a landscape scale (i.e., landscape scale project).

i) **Phase I** – Research study 6 ha at 3 sites; Kangaroo Island, Mule Creek (Bing Bong) Roper River.

ii) **Phase II** – Pilot project. The results of Phase I will be incorporated into Phase II which will cover 1,000 ha on Kangaroo Island.

iii) **Phase III** – landscape scale BCER commencing in GoC South (15,000 ha), followed by GoC Central (500 ha) and GOC North (23,500 ha) with a combined total of 39,000 ha. The results of Phases I and II will be incorporated into Phase III to refine and improve BCER design assumptions and operational performance.

D. Blended approach using options B and C.

To progress to complete program approval subject to research and trial outcomes of phases I and II. This to include regular program and project evaluation and approval compliance reporting as stipulated by the NT EPA

The preferred option for Phase I is option B.

6 Proposal description – application of the principles of environmental protection and management

6.1 Introduction

Chapter 6 accounts for Part 2 of the NT EP Act and, for the general duty of proponents provide for under section 43 of the EP Act including:

a) Principles of ecologically sustainable development.

b) Environmental decision-making hierarchy.

c) Waste management hierarchy.

Commonwealth legislation refers to sustainable development by defining its principles, which are:

d) decision-making processes should effectively integrate both long-term and short-term economic, environmental, social, and equitable considerations;

e) the precautionary principle — if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;

f) the principle of inter-generational equity — that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations;

g) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making; and

h) improved valuation, pricing and incentive mechanisms should be promoted.

The Proponent operates within and makes project-based decisions based on its Environment and Sustainability Policy. Table 6-1 provides further evidence of how the Proponent has accounted for the principles of sustainable development, environmental protection, and environmental management hierarchies within the context of the Proposal.

The Proposed projects also have the potential to meet relevant international and national frameworks and objectives- for example:

a. The United Nations Framework Convention on Climate Change.

i. The Paris Agreement.

ii. The Warsaw Framework for REDD+

b) The Convention on Biological Diversity.

c) The World Heritage Convention.

d) The 2030 Agenda for Sustainable Development (BC-S2C contributes toward 11 of the 17 UN SDG).

e) The United Nations Decade on Ecosystem Restoration.

f) The United Nations Decade of Ocean Science for Sustainable Development (2021- 2030).

g) Australia's Long-Term Emissions Reduction Plan.

h) NT Climate Change Response: Towards 2050.

i) Greenhouse Gas Emissions Offsets Policy and Technical Guidelines – NT Offsets Framework.

j) Territory Benefits Policy.

6.2 Assumptions

The proponent makes the following assumptions for implementing the proposal:

1. That its proposed BCER techniques using VM0033 will succeed. This assumption is based on global mangrove restoration projects that have employed the same techniques such as those in Mesoamerica (Southern USA, central America, Caribbean and northern South America)[5] and Asia (Pakistan[6]). It is also based on learning from Phases I and II of the Proposal.

2. That over the permanence period of a project's life (i.e., 100 years), up to 20 % of its BCER work will be lost due to the impacts of cyclones, storm surges, flooding, sea fluctuations.

3. The information provided in Chapter 8 assumes all environmental avoidance, mitigation and management measures would be in place during construction and operation for each restoration project.

4. That Acid Sulphate Soils (**ASS**) will require careful management to avoid long term adverse impacts on wetland sediments and water quality.

5. That site may be restricted or limited by Potential ASS or Actual ASS. In the absence of detailed site-specific soil chemistry data, and using the precautionary principal approach, the proponent has prepared an Acid Sulphate Soil Plan of Management.

6. That implementing the proposal would lead to carbon abatement at a landscape scale and, would create significant project co-benefits that are positive and long term.

7. For planning purposes, calculated carbon emissions and risk of reversal buffer results in a negative 5 % t CO_2-e that gets deducted from our total carbon abated (TCO_2-e) calculations.

[5] *Manual for the ecological restoration of mangroves in the Mesoamerican Reef System and the Wider Caribbean.*
[6] *Delta Blue Carbon – 1 First Monitoring Report March 2022.*

Table 6-1 Principles of sustainable development and management hierarchies

Section 43 General duty	Yes	No	Proponent comment
Have the following principles of ecologically sustainable development been taken into consideration in the design of the proposed action?			
Decision-making principle	✓		The Proponent has undertaken consultation with Traditional Owners and Custodians (ongoing process) and appointed key personal to fully understand the importance of decision making and cultural heritage practices where land and sea meet. Furthermore, it has completed significant desktop environmental screening and scoping work that has included the assessment of alternative sites against key restoration requirements and criteria. This process has allowed the proponent to identify positive and negative impacts associated with implementing the proposal. Combined, these steps are the foundation of the proponent's decision-making principle for the Proposal.
Precautionary principle	✓		At this stage of the proposal, there remains some uncertainty as to the extent of acid sulphate soils. In the face of this uncertainty and using the precautionary principle, the proponent is preparing a detailed Acid Sulphate Soils Management Plan that will be appended to each project registered under the ERF or VERRA methods. Where possible, the proponent will also utilise its excellent relationships with Traditional Owners to examine their knowledge of acid sulphate soils.
Principle of evidence-based decision-making	✓		The eco-hydrology and feasibility studies where we define the current condition of the mangroves and their topography, hydrology, physiochemical properties, soil, vegetation etc. support evidence based decisions as do the ongoing project monitoring, reporting and verification (MRV). Each Program will have several BCER Projects within it again reinforcing an evidence based decision making process: The delivery of BCER will be undertaken in three phases: 1. Phase I – Research study 6 ha. 2. Phase II – Pilot project. The results of Phase I will be incorporated into Phase II which will cover 1,000 ha on Kangaroo Island. 3. Phase III – landscape scale BCER commencing in GoC South (15,000 ha), followed by GoC Central (500 ha) and GOC North (23,500 ha) with a combined total of 39,000 ha. The results of Phases I and II will be incorporated into Phase III to refine and improve BCER design assumptions and operational performance.

Section 43 General duty	Yes	No	Proponent comment
Principle of intergenerational and intergenerational equity	✓		The Proposal would facilitate community connection and capacity building between many local and regional stakeholders. The potential for intergenerational equity is linked directly to the 100-year registration period for each BCER project. Therefore, the opportunities for intergenerational opportunities and equity associated with the proposal are tangible. Locating the S2C-I in the community, creating maximum local jobs, business opportunities, equity opportunities (shares and directorships) and community capacity building are being built into the project design early.
Principle of sustainable use	✓		The Proposal would not involve exploiting natural resources. However, brackish/saline groundwater consumption may be required to supplement natural tidal water supply to keep mangrove and saltmarsh species alive during period of extreme low moisture conditions that may otherwise have lead to their mortality or sever stress if not supplemented.
Principle of conservation of biological diversity and ecological integrity	✓		The Proposal would deliver mangrove restoration at a landscape scale. This action would improve local and regional biological diversity and ecological integrity at a landscape scale.
Principle of improved valuation, pricing, and incentive mechanisms	✓		The ongoing project monitoring, reporting and verification (MRV) underpins improved valuation. The project MRV provides the validation and verification of GHG emission reductions or removals used by carbon credit certifiers allowing for them to issue credits. By using our proprietary project platform using block-chain technology, we facilitate increased transparency, accountability, integrity and pricing. All BCER projects will be registered and audited under the qualifying method statements and auditors (VERRA, Gold Standard or ERF). BC-S2C plans to introduce a range of incentive mechanisms (royalties, local jobs and business opportunities etc.) that will be monitored by the relevant project steering committee.
Have the following management hierarchies been taken into consideration in the design of the proposed action?			
Environmental decision-making hierarchy	✓		In line with Section 26 of the NT EP Act, the Proponent has considered the design and implementation of the Proposal to avoid adverse impacts on the environment. Where impacts have been identified management measures have been identified in section 8.4.

Section 43 General duty	Yes	No	Proponent comment
Waste management hierarchy	✓		Where hydrological restoration generates spoil waste, it will, where technically possible, be re-used onsite during topographical restoration activities. The Proponent is experienced in the management of waste and the waste hierarchy. Accordingly, it will follow its internal principles of prevention, minimisation, reuse, recycling and finally disposal across all aspects of its business.
Other section 43 considerations			
Have communities that may be affected by the proposed action been provided with information and opportunities for consultation?	✓		Extensive consultation with Aboriginal communities spanning the entire region commenced in June 2022 and will continue over the life of the project. BC-OC will be the primary provider of operation and maintenance (O&M) services at the S2C Institute and will provide most of the labor, equipment, and services. BC-OC is jointly owned by BC-S2C and Indigenous shareholders (49% owned by BC-S2C and 51% Indigenous – in stages). There are several Aboriginal Directors on BC-OC board who are traditional owners within the proposed BCER site. Their role is to ensure social, economic, cultural, and environmental benefits flow to Aboriginal people from the BCER projects.

7 Consultation

7.1 Legislative context of engagement and consultation

The Proponent acknowledges sections 3(d) and (e) of the EP Act which identifies the need for broad community involvement, including Aboriginal people, in the development of a Proposal. The Proponent also acknowledges the Stakeholder Engagement and Consultation guideline released by the NT EPA (2020).

By informing the community from an early stage of the Proposal's lifecycle, the community has an opportunity to make informed decisions on proposed activities. This meets the requirement of section 42(d) of the EP Act. If this is achieved, the responsible Minister can be satisfied that the community has been consulted regarding the potential environmental impacts and benefits of the Proposal (section 73(2)(a) of the EP Act).

7.2 Overview of approach to engagement

The underlying method of the Proponent's engagement strategy is based on the International Association for Public Participation's ("**IAPP"**) best practice principles (Table 7-1).

Table 7-1 IAPP best practice principles for stakeholder engagement

Inform	Consult	Involve & collaborate	Empower
• Individual meetings. • Group meetings. • Proposal information sheets. • Website material.	• Individual meetings. • Public meetings. • Questionnaires. • Listen & receive feedback.	• Establish Steering Committee. • Workshops. • Share knowledge.	• Leadership. • Decision making. • Create business opportunities.

Using the IAPP principles, BC-S2C began identifying key stakeholders in May 2022. In June 2022, we began engaging with key stakeholders we had identified to:

1. Inform them of our aims and objectives for blue carbon restoration.
2. Listen and obtain feedback.
3. Build long term relationships.
4. Work towards mutual trust and respect.
5. Make informed decisions.

Since June 2022, BC-S2C's approach during the "inform" and "consult" phases has been to educate and raise awareness on "what is blue carbon", "who are BC-S2C", "what are proposing to do"?, "what are the risks?" , "what are the potential benefits and co-benefits of our projects", "where are we proposing our projects" and "what is the proposed project timetable and the next steps?".

As shown in Figure 7-1, the development, implementation and operation of any proposal has the potential to change people's lives in either positive, negative, or neutral ways.

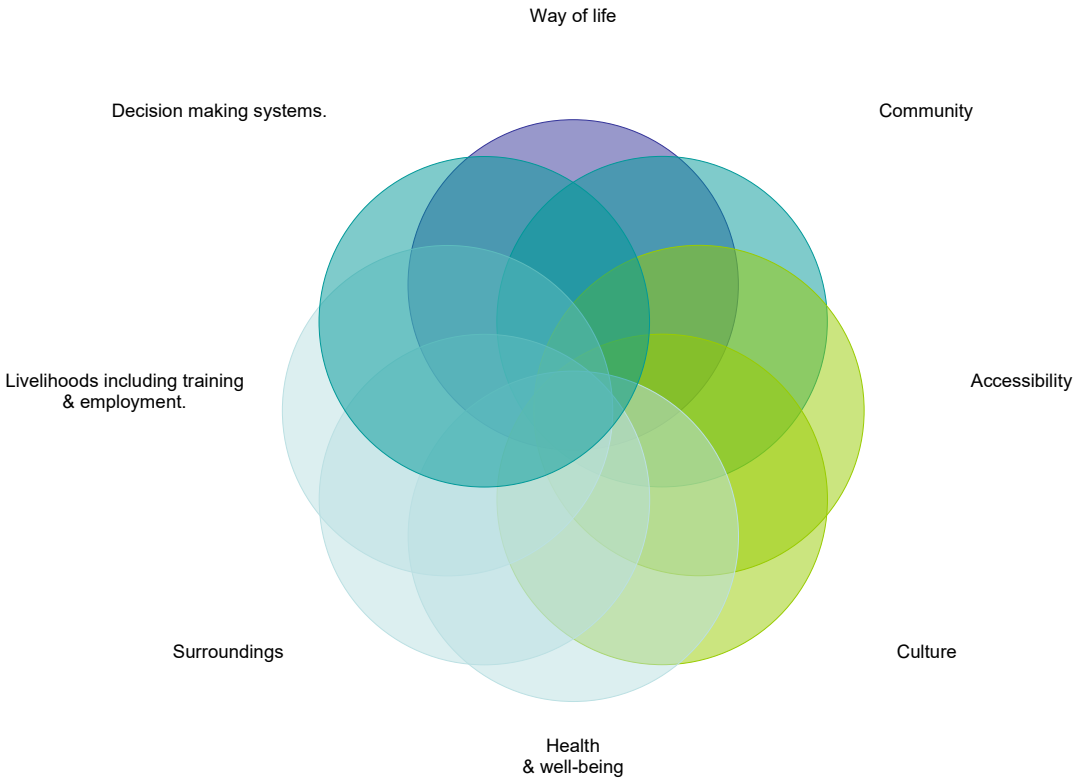

Figure 7-1 Aspects that can change people's lives linked to a proposal.

Source: Territory Benefit Policy 2019

7.3 Methods of engagement

The outcomes of the initial stakeholder identification have determined the methods of engagement for each stakeholder identified. Flexibility in methods of engagement is important. Accordingly, the Proponent has selected our methods based on:

- Objectives of the engagement (i.e., high level project introduction versus detailed technical detail).

- Timing of engagement based on project milestones.
- Expected roles of the stakeholders.
- Stakeholder needs, capacity and expectations.

The Proponent uses a combination of three methods:

i. **Introduce and inform** - These are "techniques for opening up dialogue and gathering information with stakeholders about issues linked to what is proposed". Understanding the needs and interests of stakeholders is crucial when opening.

ii. **Consult and explore** - These are "techniques that can help evaluate and analyse preliminary findings with stakeholders. During the exploring phase, the Proponent look to help keep stakeholders informed in the development process and give them a sense of ownership linked to intended project outcomes. Feedback received by the Proponent is used to further refine engagement approaches.

iii. **Engage** - These are techniques to engage and follow up with stakeholders in decisions based on engagement findings.

7.4 Identification of key stakeholders

BC-S2C follow's its internal Communication Policy and Corporate Engagement and Communication Plan (**"ECP"**), Reconciliation Action Plan (**"RAP"**) and adherence to the Carbon Market Institute's Code of Conduct to identify and engage with its key stakeholders. Since June 2022, BC-S2C has proactively consulted with a wide range of stakeholders that include:

- Traditional Owners of the land we intend to operate.
- Landowners which include Traditional Owners.
- Local Government (Roper Shire Council).
- Northern Territory Government.
- Commonwealth Government.
- Community.
- Research institutions.
- NGO's.
- Suppliers.
- Clients.
- Industry groups.
- Contractors.
- Financiers.

Table 7-2 shows what level of engagement was undertaken between June 2022 and April 2023.

Table 7-2 Engagement undertaken by BC-S2C to date.

Stakeholders	Stakeholder engagement timeline
	Q2 '22 (May, Jun) · Q3 '22 (Jul, Aug, Sep) · Q4 '22 (Oct, Nov, Dec) · 2023
Government – Federal	
Department of Climate Change, Energy, the Environment and Water - Climate Change | Emissions Reduction | Soils & Vegetation	
Department of Climate Change, Energy, the Environment and Water - Environmental Science & Nature Based Solutions	
Department of Climate Change, Energy, the Environment and Water - Markets & Partnerships	
Clean Energy Regulator - Schemes	
Clean Energy Regulator - Emissions Avoidance Methods	
Office of Township Leasing	
Geoscience Australia	
Regulator - Federal	
Climate Energy Regulator - Savanna, Agriculture & Soil Carbon	
Climate Active	
Government - Northern Territory	
Major Projects	
Investment Attraction | Investment Territory	
Department of Chief Minister and Cabinet	
Department of Trade Business and Innovation	
Land Development Corporation	
Parks and Wildlife	
Infrastructure NT - DIPL	
Regulator - Northern Territory	
NT Environment Protection Authority	
Department of Environment, Parks, and Water Security	
Crown Land Estate - DIPL	
Aboriginal Areas Protection Authority	
Norther Land Council	
Government - Local	
Roper Shire Council	
Landowners (Station owners)	
Indigenous Groups	
Yanwula IPA	
ACF	

Stakeholders	Stakeholder engagement timeline
	Q2 '22 (May, Jun) · Q3 '22 (Jul, Aug, Sep) · Q4 '22 (Oct, Nov, Dec) · 2023
Indigenous Carbon Industry Network	
Mabunji Aboriginal Resource Association (Yanyuwa IPA and li-Anthawirriuarra Sea Rangers)	
Mawa Community (Borroloola)	
NGO	
WIF	
Van Dyson Marine Fund	
Australian Conservation Council	
Research institutions	
University of Wollongong	
Sydney Institute of Marine Science	
Deakin University	
Charles Darwin University	
Industry Groups	
Contractors	
Climate Market Institute	
Wetlands International	
Carbon Credits - Buyers	
Carbon Credits - Registry (Verra)	
Carbon Credits - ACCU's	
Project Financiers	
Buyers	
Advisors (accounting / tax / insurance / legal)	
Politicians	
Labour	
CLP	
Media	
Employees	

INFORM
CONSULT

7.5 Aboriginal communities and stakeholders

7.5.1 YIPAAC

Since June 2022, BC-S2C has engaged with traditional landowners and custodians who speak for land, sea, and country at the RPP site. BC-S2C has used mostly virtual meetings and phone calls to keep the parties informed on progress to date. BC-S2C is attending Borroloola on a monthly basis to undertake group and community meetings.

One of the most important stakeholders is the Yanyuwa Indigenous Protected Area and Yanyuwa Indigenous Protected Area Advisory Committee (YIPAAC). The YIPAAC is a committee formed in Borroloola. It works to protect and manage the Yanyuwa IPA. The Yanyuwa people are the Traditional Custodians and Owners of the research pilot project site, and they play a vital role in the conservation and management of their lands and waters, promoting the cultural, social, and ecological values of the region. The YIPPAC helps to guide decision-making processes, ensuring that the Yanyuwa people's knowledge and perspectives are incorporated into the management of the IPA.

In April 2023, BC-S2C met with traditional custodians linked to the RPP site as well as the YIPAAC. Following that engagement, BC-S2C received feedback from the community of Borroloola and the YIPAAC and Sea Rangers indicates BC-S2C should focus less on meeting with individuals and small groups but instead, focus on consulting more closely and regularly with the YIPAAC and Sea Rangers. This criticism was well received by BC-S2C and will adjust their future consultation efforts in and surrounding the community of Borroloola.

7.5.2 The Northern Land Council

BC-S2C presented to the NLC in July and December 2022. The Proponent continues to engage with the NLC regarding the RPP.

7.5.3 Other Aboriginal stakeholders

In January 2023, BC-S2C issued letters of engagement to the Mawa Trust, Mabunji Corporation, and several other Land Trust's via the NLC. Efforts to reach key stakeholders in February and March were thwarted by cyclonic conditions. BC-S2C has been transparent with the approval process and is conscious of project timeframes and is conscious not to raise community expectations at this early stage.

7.6 Government and community consultation

The Proponent focuses on three tiers of government engagement, Local, State / Territory and Commonwealth. Engagement at each level varies based on the relevant environmental legislation, regulation, or guidelines. The outcomes of each government meeting would be used to formulate environmental impact assessment, engineering feasibility and operational management plans.

BC-SC2 has been consulting with Australian Government regulators who either administer the blue carbon method or, manage environmental accounting for future blue carbon projects or, those who are leading the development of blue carbon policies. A key outcome of our engagement to date with the Australian Government is the knowledge that there are no restrictions to the Proponent using international methodologies (VERRA or Gold Standard) under the CFI Act and recent reviews (Chubb review 2023) and recent climate change related policy documents (2022).

Our engagement with the NT government began in June 2022 and will actively continue over the life of our projects. To date, our key stakeholders are broadly supportive of BC-S2C's purpose and proposed phased approach to blue carbon restoration. The Proponent will keep the NT government informed.

7.7 Outcomes of engagement to date

The main questions and levels of interest raised during several face to face and virtual meetings can be summarised as:

- What is blue carbon and what is involved?
- What is the expected duration of the projects?
- What are the potential opportunities for local people?
- What are the risks?
- Are there opportunities for local jobs and businesses?
- What skills are needed to work for BC-S2C?
- When are the projects likely to commence?

Using the feedback it has received to date combined with information outlined in section 7.2, the Proponent provides a summary of potential socio-economic impacts, positive, negative or neutral, linked to the Proposal (Table 7-3).

7.8 Future consultation

The scale of consultation for the Proposal would increase through project development and implementation of Phase I. As indicated above, it would involve further face to face meetings, information sharing via various social media platforms. The Proponent would make itself available as and when required for future community engagement and consultation.

Table 7-3 Categorising the potential socio-economic impacts linked to the Proposal.

Aspect of potential change	Potential for change	Anticipated proposal impact
Way of life	How people live, work, play and generally interact each day.	Positive
Community	The composition, cohesion, character, function, resilience and sense of place.	Neutral to positive
Accessibility	Access and infrastructure, services, and facilities.	Neutral
Culture	Shared beliefs, customs, practices, values, and stories., and connections to Country, land, waterways and places.	Positive
Health & well being	Physical and mental health, especially for vulnerable people to social exclusion or substantial change. Effects on public health.	Positive
Surroundings	Ecosystem services like pollution control, erosion control, public safety, access to and use of the natural & build environment, aesthetic value, and amenity.	Neutral
Livelihoods	People's ability or capacity to sustain themselves through employment or business.	Positive
Decision making systems	The extent to which people can have a say in decisions that affect their lives, and have access to complaint, remedy, and grievance mechanisms.	Neutral

Positive social impacts of the RPP may include:

Carbon sequestration benefits

- Protect, restore existing BCE and carbon sinks at scale in the Northern Territory Gulf of Carpentaria over many generations.
- Create carbon sinks at scale that can help meet climate change, net zero and decarbonisation objectives under various industry, state and territory, national and international targets.
- Protect Indigenous peoples' intergenerational cultural heritage.
- Jobs & businesses allow communities to stay on-country.

Cultural core-benefits

- Protect Indigenous peoples' intergenerational cultural heritage.
- Jobs and businesses allow communities to stay on-country.
- Traditional land management practices.
- Food security in remote areas.

Environmental co-benefits

- Repairing degraded landscapes brings benefits to biodiversity.
- Conservation of blue, teal & green ecosystems
- Improve storm surge, flood mitigation and rising sea level resilience.
- Improve water quality.
- Meet international, national & local sustainability policies.

Social economic co-benefits

- Support local economies e.g., eco-tourism, fisheries, aquaculture.
- Protecting shorelines and coastal property.
- Create long term jobs in remote and regional communities.
- Generate wealth (wages, taxes, suppliers, carbon royalties).
- Meet several UN SDG and ESG indicators objectives.

Negative social impacts may include:

- Decreased amenity during either construction or operation of the Proposal.
- An increase to local populations which places stress on community health and wellbeing.
- Land use changes that affect community character and people's sense of place, include a sense of cultural loss for Aboriginal people.

8 Environmental factors

8.1 Pre-referral screening tool outcomes

Result of a pre-referral screening against the Proposal's construction methods and operational requirements are contained in Table 8-1. The potential for the RPP to have a significant adverse impact on environmental values and sensitivities is based on the author's industry experience and qualifications. It is also based on:

- The NT EPA checklist / guideline titled Referring a proposal to the NT EPA (2021).
- Results of desktop assessment utilising publicly available information and records linked to the site and its surrounds.
- Consultation with key stakeholders and site visits.
- Construction and operational impacts being short term.
- A lack of legacy and/or cumulative impacts following closure of the site.

Table 8-1 Proposal pre-referral environmental values and sensitivities screening results

No.	Screening question	Screening Outcome (yes /no)
1	**Hazardous nature:** Is the industry type or activity proposed inherently hazardous with the potential to give rise to multiple or major impact sources and environmental stressors with the potential to impact on the environment? If so, does the nature of the industry preclude impact sources and stressors being substantively reduced?	No
2	**Site selection:** Are any environmental values present, or likely to be present within the site/area that has the potential to be impacted by the proposed action (either directly or indirectly)? If so, is it considered impractical to change the locations or design of the action to avoid the environmental value/s?	No – refer to Figure 4-1.
3	**Construction and operation:** Are any environmental values or sensitivities within the area of influence and the region in which the proposed action is located likely to be impacted by methods of construction and operation, timing, or inputs (water, raw materials, machinery, chemicals, staff) and outputs (product, emissions, discharges, wastes) of the proposed action?	Yes – if present, acid sulfate soils, , may be disturbed. BC-S2C has prepared and will implement an Acid Sulfate Soils Plan of Management (Appendix B). This Plan will be supported by a range of other environmental management plans outlined in the Appendices to this Referral.

No.	Screening question	Screening Outcome (yes /no)
4	**End of life:** Are any environmental values or sensitivities likely to be impacted when the proposed action finishes its functional life and closes? If so, does the action have the potential to cause ongoing environmental impacts, or residual impacts?	No
5	**Cumulative impacts:** At any stage of the life of the proposal, on its own or cumulatively with other proposals and actions, is an environmental value likely to be impacted? If so, referral is likely to be required.	No

Although the overall screening outcome is "No", the Proponent has submitted the Proposal to the NT EPA to ensure the necessary level of assessment for the RPP is assessed and determined under the NT EP Act.

8.2 Environmental factors and objectives – presence / absence of environmental values

This section verifies the presence or absence of environmental values and sensitivities that have the potential to be positively or negatively impacted by the RPP. The assessment of baseline conditions has been conducted by qualified and experienced personnel within BC-S2C and reviewed by EMM Consulting in accordance with relevant NT and Commonwealth regulatory and industry guidelines including all five NT EPA environmental values. Examples of blue carbon benefits and co-benefits that meet the NT EPA's values are listed in Table 8-2.

To complete its assessment of environmental values and factors, the Proponent sourced publicly available environmental data from various local government, NT, and Commonwealth government websites. Evidence of this is summarised in Table 8-3. The Proposal is only research based. However, the potential for intergenerational opportunities associated with it will be reported in terms of long-term, positive, direct, and indirect, environmental, and socio-economic benefits and co-benefits. By integrating co-benefits into the Proposal, BC-S2C will verify:

- Restore a carbon sink that can help meet climate change, net zero and decarbonisation objectives under various industry, state and territory, national and international targets.
- Enhance areas of high conservation value.
- Deliver jobs in rural and regional communities.
- Create opportunities through creating local businesses, paying wages and suppliers.
    - Protect and enhance Indigenous peoples' cultural heritage and traditional land management practices.

Table 8-2 Aspects of blue carbon restoration that can meet NT EPA values

NT EPA value	BCE restoration value	Project benefits and/or co-benefits
Land	Climate adaption	• Carbon sinks can help meet climate change, net zero and decarbonisation objectives under various industry, state and territory, national and international targets
	Environmental	• Conservation and enhancement of an existing BCE.
	Biodiversity	• Repairing, restoring, enhancing wetland landscapes that can bring benefits to biodiversity.
Water	Climate adaptation	• By having some influence over water inundation and levels, BC-S2C's innovative and adaptive management techniques for BCE in the face of climate change impacts.
	Water quality	• Maintain and improve local and regional water quality. • Maintain and improve local estuarine health.
Sea	Climate adaptation	• Predicted sea level rise or fall is likely to result in a net loss of BCE.
	Coastal resilience	• Improve storm surge, flood mitigation and rising sea level resilience.
Air	Climate adaptation	• BCE restoration can abate the loss of carbon into our atmosphere for geological time, if they are protected and conserved beyond the 100-year permanence period.
People	Climate adaptation	• Restoring, enhancing BCE will help people who use these environments for their livelihoods. • Resilience over time.
	Cultural benefits	• Protect Indigenous peoples' intergenerational cultural heritage. • Jobs & businesses allow communities to stay on-country. • Traditional land management practices. • Food security in remote areas.
	Socio-economic & policy	• Support local economies e.g., eco-tourism, fisheries, aquaculture. • Protecting shorelines. • Create long term jobs in remote and regional communities. • Generate wealth (wages, taxes, suppliers, carbon royalties).
	Policy	• Meet international, national & local sustainability policies. • Meet several UN SDG & ESG indicators objectives. • Help companies meet their net zero and decarbonisation goals.

Table 8-3 Verification of evidence-based decision making against environmental values

NT EPA environmental value	Subcategory	Currency of information	Source of information	Method of investigation
Land	• Landforms	• Last 45 years • August 2022 • April 2023	• Historic air photos & Landsat imagery • Aerial site photography taken by the Proponent.	• Desktop analysis & field investigation.
	• Terrestrial environmental quality	• 2019 & 2022	• NT Land Clearing Guidelines. • NT Natural Resource (**NR**) Maps. • Contaminated site baseline - https://ntepa.nt.gov.au/your-business/public- registers/contaminated-land-audits	• Desktop / GIS & field visit.
	• Terrestrial ecosystems	• September 2022	• *Territory Parks and Wildlife Conservation Act 1976.* • NR Maps - Site of Botanical Significance. • NR Maps - Sites of Conservation Significance. • NR Maps Fauna Atlas - Threatened Fauna. • NR Maps Fauna Atlas – Significant Fauna and Native Fauna: • NR Maps Flora Atlas – Threatened Flora, Native Flora, Introduced Flora • Australian Government Protected Matters Search Tool.	• Desktop / GIS & field visit.
Water	• Hydrological processes. • Inland water environmental quality. • Aquatic ecosystems.	2020 & 2022	• NR Maps – Basemaps Open Street Map • Climate Change in the Northern Territory – State of the science and climate change impacts.	• Desktop & field visit. • https://nt.gov.au/environment/water/water-resources-of-the-nt/water-control-districts
Sea	• Coastal processes. • Marine Environmental Quality. • Marine Ecosystems.	• September 2022	• NR Maps – • Climate Change in the Northern Territory – State of the science and climate change impacts (Section 2.8 Coasts and Oceans).	• Desktop & field visit.
Air	• Air quality. • Atmospheric processes.	• September 2022	Climate Change in the Northern Territory – State of the science and climate change impacts (NTG, 2020).	• Desktop
People	Community and economy.	• September 2022	• NR Maps Aboriginal Lands: • Aboriginal Areas Protection Authority application lodged in December 2022. • https://nt.gov.au/property/land/heritage-listings/heritage-register-search-for-places-or- objects.	• Desktop & field visit.

8.3 Environmental factors and objectives – potential impacts and consistency with relevant policy and guidance

8.3.1 Summary of potential adverse impacts during restoration activities

Table 8-4 provides a summary of potential impacts based on environmental values linked to the Proposal. Due to the amount of baseline information obtained to date, the summary table shows there is some uncertainty regarding the potential for adverse impacts on environmental values like land, water and sea arising from restoration actions. However, with the environmental management and control measures proposed in the attached appendices, any negative impacts are considered manageable and limited to a short timeframe (i.e., < a year).

The Proponent considers the overall net impact of the RPP to be positive on the environmental and could lead to many other environmental and socio-economic co-benefits linked to coastal resilience, coastal protection, improved terrestrial and aquatic biodiversity, cultural values linked to fishing and, eco-tourism, economic development, job security and social empowerment.

Table 8-4 Summary of potential adverse environmental impacts during restoration activities.

Environmental value	Potential impacts			Context		Timeframe		
	Positive	Uncertain	Negative	Direct	Indirect	Short	Medium term	Long term
Land		✓		✓			✓	✓
Water		✓		✓			✓	✓
Sea			✓		✓	✓		
Air	✓			✓				✓
People	✓			✓				✓

The activities and/or methods of construction and operation that may give rise to impact sources and pathways for potential adverse impacts are listed in Table 8-5 and Table 8-6. The information provided in Table 8-6 assumes all environmental avoidance, mitigation and management measures would be in place during construction and operation.

Table 8-5 Potential environmental impacts that may arise by implementing the Proposal.

Environmental value	Activity / source of potential impact	Pathway	Receptor at risk	Relevant National or NT policy / guidance / code of practice
Land	• Site earthworks / digging channels, desilting existing channels. • Hazardous waste and dangerous goods storage. • Temporary spoil stockpiling containing Potential Acid Sulphate Soils ("**PASS"**) or Acid Sulphate Soils ("**ASS**)".	• Disturbing PASS or ASS leading to sediment and water contamination / acidification. • Habitat disturbance.	• Wetland drainage channels • Estuaries, • Seagrass meadows *(presence unlikely based on BCS2C field investigations to date)* • Groundwater aquifer. • Local fauna	• Developing an Erosion and Sediment Control Plan for a Residential Building Site (NT Government). • Best Practice in Erosion and Sediment Control Manual. International Erosion Control Association (2008). • Soils and Construction Managing Urban Stormwater (Landcom, 2004). • NT Open Drains – Technical Note No. 10. • NT Vegetation Retention – Technical Note No. 12. • NT Clearing Methodology – Technical Note No. 18NT. • NT Groundcover Management - Technical Note No. 19.
Water	• Hazardous waste and dangerous goods storage. • Storm surge / flooding. • Uncontrolled discharge.	• PASS or ASS contamination. • Spillage of contaminates such as hydrocarbon or oil onto clean ground leading to soil or water contamination.	• Sediments and waterways. • Groundwater aquifer.	• As above with the addition of NT Government Fact Sheet "Water Movement & Drainage".

Environmental value	Activity / source of potential impact	Pathway	Receptor at risk	Relevant National or NT policy / guidance / code of practice
Sea	• Cyclone and storm surge.	• Destruction of BCE under restoration.	• Mangrove and saltmarsh	• Not applicable
Air	• Greenhouse gas emissions.	• Gases from disturbance of AASS. • Mangrove dieback.	• Local flora and people	• As above
People	• Construction and operation.	• Noise - noting vibration is not considered to be a credible risk for the Proposal.	• People	• Northern Territory Noise Management Framework Guideline and the construction noise factsheet (NT EPA).

Table 8-6 Environmental impact assessment of the Proposal against NT EPA environment values and sensitivities

Theme	NT EPA Factor	Indicative environmental values and sensitivities	Potential significant impact (yes, no, uncertain)	Brief explanation of potential significant impact
LAND	(1) Landforms Objective: Conserve the variety and integrity of distinctive physical landforms	• Distinctive features in the landscape, either geological or anthropogenic. • Subterranean karstic terrain and faults. • Craters, gorges, ranges, massifs, escarpments, plateaus. • Monuments • Tourism related to landforms.	Uncertain	Based on desktop data provided by Natural Resource Maps (NR Maps). Until further baseline work is conducted as part of the Site Registration process, the proponent adopts the precautionary principle and assumes that its research restoration activities will need to manage the risks posed by PASS or AASS. The Proponent has prepared an ASS Plan of Management Framework (Appendix B) which will be implemented and continuously reviewed to ensure the mitigation of any potential PASS or AASS risks.
	(2) Terrestrial environmental quality Objective: Protect the quality and integrity of land and soils so that environmental values are supported and maintained.	• Good quality soils, including chemical, physical, biological and aesthetic qualities that support life. • The biological processes that depend on soil quality.	Uncertain	BCE restoration works are intended to conserve, enhance, and improve threatened species habitats. The disturbance or removal of threatened species habitats will be avoided through the Proponent implementing its Biodiversity Management Plan (**"BMP"**) included in Appendix C.
	(3) Terrestrial ecosystems Objective: Protect terrestrial habitats to maintain environmental values including biodiversity.	• Sensitive or significant vegetation or buffers. • Vegetation that provides an important ecological function. • Listed threatened species and their habitat (NT & Commonwealth). • Listed migratory species and their habitat (Commonwealth).	No	Restoration works are intended to conserve, enhance, and improve riparian habitats and their ecosystems. The disturbance or removal of riparian habitats is not required in restoration activities and, will be avoided and managed through the Proponent implementing its Project Environmental Management Plan **("EMP")** and BMP in Appendix C.
	Ecological integrity and ecological functioning	• Listed threatened species and their habitat. • Listed migratory species and their habitat. • Listed Commonwealth threatened ecological communities. • Locally endemic species or species with restricted habitat. • Species of social, cultural, livelihood and/or economic significance. • Species that are data deficient and their	No	The Proponent is aware of IPA's and is liaising with both traditional owners and the Northern Land Council (refer to Section 7.5). The outcome for the Proposal would be to work within the boundaries of any existing land and sea resource management measures. The Proposal would not undermine these measures but would make every effort to enhance them. The Proposal would complement any existing or proposed conservation and/or management activities.

Theme	NT EPA Factor	Indicative environmental values and sensitivities	Potential significant impact (yes, no, uncertain)	Brief explanation of potential significant impact
		status is unknown. • Protected area or reserve, including Indigenous Protected Area • Introduced species and/or invasive species. • Integrity of terrestrial ecosystems and the ecological services they provide. • Biological and functional diversity. • Provision of refuse. • Food supply.		The Proposal provides the opportunity to protect and enhance food supply for ecological community functioning at a local and regional level.
WATER	(1) Hydrological processes Objective: Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses, and the welfare and amenity of people are maintained.	• The supply and quantity of water in surface water features including rivers, lakes, wetlands, swamps, creeks, billabongs, intermittent streams, floodplains, mangroves, and drainage line. • The supply and quantity of water in groundwater features including aquifers, aquitards, and water tables • Declared beneficial uses. • Present and future uses, and users of water. • Current or potential water supplies, including regional scale aquifers. • Culturally important water features or other features affected by water level.	No	The proposal will largely rely on natural re-wetting from existing rivers and creeks. The RPP is not within a NT declared water control district. To ensure water levels within restored BCE are maintained to a level that supports the ongoing growth of mangrove and saltmarsh, the proponent intends to research the feasibility of using groundwater during Phase I works.
	(2) Inland water environmental quality Objective: Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses, and the welfare and amenity of people are maintained.	• The quality of water in surface water features including rivers, lakes, wetlands, swamps, creeks, billabongs, intermittent streams, floodplains, mangroves and drainage lines. • The quality of water in groundwater features including aquifers and water tables. • Declared beneficial uses. • Present and future uses and users of water. • Current or potential water supplies, including regional scale aquifers.	Uncertain	BC-S2C propose to undertake its own water quality monitoring as part of its Project Environmental Management Plan (refer to Appendix C). This is an important step with the knowledge that PASS and/or AASS may temporarily impact on the quality of sediment, water and potentially groundwater in each project site. The proponent is aware that there are no groundwater bores within its mapped RPP.

Theme	NT EPA Factor	Indicative environmental values and sensitivities	Potential significant impact (yes, no, uncertain)	Brief explanation of potential significant impact
		• Potability / drinkability. • Culturally important water features.		
	(3) Aquatic ecosystems	• Threatened species. • The health of the biota in inland waterways. • The habitats that support the lifecycle of aquatic biota. • Groundwater dependent ecosystems. • Ramsar wetlands. • Species of social, cultural, livelihood and/or economic significance. • Integrity of aquatic ecosystems and the ecological services they provide. • Biological and functional diversity. • Provision of refuge.	No	The proponent has mapped the presence of threatened species and matters of national environmental significance (refer to Figure 4-1). The proponent will not directly disturb or remove any vegetation during research pilot project site. NB - All potential 'offsite' sedimentation issues will be controlled during works program via the and associated potential impacts via the Permanence Plan, Project Operations Maintenance Plan; Sediment Erosion Control Guideline; Biodiversity Monitoring Management Plan; Biting Insects Management Plan as outlined in Appendix E.
SEA	(1) Coastal processes Objective: Protect the geophysical and hydrological processes that shape coastal morphology so that the environmental values of the coast are maintained.	• Processes that support marine ecosystems (see Marine Ecosystems Factor below) such as coral reefs, mangroves, salt marshes, seagrass meadows and sponge gardens. • Primary productivity. • Nutrient cycling. • Carbon storage. • Climate regulation. • Conservation significant low-lying areas including tidal creeks, deltas and river mouths. • Storm surge protection. • Unique coastal landforms. • Cultural and aesthetic values. • Active or passive recreation.	No	One of the key objectives for the research pilot project site is to conserve and enhance the existing blue carbon ecosystems. The reliance and protection of natural coastal processes will be studied at a site specific / project level. The results will be incorporated into proposed restoration techniques and designs. The benefits of the research pilot project include reporting carbon storage, climate regulation and coastal resilience against storm surges and flooding. It is also expected to provide significant cultural co-benefits including hunting, gathering and eco-tourism opportunities.
	(2) Marine environmental quality Objective: Protect the quality and productivity of water, sediment and biota so that environmental values	• Quality of the water, sediment, and biota. • Ecosystem health condition. • Physical parameters that support fishing and aquaculture. • Physical parameters that support	Uncertain	As described under inland water environmental quality, restoration activities have the potential to temporarily release PASS or AASS into surrounding sediments and water that, without adequate controls in place, could adversely impact ecosystem health and cultural values

Theme	NT EPA Factor	Indicative environmental values and sensitivities	Potential significant impact (yes, no, uncertain)	Brief explanation of potential significant impact
	are maintained.	recreation and aesthetics. • Industrial water supply. • Cultural and spiritual values.		within the BCE. The proponent is committed to undertaking detailed soil chemistry sampling program to baseline various parameters including pH. The information obtained from further baseline work will be used to compliment the Acid Sulfate Soils Plan of Management in Appendix B. This will be complemented by the continuous review and adaptive implementation of the 'Permanence Plan, Project Operations Maintenance Plan; Sediment Erosion Control Guideline; Biodiversity Monitoring Management Plan; Biting Insects Management Plan' as outlined in Appendix E.
	(3) Marine ecosystems <u>Objective:</u> Protect marine habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	• Conservation significant marine and coastal fauna and critical habitat such as nesting, breeding, or foraging habitat. • Conservation significant marine and coastal benthos, flora and vegetation (seagrass meadows, sponge gardens, coral reefs, mangrove communities and salt marshes). • Groups of species (species richness and assemblages of species). • Ecological functions and processes. • Species of social, cultural, livelihood and/or economic significance. • Integrity of marine ecosystems and the ecological services they supply. • Biological diversity. • Functional diversity. • Provision of refuge. • Food supply.	Yes (positive significant impact)	The Proposal seeks to conserve, rehabilitate, improve the ecological functions of marine ecosystems. All potential release of channel sediments during channel hydrology enhancement will be controlled via no offsite connectivity during excavation. Once channels are enhanced and then finally reconnected to surrounding waterways installations of silt curtains, and associated best practice controls work consistent with guidelines (below) will be followed and maintained. • Developing an Erosion and Sediment Control Plan for a Residential Building Site (NT Government). • Best Practice in Erosion and Sediment Control Manual. International Erosion Control Association (2008). • Soils and Construction Managing Urban Stormwater (Landcom, 2004). • NT Open Drains – Technical Note No. 10
AIR	(1) Air quality	• The chemical, physical and biological	Yes (positive significant	The loss of mangroves through natural causes (i.e.,

Theme	NT EPA Factor	Indicative environmental values and sensitivities	Potential significant impact (yes, no, uncertain)	Brief explanation of potential significant impact
	Objective: Protect air quality and minimise emissions and their impact so that environmental values are maintained.	characteristics of air quality. • The biological processes that depend on the air quality.	impact)	cyclones, storm surge, sea level fluctuations) is likely to result in a net loss of carbon into the atmosphere. As shown in Section 1.5, a drop in sea level of 50 cm resulted in catastrophic loss of mangroves. This risk can be controlled, and the impact minimised by ensuring sufficient water levels are maintained. Disturbance to PASS or AASS may release greenhouse gases into the atmosphere. However, the release would occur over a short timeframe and not significantly affect physical or biological characteristics of air quality.
	(2) Atmospheric processes Objective: Minimise greenhouse gas emissions so as to contribute to the NT Government's goal of achieving net zero greenhouse gas emissions by 2050.	• A contribution to the NT's greenhouse gas emissions. • Adaptation to a changing climate. • Capacity of communities and country to respond or adapt to climate change.	Yes (positive significant impact)	The founding principle of the Proposal is about positively contributing to reducing the NT's greenhouse gas emissions. The Proposal will assist in helping meet future climate adaptation scenarios within coastal blue and teal carbon ecosystem.
PEOPLE	(1) Community and economy	• Dwelling, homelands, communities, towns, and suburbs where people live. Livable environment: ○ Good amenity – air quality, noise, aesthetics. ○ Access to natural resources including bush food. ○ Recreational use of the natural or built environment (e.g., fishing, cycling, sports, picnics). ○ Access to social infrastructure and services including transport and logistics. Healthy lifestyles: ○ Sense of wellbeing. ○ Good mental health.	Yes (positive significant impact)	• The Proposal would include opportunities for community members to visit and learn more about what research is being undertaken. • The Proposal would bring full time and part- time employment to people within the NT. It would also be a training and research centre for blue carbon projects in the NT. • The Proposal would contribute to a sense of wellbeing and community spirit. • Through employment opportunities linked to the Proposal, people would have opportunities to improve their financial security. • The Proposal would be operated by a majority owned indigenous firm. It would train indigenous peoples from regional NT areas (initially Booraloola). This would bring participation in jobs, businesses, and education. • BC-S2C is also engaging with the local Land and

Theme	NT EPA Factor	Indicative environmental values and sensitivities	Potential significant impact (yes, no, uncertain)	Brief explanation of potential significant impact
		○ Community aspirations. Financial security: ○ Affordable access to food, water, electricity, transport, and communication networks. ○ Livelihoods. • Participation in jobs, businesses, and education • Existing industries such as agriculture, pastoralism, tourism, fisheries • Vulnerable sectors of the community • Connections to culture and community (that are not explicitly protected under culture and heritage legislation addressed in the Culture and heritage factor): ○ Aboriginal rights and interests, including right of access. ○ Cultural practices. ○ Sense of belonging, inclusion, connectedness, and cohesion. ○ Healthy social relationships.		Sea Ranger group to realise potential opportunities for collaboration.
	(2) Culture and heritage <u>Objective:</u> Protect sacred sites, culture, and heritage.	• Sacred sites. • Historic heritage and places. • World heritage.	Uncertain	The proponent has applied to the Aboriginal Areas Protection Authority to map the location of known items of cultural heritage significance. BC-S2C has also consulted with two qualified anthropologists who have 20 plus years in the Yanwula region. Based on the baseline engagement work completed to date, the RPP site does not contain sacred sites or known items of cultural heritage value (refer to Appendix F).
	(3) Human health <u>Objective:</u> Protect the health of the Northern Territory population.	• Drinking water. • Recreational water. • Air quality. • Bush tucker. • Radiological limits.	No	Biting insects is a major human health consideration for the Proposal. The Proponent has prepared a Biting Insects Management Plan for the RPP. The significance of water resources, air quality has been

Theme	NT EPA Factor	Indicative environmental values and sensitivities	Potential significant impact (yes, no, uncertain)	Brief explanation of potential significant impact
		• Biting insects.		discussed above. The proposal is expected to bring socio-economic co-benefits at a local scale.

8.4 Environmental factors and objectives – environment protection and management

8.4.1 Introduction

The Proponent has adopted the source-pathway receptor model for framing its environment protection and management case. This involved:

- Identifying potential adverse impacts linked to BCER activities.
- Reducing risks at source.
- Recommending pathway management in the form of:
    - Adherence to national, Territory and internal policies.
    - Adherence to environmental management plans listed below.
    - Adherence to internal environmental management procedures.
    - Adherence to internal environmental checklists.

8.4.2 Environmental management plan

The Proponent has prepared an Environmental Management Plan ("**EMP"**) for the research pilot project. The EMP is supported by a suite of sub-plan EMPs and baseline data that address specific environmental hazards and risks identified in this Report. The following sub-plan EMPs support the Proponent's EMP and will be implemented if the research pilot project is approved:

Appendix B	Acid Sulphate Materials Plan of Management Framework & supporting ASS Figure
Appendix C	• Environmental Management Plan. • Biodiversity Management Plan.
Appendix D	Threatened Species and Matters of National Environmental Significance Figure
Appendix E	• Permanence Plan • Erosion & Sediment Control Guideline. • Project Operations and Maintenance Plan. • Biosecurity Monitoring and Management Plan. • Biting Insects Management Plan.
Appendix F	• Aboriginal Heritage Protection Plan. • Emergency Preparedness and Response Plan & Waste Management Plan.

By adopting and implementing the environmental management measures, Plans and Guidelines listed above, the Proponent is confident the appropriate level of environmental protection risk management will be achieved in line with NT EPA environmental factors and objectives (Table 8-7).

8.4.3 Purpose of the Project EMP

- Ensure compliance with relevant industry, Client, and legislative requirements.
- Provide document that describes the performance expectations for environmental management.
- Provides guidance to environmental staff, Contractor, and construction personnel so that the RPP is undertaken in accordance with relevant BC-S2C and legislative requirements. It is a document that is to be kept on-site and used as a central reference for environmental management.
- Assist in creating an environment that achieves effective culture and working relationships between all people involved.

8.4.4 Responsibilities

Effective on-site environmental management would be the responsibility of the Site Supervisor who would liaise with the appointed Environmental Manager, the principal contractor and sub-contractors, consultants and other third parties. The Proponent would implement its environmental management framework for the Proposal via its Environment Policy, Environmental Management System (**"EMS"**) and site induction program.

8.4.5 Revision

This EMP will be reviewed and updated as necessary to reflect any process changes that arise from:

- Modifications to work scope.
- Statutory or other obligations.
- Feedback from risk assessments, inspections, audits, and Project personnel.
- Senior Management reviews.

Revisions will be undertaken in accordance with Client EMS document control procedures.

Table 8-7 Proposed construction and operational environmental protection and management measures

Environmental factor	Objective	Proposed environmental protection and management
Terrestrial environmental quality	• Protect the quality and integrity of land and soils so that environmental values are supported and maintained.	• Sediment & Erosion Control Guideline. The Guideline will focus on: ○ **Silt fencing**: Silt fencing is a temporary barrier made of permeable fabric or mesh that is placed along the perimeter of a construction site to control sediment-laden runoff. The fence slows the flow of water, allowing sediment to settle out and preventing it from leaving the site. ○ **Check dams:** Check dams are temporary barriers placed across channels or swales to slow the flow of water and trap sediment. The dams can be constructed using natural materials or prefabricated devices. ○ **Stabilisation techniques**: Stabilisation techniques involve the use of vegetation, erosion control blankets, or geotextile fabrics to stabilise soil surfaces and prevent erosion. Stabilisation can help to reduce the amount of sediment that enters the wetland. ○ **Minimising soil disturbance:** One of the most effective ways to control sediment movement is to minimize soil disturbance during construction activities. This can be achieved through careful planning, proper sequencing of activities, and the use of specialised equipment and techniques. ○ **Use of Best Management Practices**: (BMPs) are techniques and strategies used to minimise the negative impacts of construction activities on the environment. Implementing BMPs, such as erosion control measures and sediment management practices, can help to control sediment movement in wetland ecosystems. • Implementing the Permanence Plan.
Terrestrial ecosystems	• Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity, and ecological functioning.	• Biodiversity Management Plan. • Flora and fauna assessment, protection, and restoration procedures.
Water	• Hydrological processes - Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses, and the welfare and amenity of people are maintained.	• Implement the Sediment & Erosion Control Guideline. • Spill kits and a Spill Response Procedures • EPRP that includes cyclone and flood measures / response.

	• Inland water environmental quality - Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses, and the welfare and amenity of people are maintained.	• Sediment & Erosion Control Guideline. • Waste Management Plan. • Biosecurity Monitoring Management Plan.
Sea	• Coastal Processes - Protect the geophysical and hydrological processes that shape coastal morphology so that the environmental values of the coast are maintained.	The Proponent monitors coastal processes and water quality, and estuarine health. The Acid Sulfate Soils Plan of Management Framework includes trigger and threshold levels for detecting environmental harm. The Proponent commits to supply data from monitoring activities to DEPAW. All environmental data would be uploaded into the Proponent's cloud-based integrated vertical block chain ledger (e.g., its nominated EMS) for transparency and integrity reasons.

8.4.6 Step 1 – identify the environmental obligations of the Project

- Identify legal obligations (approval conditions of consent, tenure conditions etc.).
- Identify environmental requirements contained in the project design brief, specification, or contract. Documents may include the environmental protection and management framework contained within this document or, any other environmental impact assessment.

8.4.7 Step 2 – Identify the environmental risks particular to the site

- Review relevant documentation identified in Step 1.
- Compile a risk register for the Site.
- Liaise and engage with environmental regulators about their concerns for the Site.
- Liaise with designers to establish how they can help identify and overcome potential environmental limitations or challenges relevant to the Site.
- Prepare site inductions and alert all staff to the risks associated with construction and operation of the Site.

8.4.8 Step 3 – identify environmental responsibilities

- Describe and record the environmental accountabilities and responsibilities of all personnel working on-site, including those who may be involved in implementing and monitoring site activities.
- Define the lines of communication between site personnel, and those responsible for implementing the EMP.

8.4.9 Step 4 - Implement the EMP

- Information gathered from Steps 1 to 3 would be used to form the basis of a site-based EMS. The core document of the EMS is the EMP.
- Verify the EMP is site specific, easily accessible (hard and soft copy) and regularly revised and used.
- The EMP can be used to develop method statements for specific components of sitework.
- Method statements are critical documents on-site as these would be referenced during toolbox talks. They would focus not only on environmental matters but also health, wellbeing, and safety aspects.
- Sub management plans and procedures to the EMP would be prepared including an ESCG.

8.4.10 Step 5 - Implement the POMP and monitor

- The EMP would include a robust monitoring system including the BMMP. The BMMP would be implemented to avoid the introduction of invasive flora species and feral animals.
- The MRV aspect of the Proposal would be a requirement of the POMP.

8.5 Environment factors and objectives – cumulative impacts

The potential for cumulative impacts when a project site is located several kilometers away from the nearest project can vary depending on the nature of the projects, their scale, and the sensitivity of the surrounding environment. Cumulative impacts refer to the combined effects of multiple projects or activities on the environment and society over time, which may result in consequences that are more significant than the impacts of individual projects.

Several factors need to be considered when evaluating the potential for cumulative impacts in this context:

1. **Type of projects:** If projects involve similar activities or have similar environmental impacts, the potential for cumulative impacts may be higher. For instance, if both projects contribute to water pollution, their combined effect may result in more severe water quality degradation than if the projects were further apart. The potential for water pollution linked to the RPP is considered low (refer to Section 8.3).

2. **Scale and intensity:** The size and intensity of the projects can influence the extent of their environmental footprint and the potential for cumulative impacts. Larger and more intensive projects may have more substantial impacts on the surrounding environment, increasing the likelihood of cumulative effects. The scale of the research pilot project is contained to a catchment and watershed that is well understood. The site and areas offsite will be monitored, reported, and verified to baseline conditions.

3. **Environmental sensitivity:** The vulnerability of the surrounding environment to disturbance or degradation can also affect the potential for cumulative impacts. If the area between the two projects is characterised by sensitive ecosystems, endangered species, or critical resources, the potential for cumulative impacts may be more significant.

4. **Duration and timing:** The duration and timing of the projects can influence the potential for cumulative impacts. If both projects are operational at the same time or have overlapping construction phases, the combined impacts may be more severe than if the projects were staggered or had different operational timeframes. Subject to approval timeframes, the RPP may commence in October 2023. Other BC-S2C blue carbon projects would be subject to separate approval processes and final investment decision. Accordingly, they would not likely commence until April 2024.

5. **Mitigation measures:** The effectiveness of mitigation measures implemented by each project to minimise environmental impacts can also influence the potential for cumulative effects. If both projects have robust mitigation strategies in place, the overall impacts may be reduced, decreasing the likelihood of significant cumulative impacts. The suite of EMPs in the attached appendices are considered to provide effective control of potential cumulative onsite and offsite impacts.

In conclusion, the Proposal is not considered to result in negative cumulative impacts. Rather, the environmental and social cumulative impacts for the Proposal are regarded as being positive. The Proponent refers to these as Proposal co-benefits. For example, the Proposal is considered to help facilitate long-term and significant positive cumulative impacts on greenhouse gas abatement, increased coastal resilience to a changing climate, improved biodiversity and, maintain or enhance cultural values and practices in blue carbon ecosystems. The Proposal would also bring long-term opportunities for regional Aboriginal Australians in the form of training, employment, and the potential to create new business opportunities.

9 Commitments

9.1 Research study commitments

The Proponent commits to:

1. Continuing its consultation and engagement programs on a regular (monthly) basis with its key stakeholders on the objectives of the research pilot project.
2. Preparing site specific environmental baseline and assessment studies. This will be inclusive of:
    a) Carbon stock assessments.
    b) Surface hydrology and hydraulic modelling.
    c) Physical-chemical characteristics of surface and groundwater.
    d) Physical-chemical characteristics of soils and sediments.
    e) Greenhouse gas abatement modelling.
    f) Flora.
    g) Fauna.
3. Implementing its environmental management plan and sub-plans.
4. Seeking opportunities to improve training and job opportunities in the Borroloola and King Ash Bay regions.
5. Reporting and communicating the outcomes of potential environmental and socio-economic cob-benefits.

10 Conclusion

This Referral has been submitted to the NT EPA to determine the appropriate environmental impact assessment method for the Proposal. Though not deemed significantly hazardous, the Proposal could offer immediate and long-term environmental and socio-economic benefits such as ecological improvement, coastal resilience, feral animal control, job creation, and contributions towards a carbon-neutral future. These benefits could span multiple generations.

The Proposal has been communicated to key stakeholders who have acknowledged its potential local and regional benefits. The Proponent will continue engaging with stakeholders to ensure adequate consideration and understanding.

This Referral outlines potential impacts and their significance across environmental aspects, including land, water, sea, air, and people. Uncertainties regarding land and water values will be investigated and reported by independent experts. By implementing proposed environmental protection measures and management plans, potential risks, such as those from acid sulphate soils, are expected to be limited.

Blue Carbon Ecosystems in the Northern Territory have been negatively affected by human development and natural events, impacting their capacity as reliable carbon sinks. BCE offers significant environmental, social, and economic co-benefits, justifying Blue Carbon S2C Pty Ltd's support for the Proposal. Stakeholder backing and engagement with landowners and traditional owners can realise the discussed socio-economic co-benefits, helping meet or exceed current and future carbon targets.

Blue Carbon Ecosystems suffering from natural events need pro-active management to continue functioning as secure carbon sinks. BC-S2C will implement Verified Carbon Standard methodology (VM0033) to research its effectiveness to restore a declining blue carbon ecosystem in the NT Gulf of Carpentaria. These justifications support Blue Carbon S2C Pty Ltd's commitment to financing and developing the Proposal, providing long-term socio-economic and environmental benefits.

11 Supporting information to the Referral

11.1 What is Verra Methodology VM0033?

VM0033 is a methodology under the VCS managed by Verra. It is titled "methodology for Tidal Wetland and Seagrass Restoration".

VM0033 is designed to quantify the GHG emission reductions and removals achieved through the restoration reductions and removals achieved the restoration of degraded tidal wetlands and seagrass ecosystems (or BCE). The methodology provides guidance on project eligibility, baseline determination, monitoring, and quantification of emission reductions and removals.

By applying VM0033, project developers (e.g., BC-S2C) can estimate the climate benefits of their restoration activities and earn Verified Carbon Units (VCUs) that can be sold in the carbon offset market.

11.2 Is BC-S2C using VM0033 to secure Australian Carbon Credit Units?

No. It is not possible to sell or trade ACCUs in Australia using the VM0033 methodology for blue carbon ecosystem restoration.

11.3 Is carbon abatement under VM0033 consistent with IPCC and National inventory approaches?

Yes, carbon abatement under VM0033 is consistent with IPCC (Intergovernmental Panel on Climate Change) and national inventory approaches for accounting for greenhouse gas emissions and removals.

The IPCC guidelines provide a framework for measuring and reporting greenhouse gas emissions and removals from different sectors, including agriculture and forestry. The VM0033 method is designed to comply with the IPCC guidelines, and the carbon credits generated under this method can be used to offset greenhouse gas emissions in various sectors.

Similarly, national inventory approaches for accounting for greenhouse gas emissions and removals are designed to comply with the IPCC guidelines. The use of VM0033 to increase soil carbon sequestration can be included in national greenhouse gas inventories, and the resulting emissions reductions can be reported to the United Nations Framework Convention on Climate Change (UNFCCC).

In addition, the Australian government has developed a Carbon Credits (Carbon Farming Initiative) Act 2011, which provides a legal framework for the implementation of carbon farming methods such as VM0033. The carbon credits generated under VM0033 can be traded on the Australian carbon market and, it can also be used to meet Australia's international climate change commitments under the Paris Agreement.

Overall, carbon abatement under VM0033 is consistent with IPCC and national inventory approaches for accounting for greenhouse gas emissions and removals, and offers a credible and cost-effective solution for mitigating climate change while improving soil health and productivity.

11.4 What are the main differences between VM0033 and the Australian blue carbon methodology?

VM0033 and the Australian blue carbon method are two different carbon accounting methodologies used for estimating and reporting carbon stocks and emissions associated with coastal ecosystems such as mangroves, seagrasses, and tidal marshes. The major differences between these two methods are:

1. **Scope**: The VM0033 methodology focuses on tidal wetlands, whereas the Australian blue carbon method covers tidal wetlands, seagrasses, and mangroves.

2. **Approach:** VM0033 uses a tiered approach to estimate carbon stocks and fluxes, whereas the Australian blue carbon method uses a standardised approach based on the Intergovernmental Panel on Climate Change guidelines.

3. **Data requirements:** VM0033 requires fewer data inputs than the Australian blue carbon method. For example, VM0033 only requires information on vegetation cover and elevation, while the Australian blue carbon method requires more detailed information on vegetation structure, species composition, and sediment characteristics.

4. **Spatial resolution:** The Australian blue carbon method has a higher spatial resolution than VM0033, with a minimum mapping unit of 0.1 hectares compared to VM0033's 1-hectare minimum mapping unit.

5. **Treatment of uncertainties:** The Australian blue carbon method includes a more comprehensive treatment of uncertainties associated with carbon stock and flux estimates, while VM0033 provides less guidance on how to account for uncertainties.

6. **Geographic coverage:** VM0033 was developed for use in the United States and around the globe, whereas the Australian blue carbon method was specifically developed for use in Australian ecosystems.

In summary, the main differences between VM0033 and the Australian blue carbon method are the scope, approach, data requirements, spatial resolution, treatment of uncertainties, and geographic coverage.

11.5 What are the benefits of using VM0033 in Australia

VM0033 is a carbon farming method used in Australia to increase soil carbon sequestration in soils. It provides a greater level of flexibility for hydrological connectivity compared to the ERF blue carbon method. The long-term benefits of using VM0033 include:

1. **Carbon sequestration:** VM0033 aims to increase the amount of carbon stored in tidal wetland soils. Carbon sequestration not only helps to mitigate climate change by reducing atmospheric carbon dioxide concentrations but also provides benefits to soil health and fertility, water retention, and nutrient cycling.

2. **Improved soil health:** Increasing soil carbon through VM0033 can improve soil health by increasing soil organic matter, improving soil structure, and increasing microbial activity. This can lead to improved soil fertility, water infiltration, and nutrient availability. These are important environmental aspects that can lead to long-term environmental co-benefits linked to blue carbon restoration.

3. **Reduced soil erosion:** Soil carbon helps to bind soil particles together, reducing the risk of soil erosion. This can improve soil productivity and reduce the risk of downstream sedimentation.

4. **Increased biodiversity:** Increasing soil carbon through VM0033 can improve the soil habitat for a range of organisms, including microorganisms, insects, and earthworms. This can increase biodiversity in agricultural systems and lead to more resilient ecosystems.

5. **Economic benefits:** The increased productivity of tidal wetland soils resulting from VM0033 can lead to increased crop yields and profitability for farmers. In addition, carbon credits can be earned by sequestering carbon through VM0033, providing additional income for landowners we enter Carbon Project Agreements with.

The potential long-term benefits of using VM0033 include increased carbon sequestration, improved soil health, reduced soil erosion, increased biodiversity, and economic benefits for landowners. By increasing the amount of carbon stored in agricultural soils, VM0033 offers a sustainable solution to mitigate climate change and improve the resilience of BCE.

11.6 Would carbon abatement under VM0033 be additional to business as usual?

Yes, carbon abatement under VM0033 would be additional to business as usual, as it involves implementing carbon sequestration practices that go beyond normal farming practices.

To be eligible for carbon credits under the VM0033 method, farmers must implement management practices that are not part of their usual farming practices, such as changing crop rotations, using cover crops, reducing tillage, or incorporating organic matter into the soil. These practices increase the amount of carbon stored in the soil, resulting in emissions reductions that are additional to business as usual.

The concept of additionality is a key requirement for carbon offset projects, as it ensures that the emissions reductions claimed by the project are real and would not have occurred otherwise. Additionality is assessed by comparing the emissions reductions achieved by the project to a baseline scenario that represents business as usual or the most likely alternative scenario without the project.

In the case of VM0033, the baseline scenario would represent the emissions that would have occurred without the implementation of the carbon sequestration practices. The emissions reductions achieved by the project would then be calculated by comparing the carbon stored in the soil under the project scenario to the carbon that would have been stored under the baseline scenario.

Therefore, carbon abatement under VM0033 is additional to business as usual and provides a credible and cost-effective solution for mitigating climate change while improving soil health.

11.7 Are carbon emissions or removals measurable under VM0033?

Yes, carbon emissions or removals are measurable under VM0033. The method involves implementing management practices that increase the amount of carbon stored in soils, which can be measured using various techniques.

The most used technique for measuring soil carbon is soil sampling and laboratory analysis. Soil samples are collected from different depths and locations within the project area and analysed for their carbon content. The carbon stored in the soil can then be calculated based on the soil organic carbon concentration and the bulk density of the soil.

In addition to soil sampling and laboratory analysis, other techniques can also be used to estimate soil carbon storage, such as remote sensing and modelling. Remote sensing techniques involve using satellite or aerial imagery to estimate vegetation cover, biomass, and productivity, which are indicators of soil carbon storage. Modelling techniques involve using computer models to simulate the effects of different management practices on soil carbon storage.

Regardless of the technique used, the carbon emissions or removals under VM0033 will be quantified and verified by an accredited third-party auditor. The auditor will assess the project design and management practices, verify the carbon sequestration claims, and issue carbon credits that can be used to offset greenhouse gas emissions in various sectors. In summary, carbon emissions or removals are measurable under VM0033, and the method provides a reliable and cost-effective solution for mitigating climate change while improving soil health and BCE productivity.

11.8 Are all material emissions resulting from the pilot project included in net abatement calculations?

No, material emissions are not explicitly defined in VM0033. The method focuses on increasing soil carbon sequestration through the implementation of land management practices or actions that improve soil health and fertility, but it does not specifically address emissions of other greenhouse gases such as methane or nitrous oxide.

With this omission of VM0033 in mind, BC-S2C will account for methane and nitrous oxide emissions within the research pilot project. This action will better align with the Australian ERF methodology for blue carbon restoration. Notwithstanding, VM0033 method requires the proponent to monitor and report changes in land management practices that could affect soil carbon sequestration, as well as any unexpected emissions of other greenhouse gases. This MRV protocol ensure that the carbon sequestration claims are accurate and credible, and any unintended consequences are accounted for.

Furthermore, while VM0033 does not explicitly address material emissions, the method can contribute to reducing emissions from other sectors by providing carbon credits that can be used to offset emissions in various sectors. This is consistent with the broader goal of the method, which is to contribute to mitigating climate change by increasing soil carbon sequestration and reducing greenhouse gas emissions.

11.9 Is net abatement estimate conservative under VM0033?

Estimates, projections, and assumptions in VM0033 employ three approaches that can contribute to conservatism in the accounting process. Uncertainty discount - used to reduce the magnitude of emission reductions in proportion to the uncertainty associated with project data.

CH4 emissions from the project baseline scenario can be set to zero and result in the production of more conservative estimates of the net effect of the project on total emissions. VM0033 also requires project proponents to reassess baseline calculations every 10 years during the crediting period, which will reduce the potential to overestimate baseline emissions.

Therefore, the net abatement estimate under VM0033 is generally considered to be conservative. The method requires a conservative approach to calculating the amount of carbon sequestered in soils, which means the estimates are likely o be lower than the actual carbon sequestration achieved by the project.

The conservative approach involves using conservative assumptions for the baseline scenario, such as assuming no changes in management practices or carbon stocks over time and using conservative estimates for the carbon sequestration potential of the BCER project. This approach ensures that the carbon credits issues by the method represent real and additional emissions reductions, and they are not overstated.

This conservative approach also means that the net abatement estimate under VM0033 may not fully capture the carbon sequestration potential of the project and, may underestimate the actual emissions reductions achieved. This is because the method does not account for all the potential carbon sequestration benefits that could be achieved through more advance or innovative BCE land management practices, and it may not fully capture the long-term carbon storage potential of the soil.

Therefore, while the net abatement estimate under VM0033 is conservative, it should be viewed as a minimum estimate of the emissions reductions that could be achieved by the Proposal. This approach ensures that the method provides credible and transparent carbon accounting, and that the carbon credits issued are of high quality and can contribute to mitigating climate change.

11.10 Are the approaches employed under VM0033 supported by clear and convincing evidence?

Yes, the approaches employed under VM0033 are supported by clear and convincing evidence. The method is based on scientific research and established principles of soil carbon sequestration, and it has been developed in consultation with scientific experts, stakeholders, and government agencies.

The approaches employed under VM0033 are consistent with the latest scientific understanding of soil carbon sequestration and the factors that affect the amount of carbon stored in soils. The method employs well-established measurement techniques and monitoring protocols to ensure that the carbon sequestration achieved by the project is accurately quantified and verified.

In addition, the method has undergone a rigorous and transparent development process, which included extensive consultation with international scientific experts, stakeholders, and government agencies. The development process involved a thorough review of the scientific literature on soil carbon sequestration, as well as field trials and modelling studies to validate the effectiveness of the method.

The resulting method has been extensively tested and refined through a pilot phase and a public consultation process, which included input from a range of stakeholders, including farmers, industry representatives, scientists, and government agencies. The method has also undergone an independent review by the Emissions Reduction Assurance Committee, which is responsible for assessing the eligibility of carbon credit methods under the Australian Government's Emissions Reduction Fund (Jeff Baldock, et al; 2019)

Overall, the approaches employed under VM0033 are well-supported by clear and convincing evidence, and they have been developed through a rigorous and transparent process that involved scientific research, stakeholder consultation, and independent review.

11.11 Are the definitions and calculations technically correct and clear?

Yes, VM0033 details the scope of eligible activities and specifies the circumstances under which these apply. Ineligible activities are also defined. Definition of terms used are technically correct, unambiguous and, for the most part, consistent with their use in Australia.

11.12 Applicability of the research site using VM0033

The applicability of VM0033 is based on specific criteria and conditions:

1. **Project Activities:** The methodology applies to projects that involve the restoration of degraded tidal wetlands including but not limited to:
    a. Restoring hydrology including removing tidal barriers; improving hydrological connectivity; restoring tidal flows and lowering water levels on impounded wetland areas.
    b. Replanting or promoting natural regeneration of vegetation.
    c. Removing or reducing stressors (e.g., pollution, invasive species
    d. Protecting existing ecosystems from further degradation.
    e. Altering sediment supply including beneficial use of dredge material and diverting.
    f. Changing salinity characteristics (in order to reduce the threat of methane emissions).

2. **Project Location:** The project must be in coastal areas where tidal wetlands or seagrass meadows occur or have the potential to be restored.

3. **Baseline Scenario:** The baseline scenario should represent the continuation of current land-use practices or the most plausible alternative land use without the project intervention. The project's impact (refer to Section 7) will be measured against this baseline.

4. **Additionality:** The project must demonstrate that the GHG emission reductions or removals would not have occurred without the intervention.

5. **Monitoring, Reporting, and Verification (MRV):** The project must establish a robust MRV system to estimate the GHG emission reductions or removals, including the monitoring of key parameters, such as vegetation cover, biomass, and soil carbon stocks.

6. **Leakage:** The project should assess and account for any potential leakage, which refers to the displacement of GHG emissions from the project area to another location.

7. **Permanence:** The project should address the risk of non-permanence, which is the possibility that the GHG emission reductions or removals could be reversed in the future (e.g., due to natural disasters, land-use changes, or other factors).

As part of the research pilot project, BC-S2C will investigate site specific conditions listed below to demonstrate project applicability:

- Stratification.
- Soil carbon.
- Emissions.
- Geomorphology.
- Biodiversity.

If the project meets these criteria and follows the prescribed procedures for quantifying and verifying the GHG emission reductions or removals, VM0033 can be applied to estimated and report the climate benefits of tidal wetland restoration.

11.12.1 Stratification

Stratification in wetlands refers to the vertical distribution of water and nutrients within the soil layers, and it can have a significant impact on the biogeochemical processes that occur within the wetland ecosystem. To measure stratification at the research pilot project site, BC-S2C may use a variety of techniques, including:

1. **Soil coring:** Soil cores can be extracted from different depths within the wetland and analysed for properties such as moisture content, organic matter content, and nutrient availability. By comparing these properties across the soil layers, you can determine the extent of stratification in the wetland.

2. **Soil probes**: Soil probes can be used to measure the moisture content and nutrient availability at different depths within the wetland. By comparing the measurements from different depths, you can determine the extent of stratification.

3. **Piezometers:** Piezometers are instruments that measure the pressure of water at different depths within the soil. By comparing the water pressure measurements at different depths, you can determine the extent of stratification in the wetland.

4. **Water level monitoring**: Monitoring the water level in the wetland over time can provide insight into the extent of stratification. For example, if the water level in the wetland remains constant over time, this may indicate that there is limited stratification, while fluctuations in the water level may indicate the presence of stratification.

11.12.2 Soil carbon

The Australian Standard for measuring soil carbon is AS 4968-2008: "The storage and handling of carbonaceous materials in relation to land use and land-use change". This standard provides guidelines for the measurement, estimation, and reporting of carbon stocks and fluxes associated with land use and land-use change activities, including those related to soil carbon.

The standard outlines methods for collecting and analysing soil samples for carbon content, including laboratory analysis of soil samples using wet combustion, dry combustion, or other appropriate methods. It also provides guidance on the sampling design and protocol for soil carbon measurement, as well as data management and reporting requirements.

The standard emphasizes the need for accurate and consistent measurement and reporting of soil carbon stocks and fluxes, as well as the importance of considering uncertainties and potential sources of error in these measurements. It also recognizes the role of soil carbon management in contributing to climate change mitigation and adaptation and provides guidance on how to incorporate soil carbon data into greenhouse gas reporting and accounting frameworks.

Overall, the Australian Standard for measuring soil carbon is an important tool for promoting consistent and reliable measurement and reporting of soil carbon, which is crucial for effective climate change mitigation and adaptation strategies.

11.12.3 Methane emissions

There is no specific Australian Standard for measuring soil methane or loss of methane in soils. There are a range of national and international standards that provide guidance on the measurement and reporting of greenhouse gas emissions, including those from soil sources.

One such standard is the National Greenhouse and Energy Reporting (Measurement) Determination 2008. It sets out the requirements for measuring and reporting GHG emissions in Australia, including those from soil sources. The Standard will be used by BC-S2C to provide guidance on the measurement, estimation, and reporting of methane emissions from soils issuing a range of methods, including field measurements and modelling.

Another relevant standard is the ISO 14064-2018 Greenhouse gases – Part 1: Specification with guidance at the organisation level for quantification and reporting of greenhouse gas emissions and removals. Guidance on the selection of appropriate measurement methods, data quality requirements, and the reporting and verification of results is available through this standard.

11.12.4 Geomorphology

Geomorphology refers to the assessment and study of its physical surface features and the processes that shape them. BS-S2C has measured and will continue to measure baseline geomorphology at the Site using a variety of techniques, such as:

1. **Historical aerial photographic interpretation:**

2. **Topographic surveys:** Topographic surveys involve measuring the elevation and slope of the land surface using instruments such as GPS receivers, total stations, or LiDAR (Light Detection and Ranging) sensors. This information will be used to create detailed maps of the Site's surface and identify features such as channels, ponds, and ridges.

3. **Sediment sampling:** Sediment samples can be collected from different locations within the wetland to analyse the grain size distribution, organic matter content, and mineral composition. This information can provide insights into the depositional history of the wetland and the processes that shape the sediment.

4. **Ground-penetrating radar (GPR):** GPR is a geophysical technique that uses radar pulses to image the subsurface of the wetland. By analysing the reflected signals, scientists can identify subsurface features such as buried channels, sediment layers, and root systems.

5. **In-situ measurements:** In-situ measurements involve collecting data directly within the wetland, such as water level, flow velocity, and sediment transport. These measurements can provide insights into the hydrological and sedimentological processes that shape the wetland.

6. **Remote sensing:** Remote sensing techniques, such as satellite imagery and aerial photography, can be used to map the wetland surface and identify features such as vegetation cover, water depth, and surface roughness.

12 References

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Appendix A: NT EPA REFERRAL FORM AND CHECKLIST

Appendix B: Acid Sulfate Soils Map and Plan Of Management Framework

Appendix C: PROJECT ENVIRONMENTAL MANAGEMENT PLAN AND BIODIVERSITY MANAGEMENT PLAN

Appendix D: THREATENED SPECIES AND MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE FIGURES

Appendix E: Permanence Plan, Project Operations Maintenance Plan; Sediment Erosion Control Guideline; Biodiversity Monitoring Management Plan; Biting Insects Management Plan

Appendix F: Aboriginal Heritage Protection Plan; Emergency Preparedness Response Plan; Waste Management Plan