Bring Back the Fish

Restoration and conservation of shellfish ecosystems in the Noosa River estuary

Project Management Plan

25th of July 2019 – 30th of September 2022

June 2020

This project was made possible by The Nature Conservancy, Noosa Shire Council, The Thomas Foundation and Australian Marine Conservation Society. The project is located on Kabi Kabi Sea Country.

Contents

Version History

Version/Date	Issued as	Author	Approved
V1/20.12.2019	For TNC and NSC review	TNC	
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1. Executive Summary

This Project Management Plan (Plan) details the work-flow associated with The Nature Conservancy's (TNC) and Noosa Shire Council's (NSC) *Bring Back the Fish* conservation project for the Noosa River Estuary. The period of the plan is the 25th of July 2019 to the 30th of September 2022, as per the related TNC-NSC Alliance and Funding Agreement for this project.

The project proposes to establish an innovative and regionally significant Noosa River Partnership, amongst Noosa Shire Council, The Nature Conservancy and the Noosa Community, to improve the health and resilience of the Noosa River estuary and the industries and local communities that rely on its long-term health.

The focus of the Partnership is to:

- Improve the health and resilience of Noosa's marine and estuarine environment through innovative restoration and coastal resilience projects;
- Capitalize on the expertise of The Nature Conservancy's global networks and experience (through knowledge brokering, mentoring, study tours and access to subject matter experts) to improve Noosa River management and strengthen the long-term social, environmental and economic health and resilience of the Noosa River and surrounding marine environment;
- Demonstrate a leading example of a replicable, environmentally-focused, collaborative alliance that achieves superior outcomes for the environment and local communities compared to existing river and marine management models; and,
- Increase government (State and Federal), private, industry and community support for restoration and conservation-focused activities that improve the long-term social, economic and environmental health and resilience of the Noosa River and surrounding marine environment.

The Partnership, delivered through this Project, will initially prioritize the restoration of shellfish ecosystems in the lower estuary (as described below) in addition to:

- Providing general strategic support/advice for planning, management and evaluation associated with the new Noosa River Plan and Noosa Environment Strategy and other initiatives and projects associated with the river system;

- Engaging the Noosa community and businesses in meaningful volunteering, citizen science and marine education opportunities;

- Coordination of research and associated projects that will inform and contribute to implementation of the Noosa River Plan and Noosa Environment Strategy, with a particular focus on seagrass mapping and restoration and living shorelines; and,

- Critical evaluation and potential reform of current and future management activities with a particular focus on opportunities for sustainable commercial and recreational fishing and associated activities.

Shellfish ecosystem restoration methodology will follow standards aligned with best practice shellfish restoration and the Society for Ecological Restoration (SER) global guidelines.

A number of previous projects, including a three-year study led by the University of Sunshine Coast, established the feasibility of shellfish ecosystem restoration by demonstrating sufficient shellfish recruitment and survival, and invertebrate colonization, at a number of locations throughout the lower estuary. Following on from this initial work,

this Project is split into three work sequences or phases, to reduce ecological and financial risks through the application of an adaptive management framework whereby learnings from previous phases are included in future phases to consider prior learning and minimize risk:

1. *Optimal design and siting* (2020) which includes pre-planning to determine the optimal design, locations and most cost-effective method of shellfish ecosystem restoration;

2. *First site implementation* (2020-2021) which will restore full sized shellfish ecosystems at two sites in the estuary to test initial restoration methods and designs; and,

3. *Full restoration* (2021-2022) which restore shellfish ecosystems at all suitable (and approved) sites within the estuary.

Project management will be led by TNC in partnership with NSC and the Noosa community. A Technical Advisory Group will oversee scientific and technical aspects of the project and include representatives from TNC, NSC, State Government, Kabi Kabi and other experts as required.

The Partnership commenced on 25 July 2019 and will run for three years and three months till the 30th of September 2022, with the outcomes of the Partnership to be reviewed in July 2022. The total operating budget is $2.4M, inclusive of $1.2M from The Nature Conservancy (which includes $200,000 from the Australian Marine Conservation Society) and $1.2M from Noosa Council, with the expectation that TNC will raise further funding from a variety of other sources to support further delivery of shellfish bed restoration. The governance arrangements for this Project are defined in the Alliance and Funding Agreement between The Nature Conservancy and Noosa Shire Council executed on the 25th July 2019.

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2. Introduction

2.1 Purpose and scope

The purpose of this Plan is to detail the workflow necessary to successfully deliver the Project (Bring Back the Fish, defined in the TNC-NSC Alliance and Funding Agreement) including project timelines, activities, methodology and budget. It provides an overview of the restoration targets, goals and objectives associated with the shellfish restoration sub-project. It also provides the basis for the development of more detailed implementation plans such as the Communication Plan and Monitoring Evaluation and Reporting Plan.

The Project involves the delivery of multiple objectives, each with multiple activities required to deliver the Project goal (see below). The primary objective involves the restoration of shellfish ecosystem (created predominantly by *Saccostrea glomerata,* rock oyster) initially at two locations and then subject to successful establishment at these sites, at other locations throughout the estuary.

The Project commenced on 25th July 2019, and is scheduled to be completed by 30th September 2022.

The geographical boundaries of the project include all estuarine waters of the Noosa River Estuary including up to the high water mark (Figure 1). The political, social and community boundaries include all parties required to successful deliver on the project objectives including local and state governments, Commonwealth Government, community groups, private corporations, private trusts and foundations and individuals.

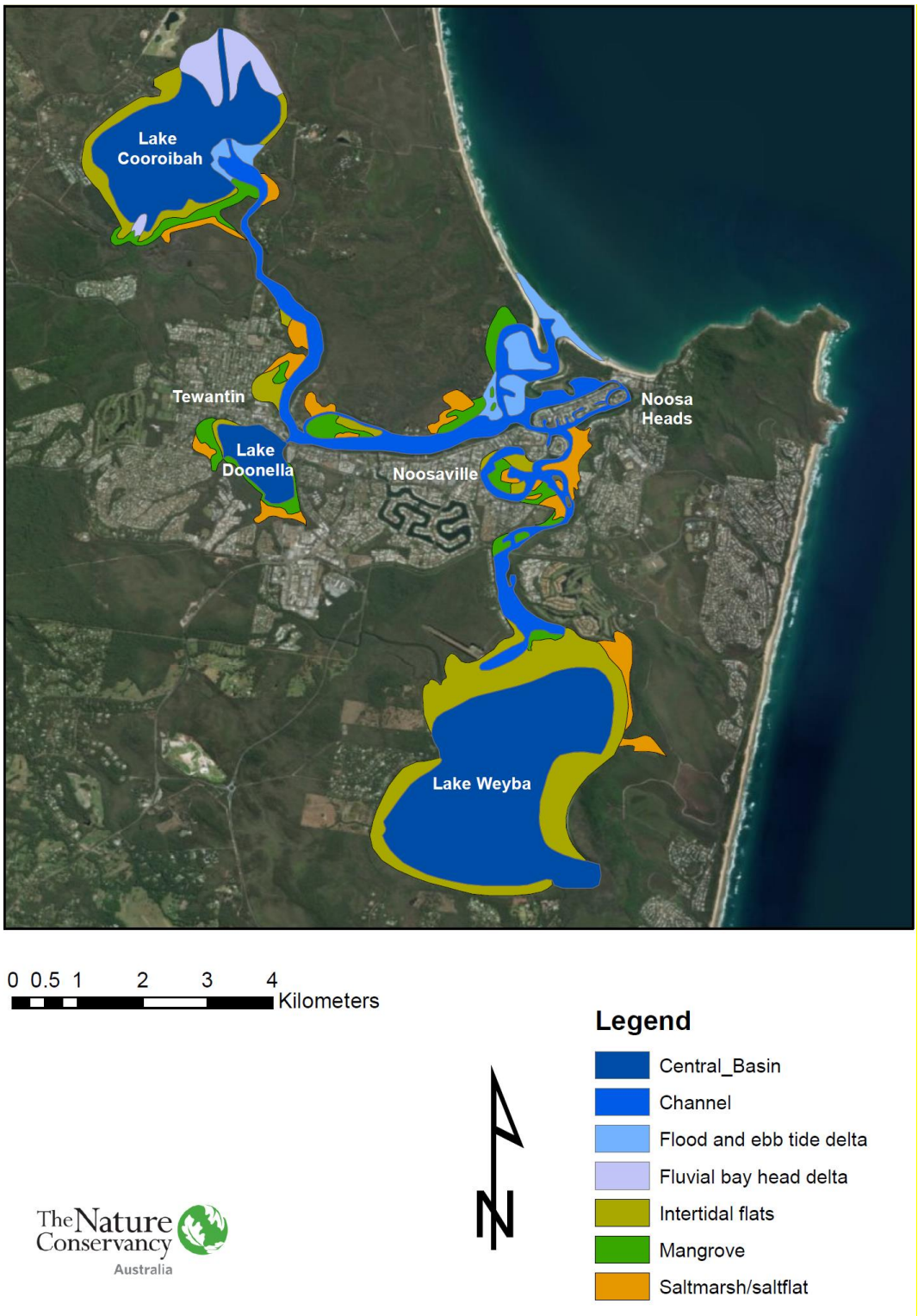

Figure 1. Geographic extent of the Project area within the Noosa River system.

2.2 Project background

Over the last four years, Noosa Shire Council (NSC) and The Nature Conservancy (TNC) have worked together to build a deeper understanding of the environmental significance and long-term sustainable management options for the Noosa River. This has included:

Noosa River Expert Workshop, Powerhouse Museum, 2014
A two day workshop, hosted by TNC on behalf of The Thomas Foundation and Noosa Parks Association, comprising 12 academic and NGO estuary scientists. The workshop identified 14 conservation activities that could lead to a healthier Noosa River, with shellfish ecosystem restoration listed as a priority action in addition to prawn restocking and Kin Kin sediment management. These activities (including further scoping studies) were later jointly funded by NSC, Noosa Parks Association, The Thomas Foundation and the Noosa Biosphere Reserve Foundation.

TNC Oyster Restoration Scoping Study, 2015
TNC and Ecological Service Professionals Pty on behalf of NSC and others undertook a short, five-month ecological assessment to quantify oyster densities across 11 intertidal and subtidal sites within the estuary. The study confirmed high densities of oyster recruitment particularly around Weyba Creek, the main channel around Tewantin, and in the narrow channel between Goat Island and Noosa North Shore. The project recommended installing a number of pilot reefs for further assessment.

University of Queensland Historical Ecology of the Noosa Estuary fisheries, 2015
Ruth Thurston from the University of Queensland undertook a historical ecology study on behalf of TNC and NSC in the Noosa River estuary to develop an understanding of historical fisheries productivity, including shellfish. The study confirmed shellfish ecosystems used to exist in the estuary and were commercial harvested in the early 1900s. Fish populations were also significantly larger in the past than they are today.

University of Sunshine Coast, Bring Back the Fish, 2018-2020
A three-year study which installed a series of experimental 'reef units' consisting of coir bags filled with oyster shell at 15 sites across the estuary. The project studied the structural integrity, oyster recruitment, fish and invertebrate community assemblages and human interactions with the reefs. This project collected important ecological information that will support the final design and implementation of shellfish ecosystem restoration in this Project.

NSC and TNC in addition to other organizations with an interest in the River's sustainability (including Noosa Parks Association, The Thomas Foundation and Noosa Biosphere Reserve Foundation), through a series of dialogue and presentations to Noosa Shire Council, have recognized the strategic priorities of both organizations and of others would be more effectively served through a formal partnership, rather than on an individual project basis. This agreement led to the development of *this* Project which is the main delivery mechanism of the TNC-NSC Partnership.

2.3 Project objectives and deliverables

The Project has a number of objectives and deliverables, each managed as separate sub-projects (Table 1) and described in further detail in the following chapters. Deliverables marked with (*) in Table 1 are at the discretion of NSC (i.e. if required). Further dialogue between TNC and NSC since July 25th 2019, has resulted in the prioritization and emphasis on delivering the following conservation initiatives:

1. Restoration of Noosa's shellfish ecosystems (Objectives two and four)
2. Engage the Noosa community and local businesses in meaningful volunteering and marine education opportunities (Objective three)
3. Exploration of the potential to restore seagrass habitats in Lake Cooroibah (and potentially elsewhere) to reduce sediment resuspension and increase invertebrate and fish biomass in the estuary (to be delivered as part of Objective two and five)
4. Provide technical advice to NSC in identifying opportunities for sustainable commercial and recreational fisheries in the Noosa River (to be delivered as part of Objective five)

These conservation priorities will be delivered within the framework outlined in Table 1 and project budget (Chapter 9) with further details provided in the following chapters.

Table 1. Project goal, objectives and deliverables.

Project Goal	**To improve the environmental health of the Noosa River Estuary through active restoration and conservation activities that engage the Noosa Community in meaningful conservation and support economic and community wellbeing.**			
Objectives	Deliverables	Expected completion date (from 1 July 2019 unless otherwise stated)	Measurable outcomes	Party responsible for Deliverable
A-1 Project establishment and management **Establish effective project governance, management, communication and reporting sufficient to successfully implement shellfish restoration project**	(A1.1) A Technical Advisory Group (TAG) is established to provide project oversight. This will include a clear terms of reference and consist of representatives from key stakeholders (NSC, TNC, Kabi Kabi and at least two other independent parties).	3 months from appointment of Project Manager	Terms of reference for the TAG developed, TAG is established and at least one meeting held. Evidence of Kabi Kabi involvement.	TNC TNC
	(A1.2) Appointment of dedicated project manager who is a marine biologist with extensive project management experience, for the term of the Agreement.	6 months	Appointment of Project Manager to oversee the Project.	TNC
	(A1.3) A Project Implementation Plan detailing at a minimum: A detailed risk assessment associated with the project. A communications and media plan, outlining media protocols, opportunities and the role of TNC and NSC. A monitoring, evaluation and reporting plan which identified ecological and social monitoring programs, how they will be reported on and how this will fed back into the project.	6 months	A Project Implementation Plan produced by TNC, endorsed by Technical Advisory Group, and delivered by TNC to Noosa Council for presentation and approval by Noosa Council its approval. A Project Implementation Plan presented to Noosa Council by TNC in conjunction with Council officers for its approval, and (if acceptable) approved in writing by Noosa Council by no later than two months after delivery.	TNC TNC & NSC
	(A1.4) Participate in public forums to provide the Noosa community	Ongoing for the duration of the project	Participate in at least three public presentations/forums in the first 12 months (ideally within first 9	TNC

Project Goal	To improve the environmental health of the Noosa River Estuary through active restoration and conservation activities that engage the Noosa Community in meaningful conservation and support economic and community wellbeing.			
Objectives	Deliverables	Expected completion date (from 1 July 2019 unless otherwise stated)	Measurable outcomes	Party responsible for Deliverable
	opportunities to learn about the project and TNC.		months) with the purpose to provide the Noosa community opportunities to learn about the project and TNC. Participate in at least six public presentations/forums in years 2 and 3, with the purpose to provide the Noosa community opportunities to learn about the implementation and outcomes of the project. A minimum three media statements throughout duration of project	TNC TNC & Noosa Council
	(A1.5) Annual project reports and final report each of which address, at a minimum: Activities undertaken during the subject financial year, status and progress against deliverables, budget progress, income and expenditure, report against monitoring and evaluation program and measurable outcomes and outline of proposed upcoming works/activities for future period.	For each annual project report - Yearly For the final report – 30th September 2022	An annual project report (and, when applicable, final report) is prepared and produced by TNC, endorsed by Technical Advisory Group, and delivered by TNC to Noosa Council, within 60 days of the end of each financial year during the term of the Agreement. The annual report (and, when applicable, final report) in Measurable Outcome 9 is presented to Noosa Council by TNC in conjunction with Noosa Council officers for its approval for endorsement within 90 days of the end of each financial year during the term of the Agreement,	TNC TNC & NSC

Project Goal	To improve the environmental health of the Noosa River Estuary through active restoration and conservation activities that engage the Noosa Community in meaningful conservation and support economic and community wellbeing.			
Objectives	Deliverables	Expected completion date (from 1 July 2019 unless otherwise stated)	Measurable outcomes	Party responsible for Deliverable
			and (if acceptable) approved by Noosa Council.	
	(A1.6) 6 monthly status and progress reports which address, at a minimum: Progress against deliverables and monitoring and evaluation report. 6 monthly financial statements including a statement of Project income/funding and expenditure	6 monthly	6 monthly status and progress reports, and financial statement, are produced, endorsed by the Technical Advisory Group, and provided to NSC, within 30 days of end of each six (6) month period. Reports and financial statements due at the end of the financial year may be included with annual reports and the final report.	TNC
A-2: Site selection **Identify suitable restoration sites for Phase II and Phase III and appropriate shellfish substrate design and configurations that minimize estuary-user conflict whilst optimizing rehabilitation**	(A2.1) Shellfish restoration suitability model incorporating physical parameters of oysters and public and industry usage, access etc. to identify priority sites for restoration.	12 months	Restoration suitability model which incorporates industry, Kabi Kabi knowledge and public interests.	TNC
	(A2.2) Obtain necessary State government permits/authorities including particular resource allocation authority, for shellfish ecosystem restoration Obtain necessary local government permits/approvals including in particular fisheries development approval for oyster ecosystem restoration	18 months	Outcomes: (a) Obtain all required State government permits/authorities for oyster ecosystem restoration. (b) Obtain all required Local government permits/approvals for oyster ecosystem restoration are obtained.	13(a) - TNC 13(b) – NSC
	(A2.3) Community, industry and stakeholder consultation sufficient to gain majority support for oyster ecosystem restoration locations.	18 months	Records of public and stakeholder consultation, including one-on-one meetings, open forums, media, etc.	TNC

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Objectives	Deliverables	Expected completion date (from 1 July 2019 unless otherwise stated)	Measurable outcomes	Party responsible for Deliverable
A-3 Community engagement **Strengthen community interest, support and participation in Noosa River restoration by establishing a community volunteering program to support oyster restoration**	(A3.1) Community, industry and stakeholder consultation to identify most appropriate community volunteering opportunities (e.g. shell recycling, oyster gardens, oyster watch, video monitoring).	18 months	Records of public and stakeholder consultation, including one-on-one meetings, open forums, media, etc.	TNC & Noosa Council
	(A3.2) Establish at least one community volunteering program identified from the above process which takes into account current and future resources, management and interest.	18 months	Record of volunteer hours dedicated to community volunteering programs, such as: shell recycling, oyster gardens, oyster watch, video monitoring.	TNC & NSC
A-4 Oyster ecosystem restoration **Restore oyster ecosystems across the lower estuary**	(A4.1) Restoration at two sites (approx. 40m-50m shore length per site) which tests oyster substrate design, configuration and deployment methods and oyster growth and survival.	24 months	At least two (2) sites with at least overall 80m shore length of oyster ecosystem restored and being actively monitored.	TNC
	(A4.2) Restoration across multiple sites, as determined by restoration suitability modelling and outcomes of community consultation.	36 months	In addition to the two pilot sites, a number of sites comprising a minimum of a further aggregated 600m^2 surface area of restored oyster ecosystems in the Noosa River estuary.	TNC
	(A4.3) Monitoring and evaluation study for both pilot and full restoration sites. Monitoring to include oyster metrics, invertebrates and fish use (detailed in MER plan).	Ongoing for duration of project, at least 6 monthly	Annual monitoring and evaluation report card with 6 monthly status reports to be provided.	TNC
A-5 Noosa River Plan	(A5.1) Run workshop with NSC to identify ongoing focus areas for TNC support.	9 months	Workshop completed.	TNC & NSC

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Objectives	Deliverables	Expected completion date (from 1 July 2019 unless otherwise stated)	Measurable outcomes	Party responsible for Deliverable
Provide technical and expert support to Noosa for planning, implementation and evaluation associated with appropriate elements of the Noosa River Plan and other coastal and marine management plans	*(A5.2) Provide technical/peer review on minimum five plans/reports/studies if requested by Noosa Council.	Ongoing for duration of project	Minimum 5 peer review reports completed during the three year term of this Agreement, if requested by NSC. If NSC requests a peer review, TNC will provide a minimum of 3 experts who are qualified in the relevant area of expertise for NSC consideration and Noosa Council's acceptance of one expert for the peer review.	TNC
	*(A5.3) Facilitate a minimum of three study tours of relevant sites in line with objectives and scope of the program in Australia/US if requested by Noosa Council (flights and incidentals covered separately by Noosa Council, accommodation and in-country travel covered by this Grant).	36 months	Minimum three individuals on study tours completed during the three year term of this Agreement, if requested by Noosa Council.	TNC & NSC
	*(A5.4) Develop a Conservation Action Plan for specific issues (not yet determined) relevant to the Noosa Estuary (including community workshops) if requested by Noosa Council.[1]	36 months	Conservation Action Plan and Community Workshops completed as required.	TNC & NSC
	*(A5.5) Facilitate access to TNC conservation networks and researchers if requested by Noosa Council.	Ongoing for duration of project	A number of new contacts/networks to assist Noosa Council with ongoing and future marine conservation activities.	TNC

[1] Note, deliverable changed to Coda Fellowship on commercial fishing (see Chapter 7). An additional deliverable for seagrass restoration (A5.8) has also been added (see Chapter 7).

Project Goal	To improve the environmental health of the Noosa River Estuary through active restoration and conservation activities that engage the Noosa Community in meaningful conservation and support economic and community wellbeing.			
Objectives	Deliverables	Expected completion date (from 1 July 2019 unless otherwise stated)	Measurable outcomes	Party responsible for Deliverable
	(A5.6) Promote Noosa Council's Noosa River Plan and shellfish restoration project in at least one national and one international conference.	36 months	Presentation to at least one national and one international conference.	TNC & NSC
	(A5.7) Promote Noosa Council's Noosa River Plan and shellfish restoration project to corporate, philanthropic and state/federal government audiences to establish further support for conservation activities that support the Noosa River Plan.	Ongoing for duration of project	A number of new corporate/ government/ philanthropic alliances and new in-kind support/financial funding contributions.	TNC & NSC

2.4 Project stakeholders, roles and responsibilities and team structure

Project stakeholders

The innovative and applied nature of the TNC-NSC partnership and genesis of the Bring Back the Fish project has resulted in significant government, community, private sector and academic interest. The below list of project stakeholders is not exhaustive and will be updated regularly throughout the project:

Government and Community

- Noosa Shire Council – Project Supporter, Technical Advisor
- Tourism Noosa - Technical Advisor, Community Partner
- Queensland Government Department of Agriculture & Fisheries – Regulator, Technical Advisor
- Maritime Safety Queensland – Regulator, Technical Advisor
- Queensland Government Department of Environment & Science – Regulator, Technical Advisor
- Queensland Government Department of Natural Resources, Mines and Energy – Regulator, Technical Advisor Community
- Kabi Kabi – Traditional Owner, Technical and Cultural Advisor
- The Thomas Foundation – Project Supporter
- Australian Marine Conservation Society – Project Supporter
- Noosa Parks Association – Community Partner

- Noosa Biosphere Reserve Foundation – Community Partner
- Sunfish and Ozfish Unlimited – Community Partner
- Noosa Integrated Catchment Association (NICA) - Community Partner
- Noosa North Shore Association Inc. – Community Partner
- Local residents - Community Partner

Private sector

- Unitywater – (potential) Project Supporter
- Suez – (potential) Project Supporter
- Ecological Service Professionals – Technical Advisor, (potential) Project Delivery Partner
- Queensland Seafood Industry Association and local commercial fishers – Technical Advisors, Community Partner
- Restaurants, seafood wholesalers (various) – Community Partner
- Local businesses associated with the Noosa River (e.g. boat hire, fishing tackle shops, tourism) – Community Partner
- Shellfish growers/aquaculture industry – Project Partner
- Commercial maritime, construction and diving businesses – Project Partner

Academic

- University of Sunshine Coast - Technical Advisor, (potential) Project Partner
- University of Queensland - Technical Advisor, (potential) Project Partner
- Central Queensland University - Technical Advisor, (potential) Project Partner
- James Cook University/Tropwater - Technical Advisor, (potential) Project Partner

Roles and responsibilities

The Nature Conservancy (TNC) is the Project Lead and is accountable for all deliverables, engaging and managing subcontractors and working with community delivery partners. In collaboration with NSC and the Noosa community, TNC will also undertake project monitoring, evaluation and reporting and lead or support community education, volunteering and communications.

Noosa Shire Council (NSC) will provide planning, consultation and implementation functions associated with the Project to ensure it can be effectively embedded within local government policy and management for the benefit of Noosa residents, businesses and visitors. This includes NSC contributing to communications and public engagement, as well as the monitoring, evaluation and reporting.

Kabi Kabi are recognized as traditional owners of the Noosa region and will be engaged at key stages of the project to provide advice on how best to incorporate Indigenous needs, knowledge and culture into the planning and long-term management of oyster ecosystems and other project outcomes.

The purpose of this Technical Advisory Group (TAG) is to:

- Support detailed project planning for the *Noosa Oyster Restoration Project* that will see oyster ecosystems re-established in the Noosa River estuary by June 2022.
- Provide ongoing expert advice on the implementation of the Project Plan, and support in overcoming legislative, scientific and practical barriers that occur during the term of the project.
- Ensure that the Project meets all technical, statutory and policy requirements in a timely manner to the satisfaction of relevant decision-making authorities.

- Ensure actions within the Project Plan are effectively delivered and communicated to all stakeholders.

Project Supporters provide financial and in-kind support for the project and may be involved in further fundraising activities.

Community Delivery Partners provide in kind support and may be responsible for leading or participating in community-based activities such as volunteering and citizen science.

Project Delivery Partners may be responsible for delivering and leading project activities as third party vendors.

Technical Advisors provide in kind and potentially paid technical support to the project usually but not limited to science and research.

3. Objective One: Project establishment and management

3.1 Purpose and deliverables

The purpose of Objective 1 is to establish good project governance through efficient project oversight and management, adherence to procurement procedures, adequate staffing and good reporting. Deliverables include:

1. A1.1 Hiring of full time Project Manager and allocation of TNC and NSC support staff to the project
2. A1.2 Delivery of Project Plan (this Plan), communication plan, and risk assessment(s)
3. A1.3 Establishment of a Project Technical Advisory Group (TAG) for oyster ecosystems restoration and associated science/research activities
4. A1.4 Participation and delivery of public education and engagement forums and media statements
5. A1.5 Annual and six-monthly project reporting

This objective will be led by the Project Manager with support from project advisors (Figure 2), overseen by the TNC Operations Manager and NSC Environmental Services Manager. TNC uses a standard project management framework called Highly Effective Teams and various project management tools and training to support project staff to deliver projects on time and within budget, and manage unplanned situations as they arise. The Project will follow the principles of Adaptive Management (Figure 3) which is intimately connected to the monitoring and evaluation process and annual review cycles (i.e. Deliverable's A1.2 and A1.5).

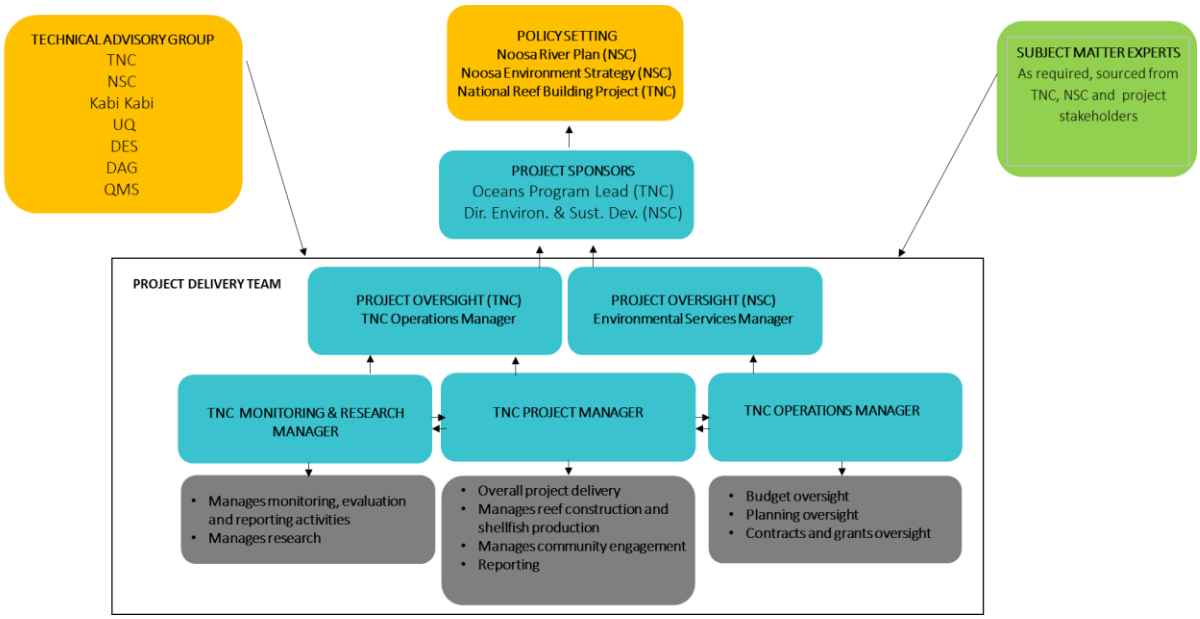

Figure 2. Project Delivery Team, including Project Sponsors, Technical Advisory Group and Subject Matter Experts.

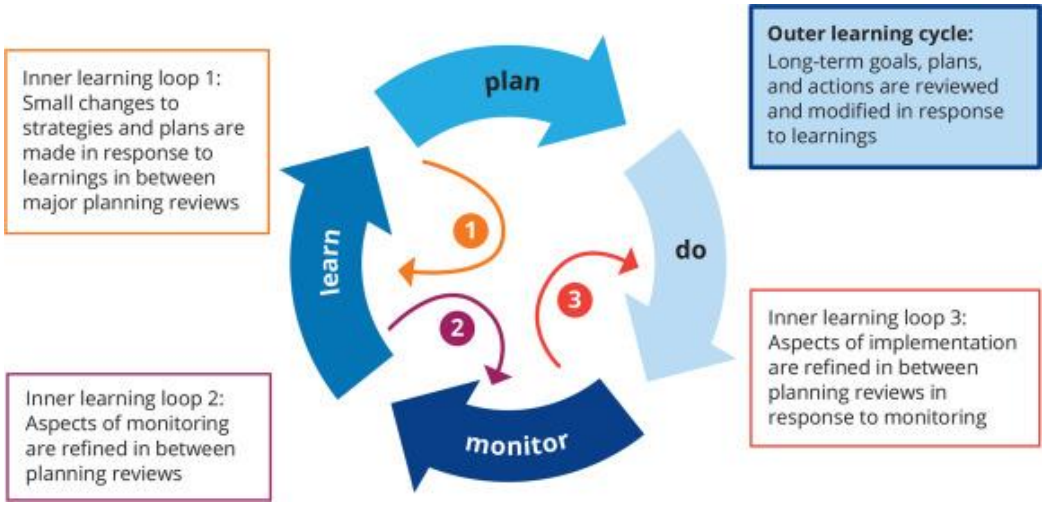

Figure 3. The adaptive management cycle showing the outer learning cycle where lessons inform the next formal phase of planning and implementation. The inner learning loops are small changes that are made based on learnings that occur between major planning reviews. The inner loops effectively allow progress in the outer loop in both directions. Reproduced from Webb et al. 2017[2].

3.2 Code of conduct and procurement principles

TNC is committed and takes seriously its core Values and Code of Conduct and requires all staff and contractors to live by these Values. They are:

- Integrity Beyond Reproach
- Respect for People, Communities, and Cultures
- Commitment to Diversity
- One Conservancy
- Tangible, Lasting Results

Further information on how our Values and Code of Conduct are executed by staff and supporters can be found on TNC's website: https://www.nature.org/en-us/about-us/who-we-are/accountability/code-of-conduct/

All contracts executed with subcontractors as part of the implementation of this Project, will require adherence to TNC's Standard Operating Procedures on *Purchasing*, *Conflict of Interest* and *Anti-Corruption Compliance* which describe in detail TNC's policies on ethical procurement. These detailed documents are available on request from

[2] Webb, J.A., Watts, R.J., Allan, C. and Warner, A.T., 2017. Principles for monitoring, evaluation, and adaptive management of environmental water regimes. In *Water for the Environment* (pp. 599-623). Academic Press.

TNC. TNC also recognize NSC's procurement principles[3] which identify similar values to TNC's Standard Operating Procedures. These are:

- Value for money
- Open and effective competition
- Development of competitive local business and industry
- Environmental protection
- Ethical behaviour and fair dealing

All third party contracts are reviewed by TNC's legal counsel and senior management in adherence to TNC's Values, Code of Conduct and Standard Operating Procedures. Approval is determined by senior management with delegation of authority from the CEO.

3.3 Project workflow

A1.1 Hiring of full time Project Manager and allocation of TNC and NSC support staff to the project:

Timeline: Within 6 months

- TNC-NSC agree project manager position functions and attributes
- TNC-NSC agree on project team structure (Figure 2)
- TNC develops project manager position description, advertises role and undertakes recruitment
- TNC-NSC onboarding for new project manager and support staff

A1.2 Delivery of Project Plan (this document), Communication Plan, and Risk assessment(s):

Timeline: Within 6 months

- TNC Draft Project Plan (this document), Communications Plan (Appendix 1) and shellfish restoration Monitoring, Evaluation and Reporting template (Appendix 2) and associated risk assessments (provided within each document) developed by project staff
- TNC to undertake in-field and desktop shellfish restoration risk assessment
- All documentation approved by NSC and Technical Advisory Group (within 9 months) (restoration-related work only)
- Documentation reviewed annually as part of Deliverable A1.5

Document titles and owners associated with this project are:

Table 2. Documents and reports associated with this project.

Document name	Owner	Status
Alliance Funding Agreement TNC-NSC	TNC- NSC	Signed 25/7/19
Project Management Plan (this document)	TNC	*Living document*
Project Communications Plan	TNC	Draft (Appendix 1)
Project Monitoring Evaluation and Reporting Plan	TNC	Draft (Appendix 2)

[3] https://www.noosa.qld.gov.au/council-procures-goods-services/suppliers-contractors-portal?documentId=203&categoryId=411

Annual/Final progress reports (2020,2021,2022)	TNC	Not Started
Six monthly report cards (2020,2021,2022)	TNC	Submitted

A1.3 Establishment of a Project Technical Advisory Group (TAG) for shellfish ecosystems restoration and associated activities:

Timeline: 3 months from appointment of Project Manager

- Terms of reference drafted, including meeting timeframes, rolling agenda items, roles and responsibilities
- Committee members nominated as representatives
- Committee members invited/confirmed as representatives
- Regular meetings chaired by TNC Project Manager

A1.4 Participation and delivery of public education and engagement forums (9) and media statements (3)

Timeline: Three forums within first 12 months. Additional 6 forums in years 2 and 3.

- Forums and key audiences identified, feedback forms/surveys developed
- Key messages, presentations and external documents (i.e. project brochures) developed
- Forums delivered
- Media statements drafted by TNC, approved by NSC
- Media statements jointly released, media monitoring engaged

A1.5 Annual and six-monthly project reporting

Reports must include details on progress made against deliverables, monitoring and evaluation and financial expenditure (income/expenditure).

Timeline: Ongoing over 3 years

- Reporting templates, developed and agreed (template attached as Annex 3)
- Draft reports sent to NSC (and where appropriate, Technical Advisory Group) four weeks prior to final completion date
- Final report revised and completed

Reporting Milestones

Table 3. Reporting dates and milestones over the three year project period.

Report Type	Draft Due	Final Due
Year 1 Annual Report 2020	31st July 2020	31st August 2020
Six Monthly Status Report 2021	31st December 2021	31st January 2021
Year 2 Annual Report 2021	31st July 2021	31st August 2021
Six monthly Status Report 2022	31st December 2021	31st January 2022
Final Report 2023	31st July 2022	31st August 2022

3.4 Deliverables checklist

Table 4. Deliverable checklist for Objective 1 (to be completed in six monthly, annual and final reports).

Deliverables	Measurable outcomes	Status and notes (*Not Started/In Progress/Delayed/Completed*)
A1.1 Hiring of full-time Project Manager and allocation of TNC and NSC support staff to the project	• PM in place	
A1.2 Delivery of Project Plan (this Plan), communication plan, and risk assessment(s)	• Project Plan completed and endorsed • Comms Plan completed and endorsed • Monitoring and Evaluation Plan completed and endorsed	
A1.3 Establishment of a Project Technical Advisory Group for shellfish ecosystem restoration and associated activities	• TAG in place • Evidence of Kabi Kabi engagement	
A1.4 Participation and delivery of public education and engagement forums and media statements	• 9 community engagement forums • 3 media statements released	
A1.5 Annual and six-monthly project reporting	• 3 six monthly status updates • 3 annual reports	

4. Objective Two: Site Selection

4.1 Purpose and deliverables

The purpose of this objective is to identify suitable areas for shellfish and potentially seagrass restoration in the Noosa Estuary. The end goal is to spatially identify all areas where restoration is possible (maximum restorable bottom) by considering ecological, social, cultural and regulatory input. Multiple data sets are used and overlaid on a bathymetric map to create a habitat suitability index. This data is then cross-referenced with observations from the field to develop a robust assessment of suitable suites. Using the habitat suitability index, priority areas can then be identified for restoration. By considering a diverse range of data (e.g. salinity, temperature, shoreline, navigation, cultural sites) the risk of siting restoration within ecological, social or culturally inappropriate locations is reduced.

The deliverables associated with this objective include:

- (A2.1) Shellfish ecosystem restoration suitability model incorporating physical parameters of oysters and public and industry usage, access etc. to identify priority sites for restoration.
- (A2.2) Obtain Local and State Government permits/authorities including particular resource allocation authority, for shellfish ecosystem restoration
- (A2.3) Community, industry and stakeholder consultation sufficient to gain majority support for shellfish restoration locations.

4.2 Data procurement and licensing

Where required, TNC will enter into data sharing agreements with third party data holders to obtain access to ecological and physical data required for project planning and decision making. Ecological data collected as part of this project (i.e. all data associated with Monitoring, Evaluation and Reporting) will be freely available by TNC on request and licensed under Creative Commons with attribution to TNC. All ecological data associated with shellfish monitoring is stored in perpetuity and freely available on Atlas of Living Australia upon completion of the Project.

4.3 Project workflow

(A2.1) Shellfish restoration suitability model incorporating physical parameters of oysters and public and industry usage, access etc. to identify priority sites for restoration.

Timeline: 12 months

TNC uses a standardized methodology for developing habitat suitably models that consists of identifying a suite of ecological, social and cultural values and condition thresholds for each of these values. An initial list of habitat attributes is developed (Table 4) which is then refined through discussions with the Technical Advisory Group, project technical advisors and the community. The model is then validated with observations from the field. A preliminary field observation was completed in December 2019 to assist with site selection.

A spatial example of the process is displayed in Figure 4.

Table 5. Example list of ecological restoration suitably attributes that underpin the restoration suitability model. The list of attributes will be refined and expanded to include cultural and social values.

PARAMETER	ENVELOPE	CRITERIA (more suitable = 4, less = 0)
Bathymetry	0-9 m	2-9m = 4; 0-2m = 3; >9m=0
Salinity Av	25-35ppt	35-30=4; 30-25=3; <25=0
Temperature Max	8-29C	8-24C= 4; 24-28 = 2; >28=0
DO Min	>4mg/L	>4mg/L = 4; <4mg/L= 0
Substrate	sand/soft sediment	Sand/soft sediment = 4; all other areas =0
Seagrass avoidance	+ 5m buffer from areas >20% coverage	Areas outside = 4; Known patches = 0
Seagrass proximity	5m - 500m	Areas within 5-500m buffer =4; all other areas =2
Rocky reef proximity	5m - 500m	Areas within 5-500m buffer =4; all other areas =2
Shipping channel avoidance -small craft channels	+ 50m buffer	Areas within buffer = 0; all other areas =4
Shipping channel avoidance- large craft channels	+ 250m buffer	Areas within buffer = 0; all other areas =4
Recreation/ski/watercraft zones avoidance	+ 250m buffer	Areas within buffer = 0; all other areas =4
Aquaculture zones avoidance	+ 500m buffer	Areas within buffer = 0; all other areas =4
Commercial fishing zones avoidance	+ 250m buffer	Areas within buffer = 0; all other areas =4
MPAs	+ 500m buffer	Areas within buffer = 0; all other areas =4
Culturally sensitive areas avoidance	+ 250m buffer	Areas within buffer = 0; all other areas =4
Historical reefs proximity	Within 250 m	Within 250m = 4; all other areas = 2
Remnant reefs/known areas of high density of oyster proximity	Within 250 m	Within 250m = 4; all other areas = 2
Distance from shore	Within 2 km	All areas within 2 km =4, clip out all other areas

- Develop draft list of habitat suitability model attributes
- Refine these with TAG, Project Expert Advisors and community
- Identify appropriate data sets and enter data licensing agreements (if required)
- Conduct data analysis using GIS software
- Produce draft and review preliminary findings
- Adjust criteria thresholds based on field observations, community input
- Produce final suitability maps and select sites

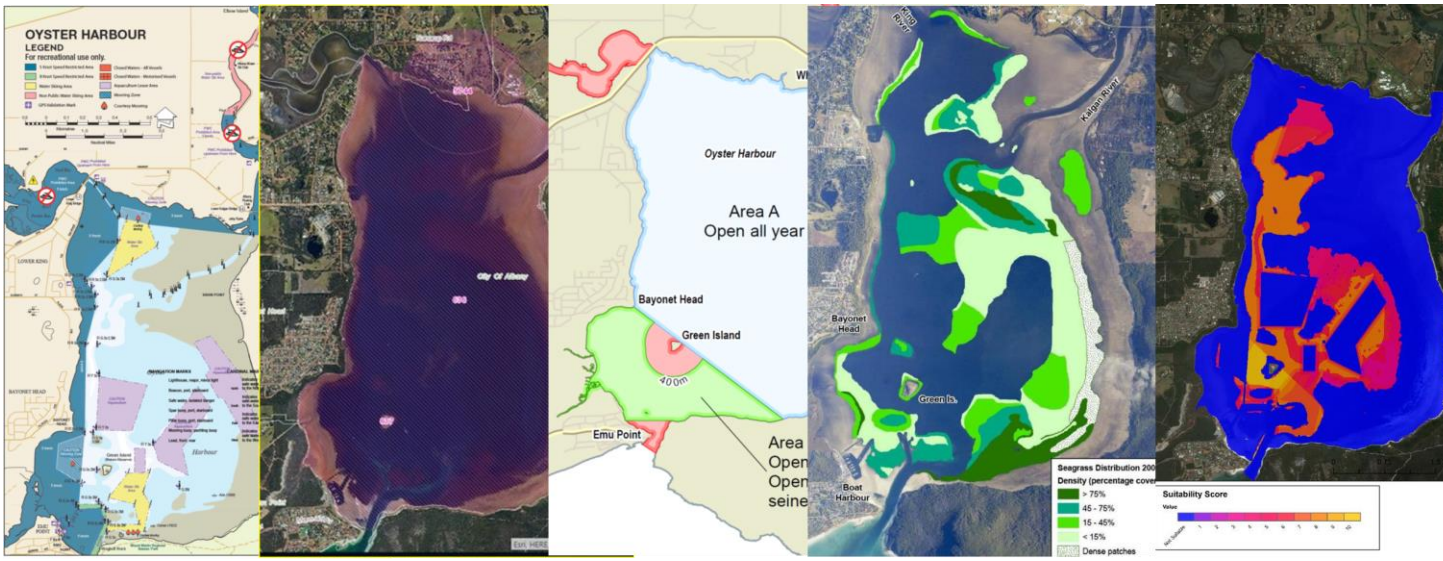

Figure 4. Example of different data layers that support development of a habitat suitability index. (Left to right: Boating navigation, Indigenous culture, commercial fishing zones, seagrass distribution, Habitat Suitability Index. Example provided for Oyster Harbour, WA).

(A2.2) Obtain necessary State Government permits/authorities including particular resource allocation authority, for shellfish ecosystem restoration

Timeline: 18 Months

TNC recognizes permitting can be a long and sometimes arduous task. The process of permitting includes not just the physical application but regular open dialogue and feedback between the permitting agencies and project proponents. This includes engagement in the TAG, departmental briefings, invitations to workshops and community forums and one-one meetings. This allows regulators to have a more complete understanding of the project objectives and processes in order to effectively apply policy and permits. Key activities include:

- Identify all necessary legislation and permits required to undertake shellfish restoration
- Engage with relevant government departments, provide briefings, meetings, one-one meetings as required
- Confirm site locations, restoration design, risk assessments and mitigation procedures
- Apply for relevant permits
- Negotiate conditions as needed

The likely relevant permits required for restoration are:

- ❖ Beneficial Reuse Permit - Queensland Government Department of Environment and Heritage
- ❖ Resource Allocation Authority - Department of Agriculture and Fisheries
- ❖ Development application for Prescribed Tidal Works – Noosa Council

This list of permits will be reviewed once the site locations and restoration designs are finalized.

(A2.3) Community, industry and stakeholder consultation sufficient to gain majority support for shellfish ecosystem restoration locations.

Timeline: 18 months

As part of Objective A1.4, TNC will engage with the community and stakeholders through the TAG, organized community forums, media and one-one meetings. The process involves socializing both the method and end result of site selection and allowing the community and stakeholders to have sufficient input into the site selection process in order to minimize the number of individuals and groups opposed to the location. Regular input and feedback will reduce the risk of stakeholders objecting to sites.

Table 6. Deliverable checklist for Objective 2 (to be completed in six monthly, annual and final reports).

Deliverables	Measurable outcomes	Status and notes (*Not Started/In Progress/Delayed/Completed*)
(A2.1) Shellfish restoration suitability model incorporating physical parameters of oysters and public and industry usage, access etc. to identify priority sites for restoration.	• Habitat suitability model which incorporates industry, Kabi Kabi and public interests.	
(A2.2) Obtain necessary State Government permits/authorities including particular resource allocation authority, for shellfish ecosystem restoration	• All relevant permits secured	
(A2.3) Community, industry and stakeholder consultation sufficient to gain majority support for ecosystem restoration locations.	• Records of public and stakeholder consultation, including one-on-one meetings, open forums, media, etc.	

5. Objective Three: Community engagement

5.1 Purpose and deliverables

The purpose of this objective is to strengthen community interest, support and participation in local conservation activities by establishing a community volunteering program to support shellfish ecosystem restoration. Community volunteering and support can occur at all stages of the restoration process including initial design and concept, planning, site surveys, material procurement and cleaning, construction and monitoring. This objective will identify activities that match the skills and enthusiasm of community volunteers with the needs of the project.

During early discussions between TNC and NSC, the feasibility of a shell recycling program to assist with the procurement of shells was determined as a high priority. A feasibility study has since been conducted to determine if shell recycling is possible within the local Noosa area. The results of the study suggest that a small recycling program could be viable in Noosa.

Other activities that are possible and will be explored during community workshops include:

- Participatory/community planning
- Shell recycling
- Shell cleaning and bagging
- Video monitoring (e.g. Remote Underwater Videos)
- Oyster, invertebrate and fish monitoring
- Oyster gardening (oyster growth study)
- Oyster watch (oyster recruitment study)

These activities can be undertaken and led by a range of groups such as schools, restaurants, corporates, environmental groups, fishing clubs, 'friends of' groups and NSC.

5.2 Project workflow

(A3.1) Community, industry and stakeholder consultation to identify most appropriate community volunteering opportunities (e.g. shell recycling, oyster gardens, oyster watch, video monitoring).

Timeline: 18 months

- Identify likely participatory and lead groups and organizations (e.g. Noosa Parks Association, high schools, restaurants)
- Establish workshop and present options
- Identify lead organizations and volunteer projects, scope resources required

(A3.2) Establish at least one community volunteering program identified from the above process which takes into account current and future resources, management and community interest.

Timeline: 18 months

- Establish delivery model, budget and project plan

- Provide resource support as required
- For shell recycling, follow TNC standard process for *Shuck don't Chuck*

Table 7. Deliverable checklist for Objective 3 (to be completed in six monthly, annual and final reports).

Deliverables	Measurable outcomes	Status and notes (*Not Started/In Progress/Delayed/Completed*)
(A3.1) Community, industry and stakeholder consultation to identify most appropriate community volunteering opportunities (e.g. shell recycling, oyster gardens, oyster watch, video monitoring).	• Records of public and stakeholder consultation, including one-on-one meetings, open forums, media, etc.	
(A3.2) Establish at least one community volunteering program identified from the above process which takes into account current and future resources, management and interest.	• Record of volunteer hours dedicated to community volunteering programs, such as: shell recycling, oyster gardens, oyster watch, video monitoring.	

6. Objective Four: Shellfish restoration

6.1 Purpose and deliverables

The purpose of this objective is to restore shellfish (native rock oyster-dominated) ecosystems in the Noosa River estuary. This objective is the primary in-water conservation outcome of the overall TNC-NSC Project. The deliverables associated with the objective are:

- (A4.1) Restoration at two sites (approx. 40m-50m shore length of substrate laid, per site) which tests substrate selection, deployment techniques, in-situ substrate configurations, system efficiencies as well as oyster growth and survival.
- (A4.2) Restoration across multiple sites, as determined by restoration suitability modelling and outcomes of community consultation.
- (A4.3) Monitoring and evaluation study for both pilot and full restoration sites. Monitoring to include oyster metrics, invertebrates and fish use (detailed in MER Plan).

A more extensive overview of the restoration process and rationale is provided below.

6.2 Background to shellfish ecosystems and rationale for restoration

Shellfish ecosystems are intertidal or subtidal three-dimensional ecosystems formed by oysters, razorfish and/or mussels at high densities[4]. Shellfish ecosystems can vary in appearance depending on the dominant ecosystem-forming species. Common attributes of shellfish ecosystems include:

- High (i.e. reefs) and low (i.e. beds) hard biogenic substrates, created by oysters and/or mussels, on otherwise soft sediment or rocky areas, which are often interspersed with sand/silt or rubble matches and/or seagrass;
- Provision of habitat and refuge for other species including sessile and mobile organisms, and thereby supporting high levels of species diversity and unique assemblages;
- Accreting dead shell material, such that the shellfish ecosystem grows in size and mass over time; and
- Provision of food for other organisms, either when consumed directly or through the species assemblages they support.

Shellfish are ecosystem engineers, providing important habitat for many species of finfish (e.g. snapper and whiting), elasmobranchs (e.g. stingrays) and invertebrates (e.g. shrimps and crabs) through their high structural complexity, including for many important recreational and commercial fishery species. Additionally, shellfish ecosystems provide water filtration, sediment stabilization and the transfer of nutrients from the water column to the surrounding community, as well as enhanced removal of potentially damaging nutrients through processes such as denitrification.

6.3 Shellfish ecosystem loss and historical significance in the Noosa Estuary

The underwater environment of the lower estuary in the Noosa River was once dominated with extensive shellfish ecosystems created primarily by the Australian rock oyster (*Saccostrea glomerata*). These ecosystems provided food and habitat for many other species including desirable fish species such as whiting, bream and snapper whilst also filtering and removing nutrients from the water column. A single oyster can filter up to 100 L of water a day. Oyster

[4] Gillies et al. 2018. Australian Shellfish Ecosystems: past distribution, current status and future management. PLoS ONE 13(2):e0190914. https://doi.org/10.1371/journal.pone.0190914

ecosystems were largely lost in the late 1800s to early 1900s. At the peak of the wild oyster harvest industry (1906-1907), it is estimated that 2-3 million oysters were harvested in the lower estuary each year[5] .

The loss of oyster biomass likely resulted in the ecosystem collapsing, with shellfish ecosystems now replaced primarily by soft (sandy and muddy) sediments. Changes to the estuary's physical-chemical condition, canal development and shoreline armoring have also likely contributed to the decline of the ecosystem or inhibited its natural recovery. Today, no substantial shellfish ecosystems exist in the Noosa River estuary, despite the presence of individual and small populations of rock oysters. The closest known intact oyster-dominated shellfish ecosystem is found near North Stradbroke Island in Morton Bay. Notably, a recent study[4] identified that the Australian rock oyster-dominated shellfish ecosystem is the most threatened marine ecosystem in Australia, with up to 94% of the ecosystem lost throughout Australia since European settlement.

6.4 Process for undertaking restoration

This Project will follow the eight principles for ecological restoration established by the international Society of Ecological Restoration (SER)[6], which have been newly interpreted for shellfish restoration[7]. The definition of ecological restoration is the process of *assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed*. The process involves moving a destroyed or degraded ecosystem along a measurable trajectory of recovery that is persistent in the future and reflective of a natural evolutionary path. Key summary steps critical to the process of restoration are:

1. The need to clearly identify and describe a target (reference) ecosystem or model for which restoration targets and metrics can be derived for the degraded ecosystem;
2. The ability to design restoration interventions based on the combination of the desired restored state (adapted from the physical structure and biological attributes of the reference ecosystem) and overcoming stressors;
3. The ability to set achievable and time-bound ecological objectives and indicators; and
4. The ability to monitor the ecosystem towards it recovery trajectory.

The process for how the project will achieve these four steps is described more fully in the Project Monitoring Evaluation and Reporting (MER) Plan and summarized in Figure 6. The MER process is guided by best-practice ecological restoration and shellfish restoration monitoring guidelines, including the Open Standards for the Practice of Conservation[8], the Society for Ecological Restoration International Standards[6] and TNC's Oyster Habitat Restoration Monitoring and Assessment Handbook[9].

In addition to ecological targets, the Project will also use the MER Plan to track progress against socio-economic and project efficiency targets.

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[5] Thurston R. 2015. Historical ecology of the Noosa Estuary fisheries. Report to: Noosa Council, The Nature Conservancy and The Thomas Foundation (available on request from TNC).

[6] Gann GD, McDonald T, Walder B, Aronson J, Nelson CR, Jonson J, Hallett JG, Eisenberg C, Guariguata MR, Liu J, Hua F, Echeverría C, Gonzales E, Shaw N, Decleer K, Dixon KW (2019) International principles and standards for the practice of ecological restoration. Second edition. Restoration Ecology 27(S1): S1–S46

[7] Fitzsimons, J., Branigan, S., Brumbaugh, R.D., McDonald, T. and zu Ermgassen, P.S.E. (eds) (2019). Restoration Guidelines for Shellfish Reefs. The Nature Conservancy, Arlington VA, USA.

[8] Conservation Measures Partnership (2013) Open Standards for the Practice of Conservation Version 3.0, accessed online via http://cmp-openstandards.org/wp-content/uploads/2014/03/CMP-OS-V3-0-Final.pdf

[9] Baggett LP, Powers SP, Brumbaugh R, Coen LD, DeAngelis B, Greene J, Hancock B and Morlock S (2014). Oyster habitat restoration monitoring and assessment handbook. The Nature Conservancy, Arlington, VA, USA. 96 pp.

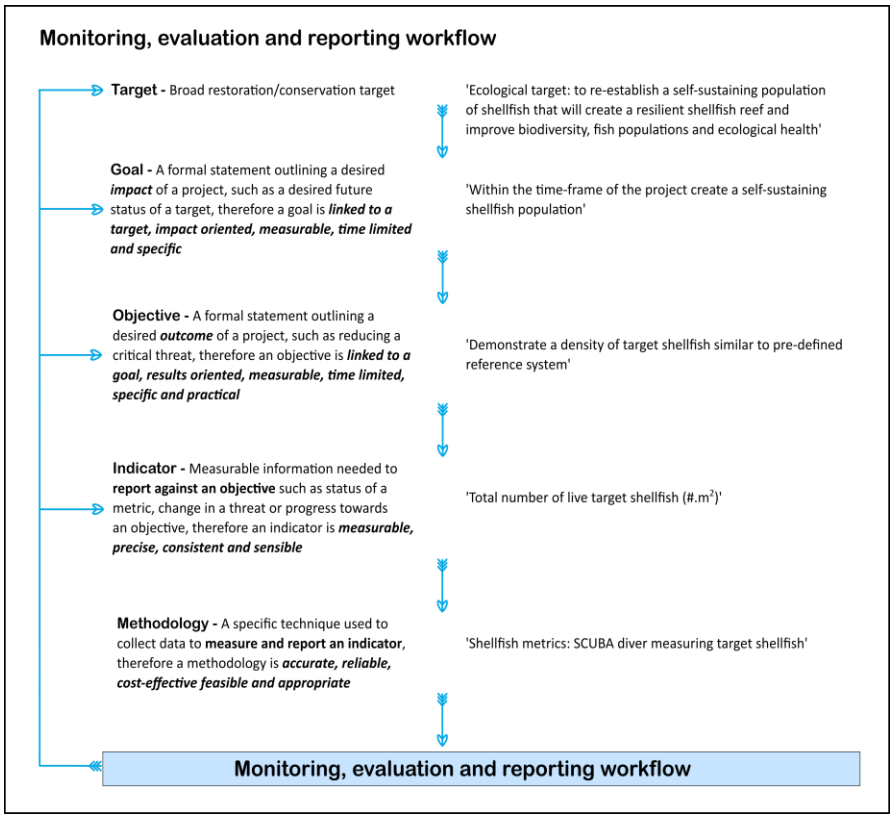

Figure 5. Framework of the monitoring, evaluation and reporting process for Noosa shellfish restoration, which follows the Open Standards for the Practice of Conservation[8]. Definitions of the Monitoring, Evaluation and Reporting level terminology are shown on the left and an example of each on the right. Project targets are considered the highest level measurable attributes, which articulate the ultimate vision of key aspects of the project. The goals, objectives and indicators that are nested under each target are Specific, Measurable, Achievable, Relevant and Time-based (SMART).

6.5 Defining the targets

The **ecological target** is to re-establish a self-sustaining population of *S. glomerata* that will create a resilient shellfish ecosystem consisting of diverse biological communities, fish populations and their interactions.

The nearest known reference rock oyster-dominated shellfish ecosystem is located in Moreton Bay, near North Stradbroke Island, approximately 150 km away. Rock oyster-dominated shellfish ecosystems have been described in McLeod *et al.* (2019)[10] which will be used as the basis to develop an ecological model of the Noosa shellfish ecosystems. Further studies describing the ecosystem (currently in review e.g. MacAfee *et al.*) and new data as part of the monitoring program will be used to identify the ecosystem attributes that will guide the process of restoration.

[10] McLeod, I.M., Boström-Einarsson, L., Creighton, C., D'Anastasi, B., Diggles, B., Dwyer, P.G., Firby, L., Le Port, A., Luongo, A., Martínez-Baena, F. and McOrrie, S., 2019. Habitat value of Sydney rock oyster (*Saccostrea glomerata*) reefs on soft sediments. Marine and Freshwater Research.

The monitoring program will use a Before-After-Control-Impact (BACI) design for community structure and function attributes as recommended by Baggett *et al.* (2014)[9]. Multiple control sites will be used to assess the relative influence of spatial variation among them compared to differences between control and impact sites, i.e. beyond BACI designs[11].

The **socio-economic target** is to create opportunities for the local community, recreational users and businesses in the Noosa Shire through shellfish ecosystem restoration.

The focus of this target will be to develop new economic and community volunteering benefits throughout the Project. By engaging project partners, stakeholders and the local community and businesses in project activities, and training (including citizen science and hands-on restoration), the project will not only provide direct economic benefits to local contractors engaged in restoration activities, but also foster ownership of the project, and help build capacity in others to undertake similar restoration projects in the future.

The **project efficiency target** is to deliver the project on time and within budget and additional funding is leveraged to support project deliverables. The partnership agreement between TNC and NSC will be used as a reference for this target.

The MER workflow associated with shellfish ecosystem restoration uses a nested approach where restoration objectives are nested within high level restoration goals which deliver the three restoration targets (described above) (Figure 7).

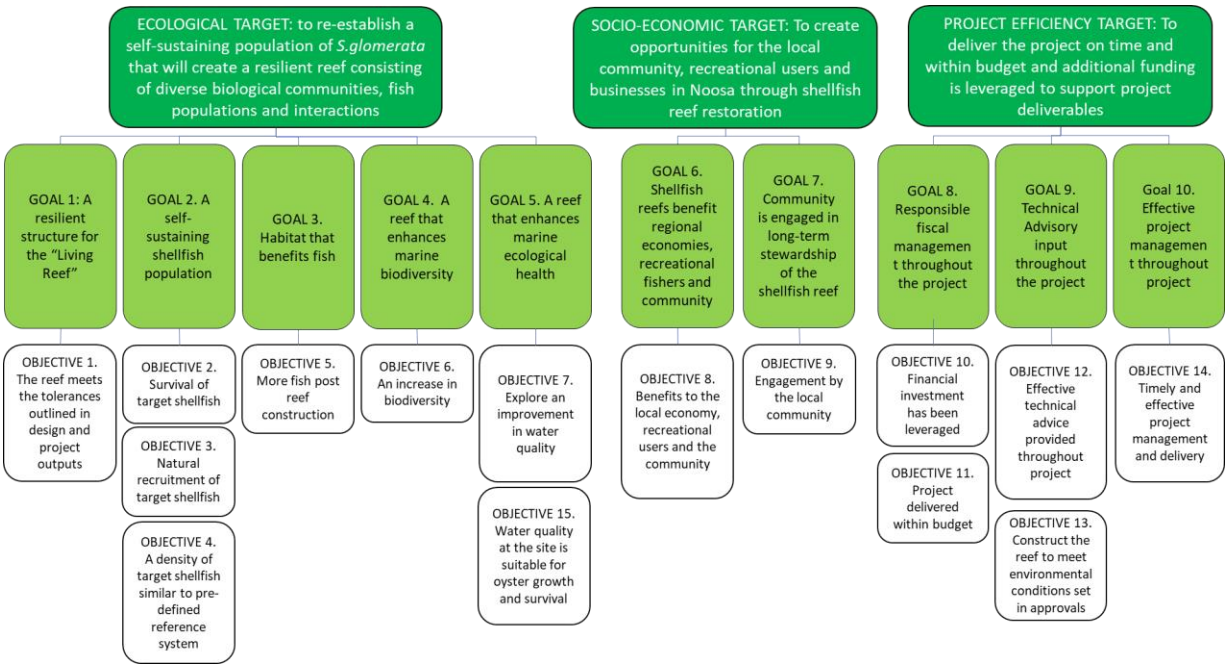

Figure 6. Summary of restoration targets, goals and objectives. Further detail is provided in the Project Monitoring Evaluation and Reporting Plan.

[11] Underwood, A.J. (1992) Beyond BACI - the detection of environmental impacts on populations in the real, but variable, world. Journal of Experimental Marine Biology and Ecology 161(2):145-178.

6.6 Shellfish ecosystem substrate composition and configuration considerations

The environmental and ecological considerations relevant for the selection of shellfish restoration sites is guided by the approaches outlined in the recently released shellfish restoration guidelines[6].

The basic design principles of shellfish restoration include:

1. Identification of suitable locations within the system that maximize connectivity between shellfish ecosystems and other associated ecosystems such as rocky reefs, seagrasses and muddy bottoms, to minimize human, biological and physical threats;

2. The laying of a locally sourced rock/rubble substrate onto the seafloor, for oysters and other associated species to attach to. This habitat substrate will be a composite of locally sourced igneous rock mixed with recycled, dried oyster shell, offering an optimal low-relief habitat on which oysters, and associate species such as pearl oysters, hairy mussels, tunicates, macroalgae, can readily settle and grow. The composite substrate provides elevation, to raise the oysters above the sediment, and hard calcareous surfaces, attractive to rock oysters in particular. This composite substrate is designed to mimic the natural shell 'hash' that would otherwise be formed by generations of oysters recruiting onto themselves, but which has since been lost from the estuary;

3. Consideration of physical features, such as aspect, height, dimensions and rugosity, in a way that can help mitigate physical and biological threats such as smothering, heat, erosion, predation and human disturbance; and,

4. Seeding of the substrate with live oysters, while the target density of adult oysters is achieved, and/or timing of the laying of the substrate to coincide with peak natural oyster recruitment periods.

The final composition, configuration and deployment methods for the habitat substrate are determined by a team of ecological and engineering advisors using physical, ecological, social and engineering parameters. Designers particularly consider the need to balance the stability of the structure, during significant weather events, and in consideration of edge effects and ecological resilience and the need to recover shellfish ecosystems of adequate size, to be self-sustaining and effective, within the available project budget.

For the pilot shellfish ecosystems, two sites will be selected to test the overall replicable patch size that can be reproduced at other locations identified by the habitat suitability analysis. The composite substrate bases at each site are likely to be long and narrow (e.g. 50 m x 5 m) and run parallel to the shoreline occupying the lower intertidal region or perpendicular to the shore, from the intertidal into the sub-tidal zone. The final configuration and locations of restoration sites in the Noosa River estuary will be assessed and approved by the TAG.

6.7 Project workflow

(A4.1) Restoration at two sites (approx. 40m-50m shore length per site) which test substrate design, deployment and oyster growth and survival.

Timeline: 24 months

- Review and synthesis of existing research (described in 2.2)

- Field surveys to assess site conditions
- Development of draft restoration design and management interventions including ongoing management
- Review by TAG, Expert Project Advisors and Stakeholders
- Permit applications
- Material procurements and third-party contracts
- Substrate configuration and deployment

(A4.2) Restoration across multiple further sites, as determined by habitat suitability modelling and outcomes of community consultation.

Timeline: 36 months

- Review of pilot MER site results and Restoration Suitability Model
- Field surveys to assess site conditions
- Development of draft restoration design and management interventions including ongoing management
- Review by TAG, Expert Project Advisors and Stakeholders
- Permit applications
- Material procurements and third-party contracts
- Substrate deployment

(A4.3) Monitoring and evaluation study for both initial and full restoration sites. Monitoring to include oyster metrics, invertebrates and fish use (detailed in MER Plan).

Timeline: 36 months

- Draft MER plan developed including:
    - Review of existing research, reference sites and models
    - Specific restoration attributes identified (i.e. oyster density, patch size, patch height, patch location, invertebrate biodiversity)
    - BACI experimental design developed including control and reference site selection
    - Reporting templates
- Review by TAG, Expert Project Advisors and Stakeholders
- MER Plan revised and endorsed by TNC-NSC
- Regular monitoring conducted
- Reports produced

Table 8. Deliverable checklist for Objective 4 (to be completed in six monthly, annual and final reports).

Deliverables	Measurable outcomes	Status and notes (*Not Started/In Progress/Delayed/Completed*)
(A4.1) Restoration at two sites (approx. 40m-50m shore length per site) which test substrate design, configuration, deployment techniques and oyster growth and survival.	• At least two (2) sites with at least overall 80 m shore length of shellfish ecosystem restored and being actively monitored.	

(A4.2) Restoration across multiple further sites, as determined by restoration suitability modelling and outcomes of community consultation.	•	In addition to the two initial sites, a number of sites comprising a minimum of a further aggregated 600m^2 surface area of restored oyster ecosystem in the Noosa River estuary.
(A4.3) Monitoring and evaluation study for both pilot and full restoration sites. Monitoring to include oyster metrics, invertebrates and fish use (detailed in MER Plan).	•	Annual monitoring and evaluation report card with 6 monthly status reports to be provided.

7. Objective Five: Noosa River Plan

7.1 Purpose and deliverables

The purpose of objective five is to provide technical and expert support to NSC particularly in regards to planning, implementation and evaluation associated with the draft Noosa River Plan and other coastal and marine management plans including the Noosa Environment Strategy.

The objective recognises that TNC has technical skills and experiences across a broad range of marine and coastal management areas and that these skills and experiences would benefit NSC staff overseeing the implementation of the Noosa River Plan and Noosa Environment Strategy. Delivery mechanisms include:

- Informal advice through meetings and one-one dialogue
- Formal requests for peer review
- Structured decision-making workshops and trainings
- Study tours
- Coda Fellowships (internal TNC temporary work placements)

Access to experts in relevant fields can include TNC local staff, TNC international staff and TNC external networks. Deliverables associated with this objective are:

(A5.1) Run workshop with Noosa Council to identify ongoing focus areas for TNC support.

*(A5.2) Provide technical/peer review on minimum five plans/reports/studies if requested by Noosa Council.

*(A5.3) Facilitate a minimum of three study tours of relevant sites in line with objectives and scope of the program in Australia/US if requested by Noosa Council (flights and incidentals covered separately by Noosa Council, accommodation and in-country travel covered by this Grant).

*(A5.4) Develop a Conservation Action Plan for specific issues (not yet determined) relevant to the Noosa Estuary (including community workshops) if requested by Noosa Council.

*(A5.5) Facilitate access to TNC conservation networks and researchers if requested by Noosa Council.

(A5.6) Promote Noosa Council's Noosa River Plan, Noosa Environment Strategy and shellfish restoration project in at least one national and one international conference.

(A5.7) Promote Noosa Council's Noosa River Plan, Noosa Environment Strategy and shellfish restoration project to corporate, philanthropic and state/federal government audiences to establish further support for conservation activities that support the Noosa River Plan

Several of the objectives marked with a * are discretionary based on the outcomes of A5.1 and future needs of NSC.

7.2 Revised deliverables

Over the course of the first six months of the project TNC and NSC further refined and agreed on the scope of Objective 5 (i.e. as a result of conversations related to delivery of A5.1). Deliverable A5.4 is no longer required as it is superseded by the draft Noosa River Plan. Instead, deliverable A5.4 has been revised to:

Review and feasibility of opportunities for sustainable commercial and recreational fishing management options for the Noosa River.

This deliverable will assist NSC to understand options for revised fisheries management arrangements. The deliverable will be implemented through a TNC Coda position in either year two or three of the project. The position will recruit an experienced fisheries manager from TNC US to undertake the review and provide recommendations.

It was also agreed that the feasibility of seagrass restoration as a method of reducing sediment resuspension and increasing invertebrate biodiversity should be explored. A new deliverable has therefore been added:

A5.8 Assess feasibility of seagrass restoration in Lake Cooroibah as a method of reducing sediment resuspension and increasing invertebrate biodiversity

7.3 Project workflow

(A5.1) Run workshop with Noosa Council to identify ongoing focus areas for TNC support.

Timeline: 9 months

This workshop has been completed and resulted in changes to Objective 5 deliverables described above in 7.2.

**(A5.2) Provide technical/peer review on minimum five plans/reports/studies if requested by Noosa Council.*

- NSC to identify feedback opportunities to TNC at earliest opportunity
- TNC to identify suitable staff(s)
- Template/process for feedback identified prior to review
- Review completed

Note: TNC has already undertaken peer review on both drafts of the Noosa River Plan and the Noosa Fishing Futures research paper.

(A5.3) Facilitate a minimum of three study tours of relevant sites in line with objectives and scope of the program in Australia/US if requested by Noosa Council (flights and incidentals covered separately by Noosa Council, accommodation and in country travel covered by this Grant).

Timeline: 36 months

- TNC and NSC identify objectives for study tour and key personnel
- TNC coordinate study tour itinerary and logistics
- TNC oversee in country/on site logistics

(A5.4) Review and feasibility of opportunities for sustainable commercial and recreational fishing management options for the Noosa River.

Timeline: 36 months

- TNC- NSC agree on scope of review and project deliverables
- Establish terms of reference for Coda Fellowship
- Recruit Coda Fellow
- Undertake desktop review, onsite and in person interviews including with stakeholders and State Government
- Produce draft report
- TAG, NSC, Project Technical Advisors provide review
- Final report presented to NSC

(A5.5) Facilitate access to TNC conservation networks and researchers if requested by Noosa Council.

Timeline: 36 months

- TNC to provide introductions and facilitate dialogue and expert feedback as required

(A5.6) Promote Noosa Council's Noosa River Plan and shellfish restoration project in at least one national and one international conference.

Timeline: 36 months

- Potential high-profile conferences identified
- Abstract developed, submitted
- Presentations provided

Timeline: 36 months

- Key messages agreed in Communications Plan
- Partnership brochures drafted and finalised
- PowerPoint slide content agreed
- Incorporate key messages into meetings

Timeline: 36 months

- Review of existing seagrass information/maps
- Commission seagrass mapping by third party (preferably local university)
- Develop habitat suitability model for seagrass (using same processes as described in Objective 2)
- Commission PhD or alternate research arrangement on practical restoration solutions (preferably local university)
- Produce executive summary of options/feasibility in final report (Deliverable A1.6)

Table 9. Deliverable checklist for Objective 5 (to be completed in six monthly, annual and final reports).

Deliverables	Measurable outcomes	Status and notes (*Not Started/In Progress/Delayed/Completed*)
(A5.1) Run workshop with Noosa Council to identify ongoing focus areas for TNC support.	• Workshop completed.	
*(A5.2) Provide technical/peer review on minimum five plans/reports/studies if requested by Noosa Council.	• Minimum 5 peer review reports completed during the three year term of this Agreement, if requested by Noosa Council. If Noosa Council requests a peer review, TNC will provide a minimum of 3 experts who are qualified in the relevant area of expertise for Noosa Council consideration and Noosa Council's acceptance of 1 expert for the peer review.	
*(A5.3) Facilitate a minimum of three study tours of relevant sites in line with objectives and scope of the program in Australia/US if requested by Noosa Council (flights and incidentals covered separately by Noosa Council, accommodation and in country travel covered by this Grant).	• Minimum three study tours completed during the three year term of this Agreement, if requested by Noosa Council.	
*(A5.4) Review and feasibility of opportunities for sustainable commercial and recreational fishing management options for the Noosa River.	• Conservation Action Plan and Community Workshops completed as required.	
*(A5.5) Facilitate access to TNC conservation networks and researchers if requested by Noosa Council.	• A number of new contacts/networks to assist Noosa Council with ongoing	

	and future marine conservation activities.	
(A5.6) Promote Noosa Council's Noosa River Plan and shellfish restoration project in at least one national and one international conference.	• Presentation to at least one national and one international conference.	
(A5.7) Promote Noosa Council's Noosa River Plan and shellfish restoration project to corporate, philanthropic and state/federal government audiences to establish further support for conservation activities that support the Noosa River Plan	• A number of new corporate/ government/ philanthropic alliances and new in-kind support/financial funding contributions.	
(A5.8) Assess feasibility of seagrass restoration in Lake Cooroibah as a method of reducing sediment resuspension and increasing invertebrate biodiversity	• Habitat mapping report, habitat suitability model, PhD study or similar	

8. Project risk assessment

Risks and management interventions associated with the Project are outlined in Table 9. These risks describe the project operational risks only. Risk associated with shellfish ecosystem restoration (e.g. impacts to habitat, marine species and users) are located within the MER Plan (Appendix 2).

Table 10. Project risks and management actions

Risk category	Risk	Description	Pre-management risk rating	Management interventions	Final rating
Reputational	**Stakeholders not supportive of project**	Project Lead fails to sufficiently engage stakeholders throughout duration of project, leading to poor stakeholder support, negative media, political intervention and potentially, project delays.	MEDIUM	1. Key stakeholders mapped and identified during early planning phase of project. 2. Open community forums held during planning phase and at key stakes thereafter. Listen and respond to community views and perspectives. 3. Where possible, include methods of co-design and/or consider community advisory groups. 4. Provide regular and transparent updates to general public at key stages of the process (e.g. through website, social media, presentations, forums, media releases). 5. Provide opportunities for community to participate and lead component of the project (e.g. historical mapping, ecosystem building, shell preparation, citizen science, 'Friends of' groups).	LOW
	Traditional Owners not supportive of project	Project Lead fails to sufficiently engage Traditional Owners in co-design practices or seek advice on culturally sensitive issues leading to alienation, negative media, political intervention and potentially, project delays.	MEDIUM	1. Identify Traditional Owners and elders who can speak for Country through Indigenous advisory groups, prescribed body corporates, or other government registers. 2. Identify cultural/environmental aspirations and consider opportunities for incorporating into planning and design (e.g. cultural mapping included in habitat suitability models, consideration of Traditional Ecological	LOW

				Knowledge into project planning, ranger programs). 3. Establish process for regular engagement with Traditional Owners, based on *their* preferred method. 4. Consider appropriate remuneration for consultation. 5. Consider Welcome to Country, Indigenous names for new shellfish restoration sites and support for cultural ceremonies/practices.	
	Poor performances of TNC or partners negatively impacts project	Threat or danger to the good name or standing of a business or entity as the result of the actions by a project partner, due to the actions of an employee, or through other peripheral parties and subcontractors.	MEDIUM	1. Undertake due diligence on all third-party subcontractors and avoid working with those with compromising or non-aligned values. 2. Listen and consider opinions of stakeholders on subcontractors and an individual's reputation. 3. Request all project partners understand and honor TNC's Code of Conduct and Values and include clauses in third party contracts. 4. Suspected concerns to be mitigated through prompt damage control measures such as direct communications with relevant individuals or businesses and terminating working relationships early. 5. Prepare key messages for any media response as part of an agreed communications protocols with project partners.	LOW
Environmental	**Rock oysters, and associate species, fail to grow and consolidate and function like a shellfish ecosystem**	Oyster recruitment, growth and survival is lower than anticipated and fails to meet restoration benchmarks. Alternate, rocky-reef or sediment habitats form or persist instead of shellfish ecosystem resulting in lower biodiversity and environmental value.	MEDIUM	6. Use science and habitat suitability models to inform the site selection process (e.g. water quality, topography, hydrodynamic, sediment analysis, benthic habitat type, historic shellfish ecosystem locations) 7. Establish TAG review process and provide opportunities for stakeholder workshops to peer review the data and process, 8. Consult with key experts and relevant authorities and draw upon experience gained from other projects and processes. 9. Develop full ecological risk assessment for shellfish restoration.	LOW

				10. Follow best practice guidelines and methods for shellfish restoration. 11. Apply adaptive management principles and scale restoration over multiple timeframes to incorporate prior learning.	
Operational	**Misalignment of project goals delivered with funding/ partner organisations**	Governance issues relating to poor communication, and conflict within partner organization resulting in misaligned objectives, breakdown of relationship and potential legal action.	MEDIUM	1. Clearly define partner roles and discuss preferred ways funding or partner organisations want to be involved. 2. Establish deliverables based on project plan and agreed timelines. 3. Establish regular communication and feedback opportunities with key stakeholders 4. Submit reports and communication materials that are high quality and on time. 5. Outline an agreed communications plan with project partners.	LOW
	Contract deliverables are not met	Project Lead and/or third party vendors not delivering on time or as agreed, potentially leading to project delays and potential legal action.	MEDIUM	1. Prepare contracts one month in advance (where possible) according to TNC standard operating procedures and relevant funder policy. 2. Establish deliverables based on project plan and agreed timelines. 3. Establish regular communication and feedback opportunities with key stakeholders. 4. Ensure flexibility around timing of works is built into contracts (e.g. adverse weather, hatchery delays). 5. Regular communication with contractors with clearly defined timelines to ensure that due dates for deliverables are met. 6. Identify alternative options that can be used to undertake the works if contractor fails to deliver.	LOW
	Project schedule delayed	The risk that activities will take longer than expected.	HIGH	1. Communicate with project partners the key dates and deliverables required to advance to schedule (update every 2 weeks). 2. If relevant, politicians, councilors and Mayor informed of upcoming dates where input is required. 3. Provide generous timing where possible for contingency.	MEDIUM

				4. Any events which may compromise the timing are managed where possible, and any necessary changes to the timeline are negotiated with partners. 5. Project management timelines will be reviewed in relation to the impacts on the project as a result of COVID-19, with special consideration given to the likely impacts on community engagement timing and modalities, fundraising and expenditure profiles.	
	Legal risks	Arising from legal and regulatory obligations, including contract risks and litigation brought against TNC	LOW	1. Contracts TOR be reviewed by TNC's legal team in accordance with Standard Operating Procedures and NSC policies. 2. All communications between principal and contractors will be recorded and filed. 3. Any conflicts or disputes with contractors first discussed informally to try and resolve issues prior to legal intervention. 4. Discuss legal proceedings with TNC leadership team if conflict cannot be resolved.	LOW
	Poor implementation	Includes risks from process problems such as materials, procurement and delivery.	LOW	1. Develop implementation plans based on lessons learnt from other projects and peer reviewed by colleagues and project partners. 2. Project Manager to draw upon the resources and expertise in the organization, having worked in shellfish ecosystem restoration in Australia and overseas over the past 15 years.	LOW
Financial	**Over budget**	Escalation of project costs due to cost estimating accuracy and scope creep.	MEDIUM	1. Base costs on previous comparable projects. 2. Align scope to the contract agreement. 3. Closely monitor the budget and review frequently. 4. Explore opportunities to advance the project with further attraction of funding.	LOW
Personnel	**Injury or death to project staff and subcontractors**	Activities that involve field work, diving, use of heavy machinery or marine works may result in personal harm, injury or death.	HIGH	1. Identify all hazards and risks at early stages of planning and complete activity-based risk assessments. 2. Communicate risks to participants at the start of field work activities.	LOW

		3. Follow TNCs Standard Operating Procedures and relevant work health safety policies 4. Conduct due diligence on all subcontractors undertaking construction works and ensure WH&S is addressed in all relevant contracts.	

SEVERE	HIGH	MEDIUM	LOW	NEGLIGIBLE

9. Project budget

The following project budget includes all costs associated with project delivery including project staff salaries, third party vendors, materials and supply associated with all project objectives. This budget is reflected in the TNC-NSC Agreement.

Please note that Year 1 budget will be amended downwards to reflect delays in commencement and the impact of COVID-19 on activities. Underspend will be moved into Year 2.

Table 11. Project budget

Activity	Total Year 1	Total Year 2	Total Year 3 (15 months)	Total
Activity #1 109145 AUST Reef Building	122,824	225,599	513,559	861,982
Activity #2 109146 AUST Hatchery and seeding	30,800	148,681	113,851	293,332
Activity #3 109147 AUST Reef integrity & performance assessment	46,200	227,186	306,903	580,289
Activity #4 109148 AUST Community engagement, capacity build, media	148,240	135,518	140,639	424,397
Activity #5 109149 AUST Project Management	131,215	48,349	60,436	240,000
Grant Total	**479,279**	**785,332**	**1,135,389**	**2,400,000**

*Note: The budget period is by financial year. The project periods are: **Year 1** – 25 July 2019 – 30 June 2020, **Year 2** – 1 July 2020 – 30 June 2021, **Year 3** – 1 July 2021 – 30 September 2023*

10. Project milestones

The anticipated project milestones are presented in Table 12. Achievement of these milestones may be subject to government requirements placed on the project that are not foreseeable at the time of writing.

Table 12. Major project milestones - anticipated

No.	Project Milestone	Indicative Action Date
1	Technical Advisory Group established and first quarterly meeting	13 May 2020
2	All Project Plans (Communications, Project Management, risk assessment, Monitoring, Evaluation and Reporting) completed	31 May 2020
3	Initial round of community workshops completed	30 July 2020
4	Seagrass surveys completed	30 November 2020
5	Shellfish Restoration Suitability Index (HSI) Completed	30 July 2020
6	Shell recycling commences#	30 August 2020
7	Seagrass Restoration Suitability Index (HSI) completed	30 November 2020
8	Citizen science activities commence#	1 February 2021
5	Design for pilot sites completed	30 June 2020
6	Seagrass restoration trials commence	30 June 2021
7	All permits and approvals for pilot sites obtained	31 October 2020
8	Restoration works at pilot sites completed	31 May 2021
9	Design for large-scale restoration works completed	30 June 2021
10	All permits and approvals for large-scale restoration works obtained	31 August 2021
11	All restoration contracts and plans established	31 October 2021
12	Large-scale restoration works completed	31 May 2022
13	All post-restoration monitoring and evaluation completed	30 June 2022
14	Complete Monitoring and Evaluation Report	15 July 2022
15	Project Review	20 July 2022
16	Completion of Final Project Report	30 July 2022

11. Appendices

Appendix 1. Project Communications Plan

Purpose

The purpose of this Communications Plan is to establish agreed communications guidelines between all delivery and funding partners for the *Bring Back the Fish* Project – The Nature Conservancy (TNC), Noosa Shire Council (NSC) and Australian Marine Conservation Society (AMCS).

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About the project

This project proposes to establish an innovative and regionally significant Noosa River Partnership, between the NSC and the global conservation organization, TNC. The partnership seeks to improve the health and resilience of the Noosa River and the industries and local communities that rely on its long-term wellbeing.

The focus of the Partnership is to:

- Capitalize on the expertise of TNC's global networks and experience (through knowledge brokering, mentoring, study tours and access to subject matter experts) to improve River management and strengthen the long-term social, environmental and economic health and resilience of the River;

- Demonstrate a leading example of a replicable, environmentally focused NGO-local government partnership that achieves superior outcomes for the environment and local communities compared to existing river management models; and,

- Increase government (State and Federal), private, industry and community support for restoration and conservation-focused activities that improve the long-term social, economic and environmental health and resilience of the River.

The Partnership is delivered through the *Bring Back the Fish* Project which prioritises the restoration of shellfish ecosystems in the Noosa River estuary, in addition to supporting activities such as seagrass restoration and review of commercial fishing identified in the draft Noosa River Plan.

The partnership commences July 2019 and continues for at least three years, with the outcomes of the first three years of the partnership to be reviewed in July 2022. The total operating budget is $2.4M, inclusive of $1.2M from The Nature Conservancy which includes a $200,000 gift from AMCS and $1.2M from Noosa Council, with the expectation that further funding will be secured, from a variety of other sources, to support on ground management activities. The majority of this funding is quarantined for shellfish ecosystem restoration.

Our vision is a clean and productive Noosa River estuary with a vibrant living oyster-dominated shellfish ecosystem that provides abundant fish and rich biodiversity for the benefit of the Noosa community.

Notable media-friendly deliverables from the project include:

- Launch of the partnership/project
- Community forums, presentations
- Citizens involved in restoration actions
- Shell recycling
- Restoration substrate deployment
- Shellfish monitoring results
- Seagrass study
- Novel commercial fishing feasibility study

Examples of Key messages

Primary message	
1	Restoring shellfish ecosystems will re-establish a previously common ecosystem in the Noosa River estuary and boost estuary health by helping to clean the water, enhance biodiversity and increase fish life.
2	This project is part of a suite of environmental initiatives delivered under the Noosa River Plan designed to improve the environmental health and recreational vale of the estuary.
3	This project is part of TNC's national shellfish restoration project that aims to rebuild 60 shellfish ecosystems across Australia. If achieved, the project will proclaim Australia the first nation in the world to have recovered a critically endangered marine ecosystem. Shellfish restoration projects in Melbourne's Port Phillip Bay and South Australia's Gulf St Vincent have already been completed with others underway near Adelaide, SA; Perth and Mandurah, WA, and now Noosa, QLD.

Secondary messages

- Shellfish ecosystem restoration works in tandem with various other estuary and catchment management initiatives to support the health of the Noosa River under increasing challenges such as population growth and climate change impacts (they are not a silver bullet but enhance overall estuary resilience).
- Shellfish ecosystems were once common in the Noosa River estuary. These were extensively commercially harvested in the late 1800s and along with changes in catchment land use and urban development, these impacts are collectively responsible for their decline.
- This project is a collaborative effort. Its success depends on working with a wide range of stakeholders including government, scientists, industry, indigenous groups and community groups.
- As well as improving estuary health, this project provides opportunities for community engagement, education and industry participation through shell recycling and ecosystem monitoring.
- Previous trials undertaken in the Noosa River were just that – trials. It was not anticipated at the time that the final shellfish ecosystems would look anything like the initial experimental shell-filled coir bags. Previous trials, and studies, have helped answer questions around oyster spat availability, interaction with adjacent habitats, human recreation impacts and siltation.
- This project has been made possible by the generous support of Noosa Shire Council, The Nature Conservancy, The Thomas Foundation and Australian Marine Conservation Society.
- People interested in learning more about the project, becoming involved or providing a donation, can contact Project Manager, Craig Bohm (craig.bohm@tnc.org), or visit The Nature Conservancy website at http://natureaustralia.org.au

Communication goals

A. Improve awareness amongst local community, businesses and visitors on the objectives and outcomes of the project and need for the *Noosa River Plan* and associated activities.
B. Spark greater community interest and stewardship in supporting shellfish restoration and wider estuary health.
C. Encourage further funding support in the project (i.e. to support more habitat restoration, ongoing monitoring, and/or local training and/or employment opportunities.
D. Acknowledge project funders and supporters and demonstrate our commitment to project delivery.

We will do this by:

i. Promoting all newsworthy stages of the project to print, TV, radio and online media through media statements, media briefings and social media channels.
ii. Building general community awareness of the project through face-to-face interactions such as guest presentations and workshops.
iii. Building key stakeholder and donor awareness of the project through targeted briefings and site trips.

Primary media contact for all media queries

Tony Jupp, Associate Director of Communications, The Nature Conservancy. Email: tjupp@tnc.org

Ken Furdek, Communications & Community Engagement Manager, Noosa Shire Council. Email: ken.furdek@noosa.qld.gov.au

Primary partners & roles

The Nature Conservancy (TNC): is the world's largest conservation organisation working around the globe to conserve the lands and waters on which all life depends. TNC is a foundation partner that is responsible for leading the management and delivery of all components of the project, including planning, implementation and monitoring as well as other associated initiatives.

Noosa Shire Council (NSC): is the local government agency who manages the Noosa region, an area about 130 kilometres (81 mi) north of Brisbane. The Shire is known for its sustainability and design principles and as a tourism destination of choice for Australians and international visitors. NSC is a foundation partner who is responsible for supporting project implementation.

Australian Marine Conservation Society (AMCS): AMCS was founded 50 years ago by a community of scientists and ocean conservationists, who came together to take action to protect our marine life. They advocate for real, evidence-based solutions based on the best available science. AMCS work closely with research centres across the globe and employ conservation experts to safeguard the future of Australia's amazing oceans. AMCS is a funding partner.

The Thomas Foundation: In 1998 David and Barbara Thomas established The Thomas Foundation to pursue their long-time philanthropic interests. Initially the Foundation supported projects in Education, the Arts and Conservation. In 2013 the Foundation's focus shifted to marine issues. The Thomas Foundation is a funding partner.

Secondary partners

All project stakeholders identified in the Noosa Project Management Plan (Chapter 2.4) could be considered secondary partners involved in delivering or engaged in some aspect of the project. Where these groups produce their own media and communication related to the Project or are incorporated in media and communications produced by Primary Partners, all groups must adhere to the communication protocols detailed (below) in this Communications Plan.

Communication Protocols

1. For all jointly branded communications that involve Primary Partner logos, all Primary Partners must agree to the content before publication. Timeframes agreed include:

    - Joint Media Releases – 48 hours
    - Promotional materials – 2 weeks
    - Community notices to attend public events (e.g. workshops, volunteering days, seminars) – 1 week

2. Primary Partner staff designated to talk to media will be nominated by each organisation during the notice and approval period described above.

3. For all individual Primary Partner communications and secondary partner communications, all parties agree to reference The Nature Conservancy, Noosa Shire Council, The Thomas Foundation and Australian Marine Conservation Society as project funders. However, there is the joint understanding that media may not always acknowledge all partners in any published communication.

4. All public documents including scientific papers and reports published by Primary Partners, Secondary Partners and third-party recipients of project funding (e.g. Universities) MUST include the following statement as acknowledgment:

    This project was supported by Bring Back the Fish, a three-year initiative to restore shellfish ecosystems and improve estuary health in the Noosa River estuary, funded by The Nature

Conservancy, Noosa Shire Council, The Thomas Foundation and Australian Marine Conservation Society.

5. For media approaches, each partner's spokesperson has the autonomy to engage in interviews, however, this is also subject to individual partner internal communication approval processes.

6. All media spokespeople agree to use the key messages in this communications agreement as a guide to frame project messages and comments.

7. All nominated media spokespeople have the permission of their respective organisations and all partners, to be a representative of the project to the media, including print, TV, radio and online.

8. All partners agree to share media clips about the project that are picked up by their media monitoring services.

Target Audiences

Government

- Federal government
- Queensland Government
- Other Local Governments (i.e. councils adjoining Noosa)

Environmental and other NGOs

- Community conservation groups
- Peak stakeholder bodies

Corporate

- Financial supporters (current and new)
- Local businesses
- Tourism associations

General Public

- Recreational fishers
- Community conservation groups
- Diving groups
- Recreational boating community
- River foreshore communities

Media Targets

- TV news – Channel 7/9, ABC
- The Courier Mail
- Noosa News
- Websites and social media feeds of relevant organisations, e.g. peak stakeholder bodies, conservation-based groups, fishing groups
- Fishing magazines.

Potential Communication Tools

TNC will lead the media relations and public engagement for this project. Below is a list of potential tools that could be created to promote the project:

- Media Statements
- Fact sheets/brochures
- Project videos/vignettes
- Still photographs
- Webpages
- Facebook and other social media posts
- Infographics
- Site visits

Issues management

The primary risk identified for the project is reputational. This means that the reputation of TNC and/or any of the partners would be a risk should an operational matter or communication activity associated with the project (or a perception of either) generate negative public opinion or negative stakeholder feedback.

The table below is not exhaustive. Rather, it lists some known reputational risks for issues management and the recommended communication responses. As predicted at the commencement of the project, the likelihood of these risks occurring is very low as there are no negative outcomes and only supportive stakeholders.

Risk	Communication Response
Recreational fishing/conservation NGO alliance is seen as inappropriate	• Improving the health of the Noosa River and restoring fish habitats is a focus for both partners
Government/conservation NGO alliance is seen as inappropriate	• Improving the health of the Noosa River and restoring fish habitats is a big part of this unique partnership
Partnership and/or project criticised as having no practical benefits	• Regular updating of key stakeholders
Partnership and/or project do not deliver on particular objectives	• Honest, regular communications • Focus on progress & other outcomes achieved
Negative commentary circulates on social media	• Partners to all monitor own social media • Respond with appropriate key messages to manage concerns/comments raised
Negative mainstream media commentary	• Targeted media approaches around milestones • Media monitoring • Letters to the editor
Negative commentary that TNC is a big US NGO	• TNC is working around the world in more than 70 countries, including many marine conservation programs
Stakeholders do not engage with project	• Strong project branding • Possible rolling calendar of briefings, site visits & conference speaking • Regular stakeholder engagement • Engaging materials

Bring Back the Fish

Restoration and conservation of shellfish ecosystems in the Noosa River estuary

Monitoring, Evaluation and Reporting Plan 2020-2022

June 2020

This monitoring plan will be reviewed and updated as new information specific to the Noosa project becomes available.

Noosa River mouth © Marcos Barboza

This project was made possible by The Nature Conservancy, Noosa Shire Council, The Thomas Foundation and Australian Marine Conservation

Purpose

The purpose of this Plan is to outline the Monitoring, Evaluation and Reporting (MER) approach for the Bring Back the Fish conservation project for the Noosa River Estuary. The Plan details the environmental, social and economic targets and goals of the project. This plan includes information on performance metrics, monitoring methods, analyses and reporting. The Project's timeframes, organisational roles and responsibilities for collecting and analysing data are also provided.

The project follows the MER principles of the international Society for Ecological Restoration (SER), the Open Standards for the Practice of Conservation (OSPC) and best practice methods for shellfish ecosystem restoration. This includes establishing project targets, goals and objectives and using a reference ecosystem, or reference model, as a predefined ecological target. Reporting of project indicators includes both reporting of trends towards an ecological trajectory and standard project inputs and outputs (e.g. oysters deployed, m^2 of habitat provided).

The execution of this Plan will enable project partners and funding bodies to determine whether the project is successful in achieving predefined environmental, social and economic targets. By monitoring a common set of ecological indicators, we will also be able to compare these results with other restoration projects in Australia and globally.

Introduction

Shellfish ecosystems, which are created predominately by the rock oyster (*Saccostrea glomerata*), and native flat oyster (*Ostrea angasi*), were historically extensive along the coastline of southern and eastern Australia. Since European arrival, these bivalve ecosystems have declined in extent and condition largely as a result of unsustainable fishing methods which removed much of the shellfish ecosystem structure[12]. This loss was further aggravated by a decline in water quality, sedimentation of bays and estuaries and possibly the introduction of new diseases. Since the loss of shellfish ecosystems in Australia largely occurred outside of living memory, only recently have we begun to understand the true historic extent of shellfish ecosystems and the critical role they play in supporting fish production, natural water purification and biodiversity.

Oyster-dominated shellfish ecosystems were once a dominant feature of the Noosa River estuary, feeding the local Kabi Kabi Traditional Owners and early European settlers in the region. The commercial oyster industry, in the Noosa River, commenced in the 1870's or 1880s, and ceased, having become economically unviable, by the 1940's[13].

The Nature Conservancy will work alongside the Noosa Shire Council (NSC), commercial and recreational fishers, and the community to restore rock oyster-dominant shellfish ecosystems in the Noosa River estuary.

The primary activity of the project involves laying a composite substrate, or bed of local rock rubble and dried oyster shell, on which rock oysters, and associated species, settle, grow and eventually 'cement' together to form the oyster-dominated ecosystem. To restore shellfish ecosystems, juvenile native oysters (pre-seeded onto recycled shells in a hatchery) will be mixed with a local igneous rock/rubble and deployed into carefully selected, intertidal and shallow subtidal areas and positioned parallel to depth contours.

These ecosystems will be accessible to the general public. Activities associated the project, and consequent improvement in the ecological health of the estuary, will help support the regional economy through job creation and ecotourism. The project is modelled on successful shellfish restoration projects in Victoria, South Australia and the United States[14].

The underlying habitat substrate, which is deployed by the project, and on which the oysters and other invertebrate species settle and grow naturally, will be designed by TNC technical staff in collaboration with members of the Project's Technical Advisory Group (TAG) and will be assessed/reviewed by engineers, where necessary.

The project is split into three distinct phases that allows for examination and learning of lessons from previous phases of the project that can be incorporated into subsequent phases (i.e. adaptive management principles). These phases commenced with Phase I, an external experimental project, in which -small-scale experimental

[12] Gillies CL, McLeod IM, Alleway HK, Cook P, Crawford C, Creighton C, et al. (2018) Australian shellfish ecosystems: Past distribution, current status and future direction. PLoS ONE 13(2): e0190914. https://doi.org/10.1371/journal.pone.0190914

[13] Thurstan, R. H. (2015). Historical ecology of the Noosa Estuary fisheries. *Report to Noosa Council, The Thomas Foundation and The Nature Conservancy*.

[14] The Nature Conservancy (2015) Measuring the Recreational Fishing Benefits of a Restored Oyster Habitat, online via http://www.nature.org/media/texas/hmr_final_distribution.pdf

units, comprised of shell enclosed in coir netting, were set at 14 sites throughout the estuary and the settlement, growth and use patterns of river organisms interacting with these units were measures and analysed.

In phase II, the project will apply successful restoration methodologies accredited by the Society for Ecological Restoration (SER). The project will deploy into two carefully selected sites in the river composite of locally sourced rock rubble, mixed, in part with dried oyster shell. This substrate will be laid in carefully designed configurations to maximise it's potential to recruit oysters naturally and promote oyster survivability. These two sites will be carefully monitored and evaluated before phase III commences.

In phase III, after analysis of the construction, ecological and social successes and challenges experienced in phase II, additional substrate will be deployed at the same and/or additional sites in the estuary, as suitable deployment sites, and community will, allow. This MER Plan is focused primarily on the delivery of Phase II, with refinements to be added for adoption in Phase III.

More detail about each phase is presented below:

Phase I (2018-2020)

Phase I was delivered by the University of the Sunshine Coast. It entailed a three-year study which installed 14 trial 'reef' units consisting of coir bags filled with oyster shell at sites throughout the estuary. The project studied the structural integrity, oyster recruitment, fish and invertebrate community assemblages and human interactions with the structures. This project collected important ecological information that will support Phases II and III – this project.

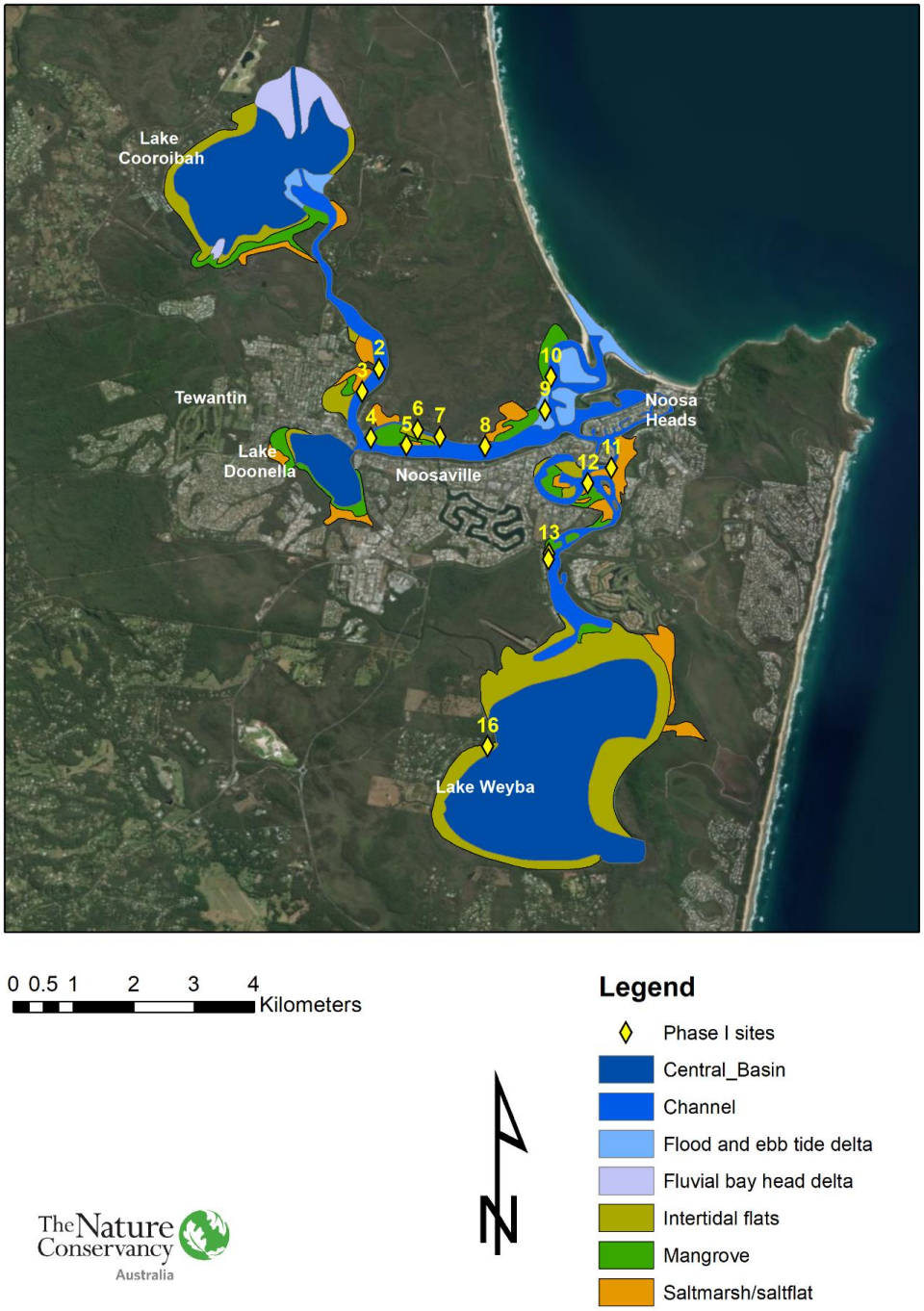


Figure 1: Map of Phase 1 small scale research locations in the Noosa River estuary, QLD

Phase II (2019-2020)

Phase II of the project is led by The Nature Conservancy (TNC) in partnership with Noosa Shire Council (NSC), and directly involves the community and key operational partners in the collection and deployment of restoration substrate (including oyster shell), monitoring of oyster recruitment (and related habitat parameters), evaluating success and reporting to interested stakeholders and the wider community.

Within Phase II, the following outputs are expected to be achieved:

- Restoration works completed at two restoration sites (approx. 40 m - 50 m shore length per site) which examines design and oyster growth and survival.
- Monitoring and evaluation study, with monitoring to include oyster metrics, invertebrates and fish use (detailed in MER plan).
- Engage community members in citizen science and/or restoration activities.
- Promotion of project and objectives to wider community through the media; and
- Improve skills and confidence of local partners/community in delivering large scale marine restoration projects.

The ecological objective of Phase II is to establish a viable breeding population of native rock oysters that can form the basis of self-sustaining shellfish ecosystems in the future. At this scale, the aim is to make a measurable difference to fish abundance and the productivity of the Noosa River estuary at the site scale – which are long-term outcomes coveted by the local Noosa community, visitors and government.

Notionally, a composite substrate, on which oysters and other invertebrates will settle and grow, will be comprised primarily of locally-sourced rock/rubble and dried oyster shell will be laid in configurations specific to each site, but which will be deployed, from a barge, with the following dimensions:

- Row dimensions: 0.1 – 0.3 H x 4 - 5 W x 40-50 L (metres) – in single line or patch configurations, depending on the nature of each site)
- Total Substrate Area: 400 m^2seafloor area will be restored
- Substrate sinkage: 200 millimeters tolerance (to be determined)
- Volume of substrate: TBD

The outcomes of Phase II will demonstrate the environmental, social and economic benefits of undertaking shellfish ecosystem restoration in QLD estuaries whilst also providing tangible environmental and social benefits to the local community.

Phase 3 (2020-2022 and beyond)

Phase 3 will seek to undertake system (estuary)-wide restoration using an assisted restoration approach, whereby shellfish ecosystems (a further 600 m^2 of aggregated reef substrate) are restored at multiple locations throughout the estuary.

Additionally, the project will explore and test the feasibility to restore seagrass habitats in Lake Cooroibah (and potentially elsewhere) to reduce sediment resuspension and increase invertebrate and fish biomass in the estuary.

The long-term goal of Phase III is to measurably improve the health (including fish productivity and water quality) of the entire estuary (i.e. at the system or estuary scale) of the Noosa river, thereby increasing the environmental, social and economic benefits provided by the estuary to the local community (with a focus on benefits to shellfish aquaculture, fisheries and ecotourism industries as well as amenity and recreational value for the local community).

Project team

The following is a list of the core group of practitioners who are responsible for designing, implementing, and monitoring the restoration sites:

Craig Bohm, The Nature Conservancy - Project Coordinator - Responsible for monitoring design, planning and overall project coordination

Dr. Simon Reeves, The Nature Conservancy – Monitoring Manager - Responsible for managing data collection and analysis and coordinating the diving plan (see Appendix 1), *Reef Life Survey*, oyster density/growth fieldwork and Report cards

Simon Branigan, The Nature Conservancy – Operations Manager (Oceans) – Responsible for oversite of project delivery and technical advisor.

Dr. Chris Gillies, The Nature Conservancy – Project Sponsor and advisor, responsible for approving resources, monitoring design and undertaking *Reef Life Survey* and oyster density/growth fieldwork

Additional divers will be engaged as required to undertake fieldwork.

Subject Matter Experts will be consulted with at key times during the monitoring program for guidance, expertise and review. These experts include, but not limited to:

Dr. Boze Hancock, The Nature Conservancy – Expert Restoration Scientist with TNC's Global Oceans Team focusing on providing science support for marine habitat restoration, particularly through quantifying the ecosystem services these habitats provide human communities, such as coastal protection, fish production and improved water quality.

Project Technical Advisory Group (TAG), representatives from project stakeholder groups with an interest in technical delivery of the project, including monitoring and evaluation.

Other experts will be included as required to provide advice on MER components throughout the project's delivery. The framework for monitoring activities and responsibilities can be seen in Figure 2.

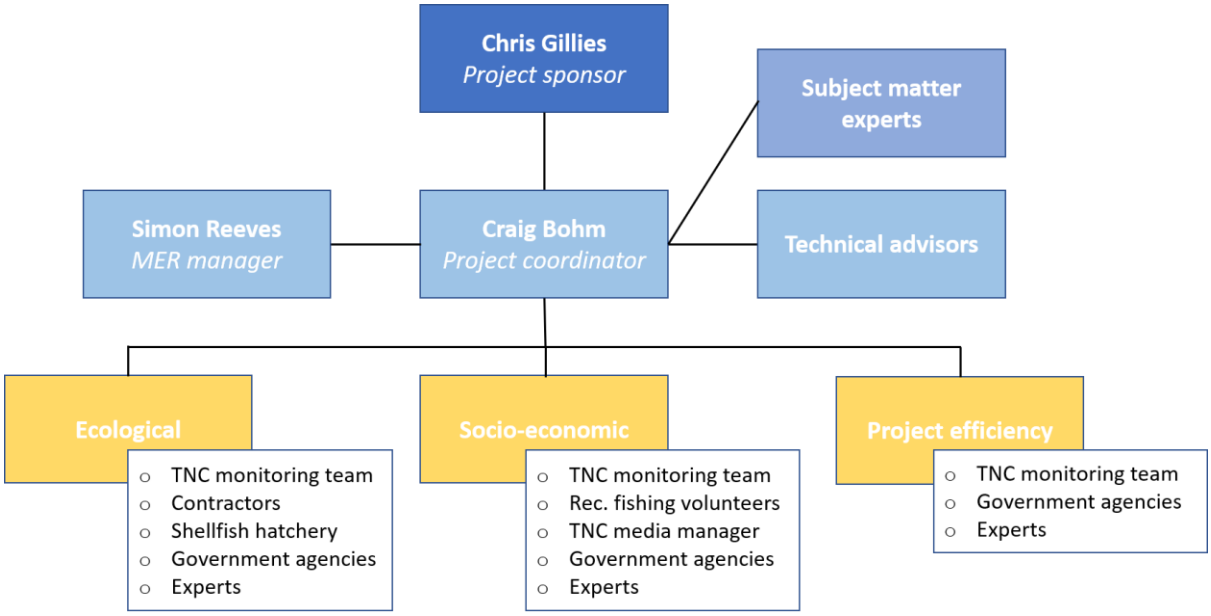


Figure 2: Monitoring project team chart with key responsibilities for project deliverables

Timeline

Figure 3: Project timeline identifying project deliverables and indicative timing for monitoring and restoration activities. Ongoing monitoring will be required to evaluate the success of the restoration works against the Project's Targets, Goals and Performance Indicators.

For more detail of monitoring activities within the Project, see Annex 2: Draft monitoring Timeline.

Targets, goals and objectives

The development of the monitoring, evaluation and reporting (MER) process follows a MER framework as outlined in
Figure 4: Framework of monitoring, evaluation and reporting process for TNC shellfish restoration projects, which follows the Open Standards for the Practice of Conservation. Definitions of MER level terminology is show on the left and an example of each.

At the highest level, there are broad restoration targets with goals and objectives which hierarchically convey the objectives of the project. Each target can have multiple goals and objective. Each objective can have at least one indicator (but potentially more) that assesses whether the objective has been met. Thus, each target could have single or multiple goals that can be outlined by single or multiple objectives that are in turn measured by single or multiple indicators, with each indicator being measured by a specific method. The process outlined here is derived from the Open Standards for the Practice of Conservation[15].

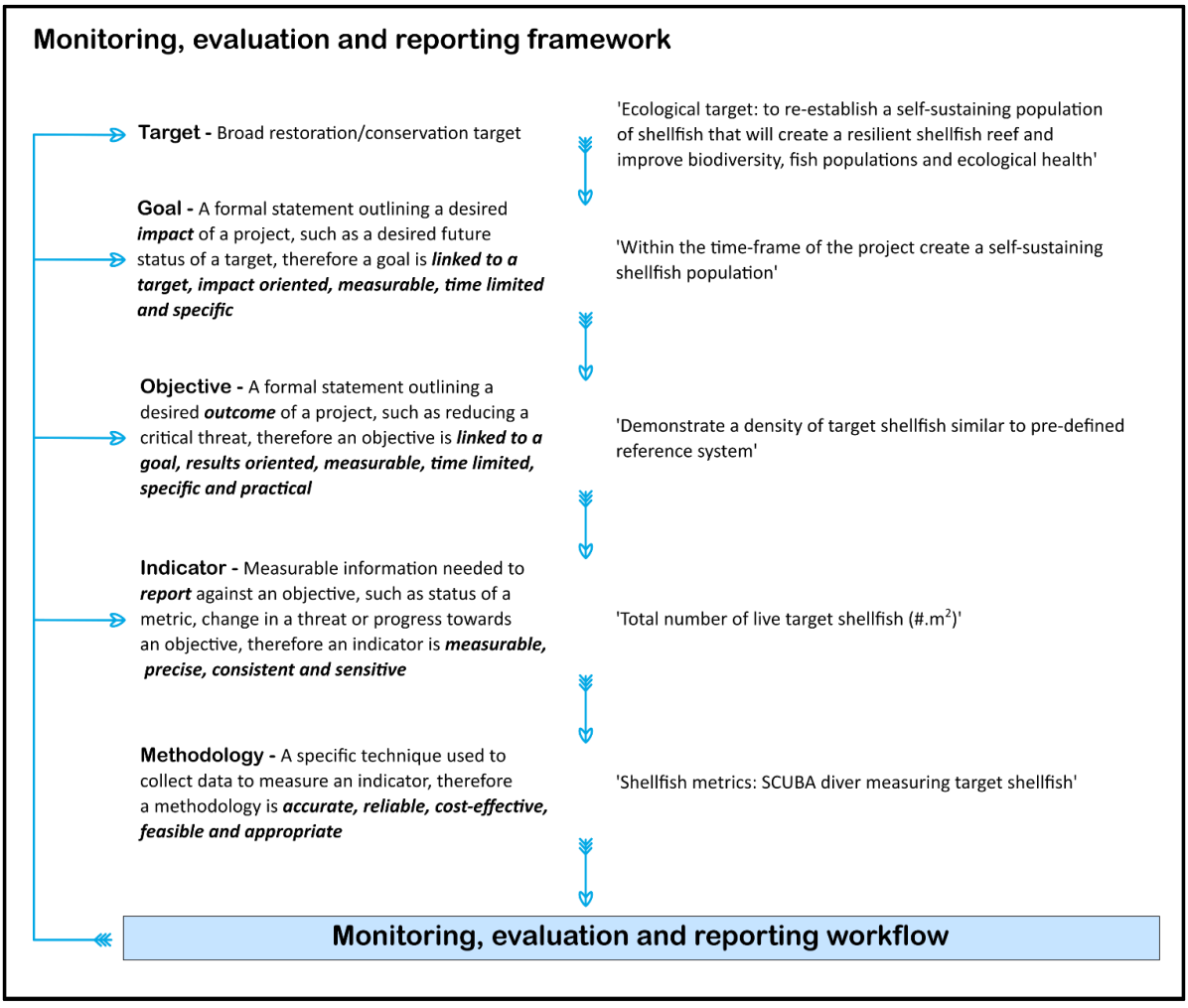


Figure 4: Framework of monitoring, evaluation and reporting process for TNC shellfish restoration projects, which follows the Open Standards for the Practice of Conservation. Definitions of MER level terminology is show on the left and an example of each on the right

[15] http://cmp-openstandards.org/

It is now commonly accepted that restoration of ecosystems can not only provide environmental benefits but also community, social and economic benefits too. With this in mind, the Project has established three targets that encompass these multiple benefits, in addition to ensuring the project is delivered cost-effectively and in a timely manner.

The targets identified in Table 1 are to be achieved by the end of Phase 2 of the Project.

Table 1: Project targets and descriptions

Project Targets	Description
Ecological	To re-establish a self-sustaining population of *S. glomerata* that will, with associate species, create a resilient shellfish ecosystem consisting of diverse biological communities, fish populations and their interactions.
Socio-economic	To create opportunities for the local community, recreational users and businesses in the Noosa Shire through shellfish restoration actions.
Project efficiency	To deliver the Project on time and within budget and additional funding is leveraged to support project deliverables

Ecological target and reference ecosystem

The ecological goals and objectives underlying the Project's ecological target have been developed in accordance with best practice restoration monitoring guidelines[16] [17] [18] and current research that defines ecological attributes to guide the restoration of rock oyster *(S. glomerata)* dominated ecosystems[19] i.e. an ecological reference model.

Ultimately, the ecological target of this phase of the project is to restore a biogenic shellfish ecosystems in multiple locations in the Noosa River estuary. These biogenic habitats will be dominated by native oysters (*S. glomerata*) and colonised by a diverse assemblage of associated organisms such as other shellfish, bryozoans, crustaceans, barnacles and calcareous polychaetes and fish.

Through restoration efforts, the current site will shift from an existing bare sandy and/or rubble bottom, with low species diversity (
Figure 5a) to mixed habitats with high diversity (
Figure 5b, c). The conceptual diagram below shows the expected stages of ecosystem transition and restoration: from substrate deployment, partly seeded with juvenile oysters, to a biodiverse, self-sustaining living shellfish ecosystem (
Figure 6).

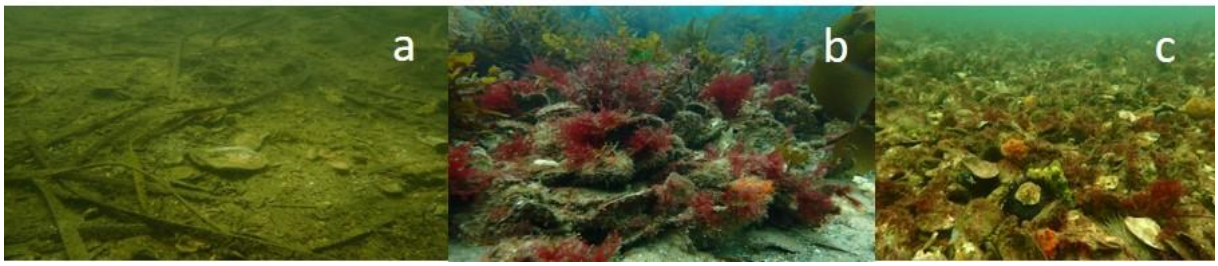


Figure 5: Sandy bottom substrate (a) compared to natural oyster ecosystem in George's Bay Tasmania displaying different vertical profiles and structure (b,c). © C Gillies, The Nature Conservancy.

Figure 6: Stages of development to create a living shellfish ecosystem © The Nature Conservancy

[16] The Nature Conservancy et al, Oyster Habitat Restoration Monitoring and Assessment Handbook
[17] Mcdonald *et al* (2016). National standards for the practice of ecological restoration in Australia, Restoration Ecology, *Vol. 24, No. S1, pp. S4–S32*.
[18] Conservation Measures Partnership (2013) Open Standards for the Practice of Conservation Version 3.0, accessed online via http://cmp-openstandards.org/wp-content/uploads/2014/03/CMP-OS-V3-0-Final.pdf
[19] McLeod, I. M., Boström-Einarsson, L., Creighton, C., D'Anastasi, B., Diggles, B., Dwyer, P. G., ... & McOrrie, S. (2019). Habitat value of Sydney rock oyster (Saccostrea glomerata) reefs on soft sediments. *Marine and Freshwater Research*.

Socio-economic target

The goals and objectives underlying the Project's socio-economic target have been developed to align with practice restoration monitoring guidelines. Through the restoration of a biogenic shellfish ecosystems in the Noosa River estuary, it is expected that maritime construction (provision and deployment of restoration substrate) and recreational fishing opportunities will be enhanced, leading to improved social and economic benefits for the local community such as: new opportunities for community volunteering and environmental stewardship, job creation and flow on economic benefits for local businesses related to the tourism and service industries (who will benefit from a healthier Noosa River estuary).

Ultimately, the socio-economic outcomes sort from this phase of the project include enhanced local capabilities to deliver nature-based restoration projects; elevated awareness and support for shellfish restoration efforts, through community volunteering and citizen science activities; improved recreational fisher satisfaction, with the government's estuary management approach; and, the creation of employment opportunities in the research, restoration and monitoring components of the project.

Project efficiency target

The goals and objectives underlying the project efficiency target have been developed to assess the effectiveness of the project in delivering outcomes on time and within budget and additional funding is leveraged to support project deliverables.

The project efficiency target involves the effective management of the project's finances, appropriate planning and project management and establishment of project governance processes including review of key documentation by the projects Technical Advisory Group (a group of stakeholders with expertise that will provide advice and direction related to project delivery). Within this phase of the project, the project efficiency target is to deliver project documentation, and other project outputs on time and within budget, whilst acquiring all relevant permits in line with an approved project management plan.

Indicators and methods

The indicators and methods used to monitor and evaluate the project are aligned with the project's goals and objectives and will in-turn contribute to the targets.

The matrix presented at Attachment 1, shows how the Targets flow on to Goals, Objectives, Indicators and Methods. The draft Monitoring Timeframe for delivery of MER actions is presented in Attachment 2.

The methods for monitoring the ecological indicators are adapted from the *Shellfish Habitat Restoration Monitoring and Assessment Handbook*[20] with detailed methods provided in Annex *3: Monitoring methods*.

Methods for monitoring socio-economic indicators are mostly developed around measuring community involvement and stakeholder satisfaction with project outcomes. This is done through a range of tools including surveys, semi-structured interviews and collection of project metrics (e.g. number of attendees, number of media mentions). Details for these methods are provided in Annex 4: *Monitoring methods: socio-economic*.

Methods for monitoring project efficiency indicators are mostly developed around tracking expenditure and financial support, technical assistance and project planning documentation as established in the Alliance & Funding Agreement established for the project. Data aligning to the project efficiency indicators will be collected by the project lead and compiled in financial and progress reports to be completed throughout the project.

[20] The Nature Conservancy et al, Oyster Habitat Restoration Monitoring and Assessment Handbook

Evaluation

Ecological performance indicator evaluation

The experimental design for ecological indicators (listed in **Annex 1: Draft table outlining targets, goals, objectives and associated performance indicators for the**) is based on a Before-After-Control-Impact (BACI) design[21], adapted to shellfish ecosystem restoration as outlined in the Universal Oyster Metrics in the Oyster Restoration Monitoring and Assessment Handbook[22].

To evaluate the ecological impact, and to assess the performance of the shellfish ecosystems in meeting their restoration goals, it is necessary to perform both pre- and post-construction monitoring and assess these against control sites located in two different adjacent habitats: soft sediments and seagrass habitats. In the absence of a suitable local reference ecosystem being available, the project will use an interim target reference system developed from research (i.e. Mcleod et al. 2019) for the purpose of guiding *S. glomerata* ecosystem restoration. The inclusion of a reference system or target is considered best practice approach to restoration[23].

Two control monitoring locations, one for seagrass and one for sandy substrate, will be established near the proposed shellfish ecosystem restoration impact area. An indicative diagram of the Impact and Control sites is shown below (see Figure 7).

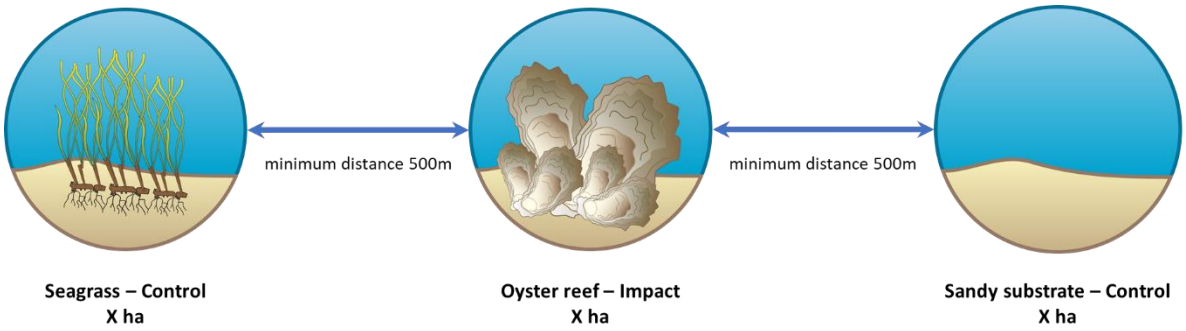


Figure 7: Impact site (proposed 200 m^2 shellfish ecosystem area) and sandy substrate-control (200 m^2 bare sand habitat). TBD once site assessment has been completed. The sandy control and seagrass site are positioned at a minimum distance 500 m from the impact site, but still within an area of equivalent environmental conditions in order to evaluate changes as a result of the "Impact" action.

Socio-economic performance indicators

Socio-economic indicators will be evaluated by analysing data collected by the Project Coordinator and pre- and post-substrate deployment socio-economic testimonials from key stakeholders and the community. Evaluation of performance indicators will be done by standard analysis workflows ensuring clear and consistent evaluation products. Each indicator will be assessed against a planned benchmark (planned output and timeframe) and will be allocated a score relating to the how the results of the metric measures up against the benchmark. This scoring will be consistent with those allocated for the ecological and socio-economic target indicators.

Project efficiency indicators

Project efficiency indicators will be evaluated by reviewing the project deliverables and budget against established outputs and timing established for contracts, the Project Business Case and Project Summary Investment Plan (to be developed later in the project). Each indicator will be assessed against a planned benchmark (planned output and timeframe) and will be allocated a score relating to the how the results of the metric measures up against

[21] Underwood, A. J. (1994). On beyond BACI: sampling designs that might reliably detect environmental disturbances. *Ecological applications*, *4*(1), 3-15.

[22] The Nature Conservancy et al, Oyster Habitat Restoration Monitoring and Assessment Handbook

[23] Gillies CL, Crawford C, Hancock B (2017) Restoring Angasi oyster reefs: What is the endpoint ecosystem we are aiming for and how do we get there? Ecological Management & Restoration 18:214-222

the benchmark. This scoring will be consistent with those allocated for the ecological and socio-economic target indicators.

Evaluation steps

Summarise

Initially for each performance indicator, where applicable, the data will be compiled and summarised returning mean, standard deviation, standard error, coefficient of variation (CV) and a simple calculation of sample size (n) to understand if increased sampling effort is required. Metrics will also be visualised by plotting time series plots that visualise how the metric has varied through time.

Score

Following summarising the data a score will be calculated in reference to a benchmark. This benchmark will be either a pre-defined benchmark in reference to a known condition i.e. 50 shellfish per m^2 that defines a viable population density similar to that found in natural shellfish ecosystems (Gillies et al. 2017). If no pre-determined benchmark exists, the indicator will be measured against a benchmark defined by the mean of the value of the indicator as measured at control sampling locations. The results will then be standardised by providing % of the measure compared to the benchmark and categorised into one of six score categories (see Figure 8).

Trend

The trend for each indicator will be assessed by fitting the raw data for each site as a linear model. The significance of the t-value, that assesses whether the coefficient is significantly different to zero will first be examined. If the metric is not significantly different to zero, the slope will then automatically be assigned to the 'Stable' category. If slope is significant the value of the slope coefficient is then categorized into one of 6 categories (see Figure 8).

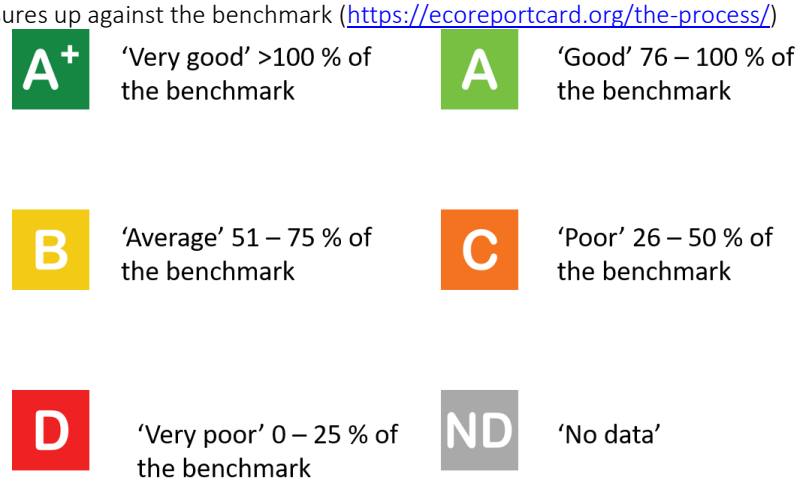
Additional analysis

Where necessary additional analyses will be undertaken to statistically assess differences of metrics between sites i.e. impact versus control. These analyses will be univariate (Analysis of variance - ANOVA) or multivariate analyses (permutational multivariate analysis of variance) where appropriate.

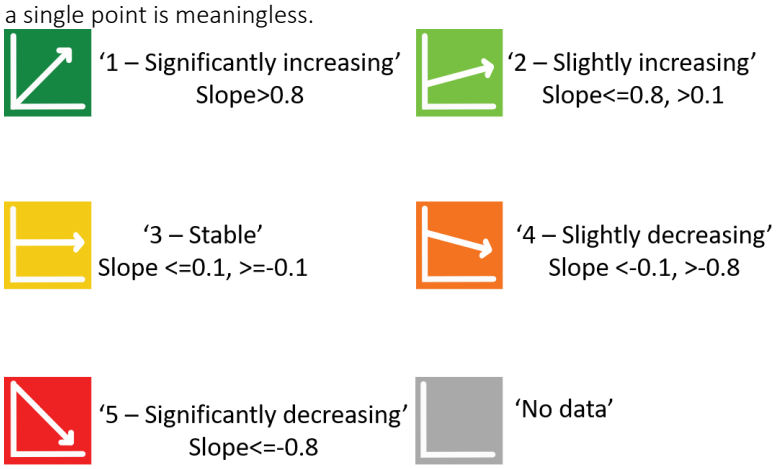
The data will be evaluated using the R language and environment for statistical computing alongside RStudio which allows scripts of code to be created ensuring standard analysis workflows and evaluation products

How the scores are calculated

The restoration score is calculated by comparing indicators (underlying the restoration targets) to defined benchmarks (see appendix 1). From this the results are classified into scores depending on how the results of the metric measures up against the benchmark (https://ecoreportcard.org/the-process/)



The trend for each indicator is also evaluated, where applicable, to understand if the indicator is increasing or decreasing. An indicator's trend will receive a 'No Data' categorisation with only one sampling event as a trendline through a single point is meaningless.



Scores and trends are combined into an overarching score for each target and an overall score. All scores are evaluated against the Restoration Index. The region-wide scores are derived by combining the site-based scores for each restoration target.

Figure 8: How score and trend is calculated and categorized.

Reporting

The evaluation products will be used to produce three reporting documents able to be communicated to stakeholders as per the Project Communication Plan. Project reporting products to be developed are described below and in Financial and audited annual reports will be provided to project funders in line with requirements specified within contracts. This includes cumulative expenditure reports (due 10 business days after predetermined dates annually) and audited annual reports for each financial year expenditure (due within 3 months after the end of financial year). Each of these reports will provide a summary of outputs and progress

against specified benchmarks and/or milestones and will form the basis for the evaluation of the indicators that sit under the project efficiency targets.

Table 2

1. Progress Summaries

Annual progress summaries will be produced outlining the progress of the restoration sites against the targets, goals and performance indicators. The summaries will be produced annually following completion of monitoring fieldtrips. The progress summaries will be easily interpreted and include infographic displays aimed at donors, project partners, restoration practitioners, community groups and the general public.

2. Technical report

A technical report will be produced that reports on progress against targets, goals and performance indicators throughout the project. The technical report will be detailed scientific report providing details on the monitoring data collected and an evaluation of how this relates back to the primary targets for the project. The audience for the annual technical report is academic and government scientists, project partners, restoration practitioners.

3. Financial and audited annual project reports

Financial and audited annual reports will be provided to project funders in line with requirements specified within contracts. This includes cumulative expenditure reports (due 10 business days after predetermined dates annually) and audited annual reports for each financial year expenditure (due within 3 months after the end of financial year). Each of these reports will provide a summary of outputs and progress against specified benchmarks and/or milestones and will form the basis for the evaluation of the indicators that sit under the project efficiency targets.

Table 2: Project reporting schedule

Report	Due date
Cumulative Expenditure Report #1	
Audited Annual Report #1	
2019-20 Project Summary (Baseline)	September 2020
Cumulative Expenditure Report #2	
Audited Annual Report #2	
2018-19 Project Summary	
Phase 2 Technical Report	

Figure 9 provides an outline of the monitoring, evaluation and reporting workflow described in the sections above.

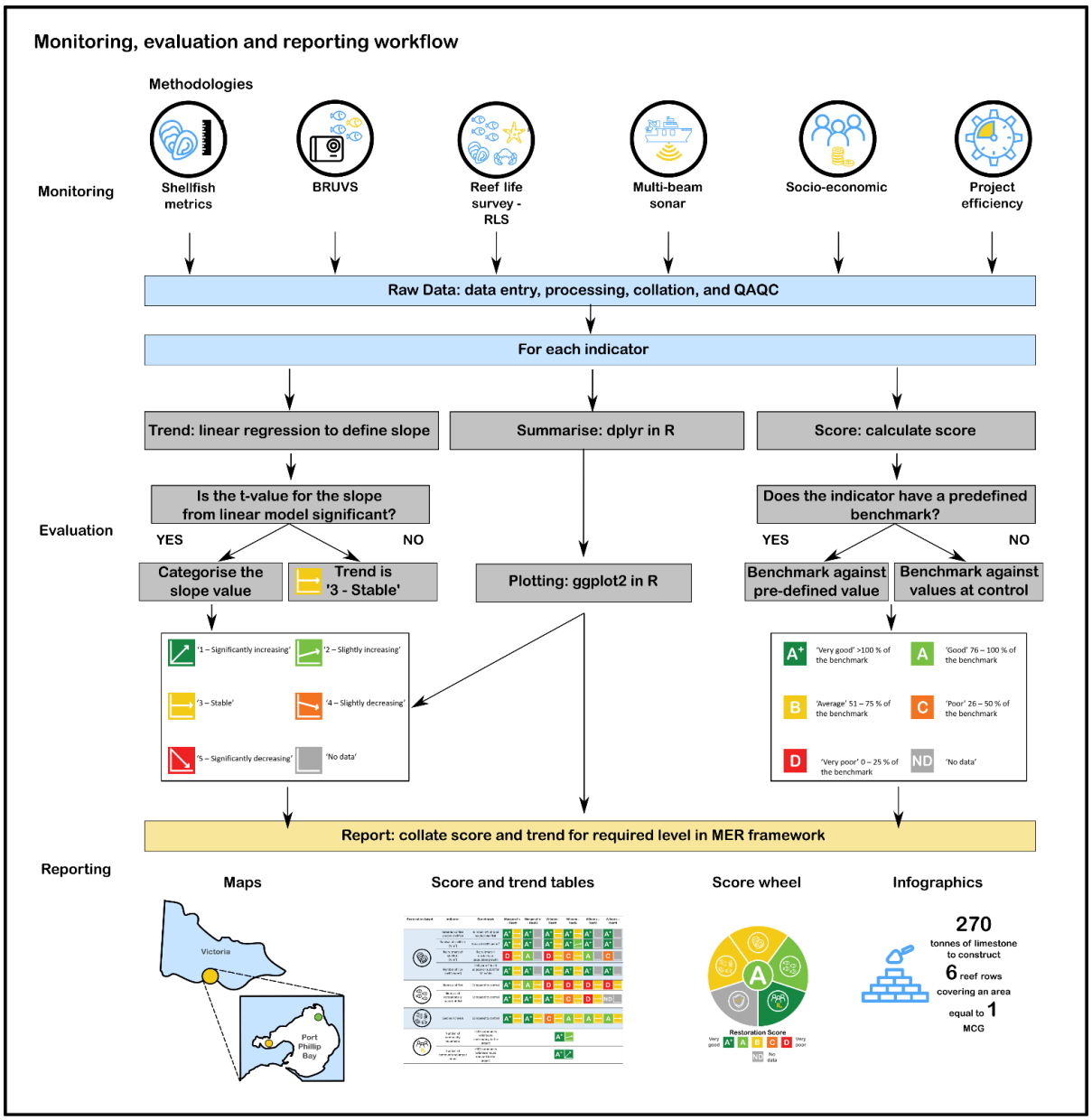


Figure 9: Restoration targets and MER workflow

Data management

The project will follow global best practice in data management as outlined in the British Ecological Society's Guide to Data Management in Ecology and Evolution[24]. Principles include standardized and consistent procedures to collect, process, check, validate and verify data. Data and information will be openly shared, proactively released, licensed to promote re-use and housed on the Australian Ocean Data Network (AODN).

[24] Alpert P, Baier A, Baker L, Bartomeus I, Beckerman A, Brophy C, Buckley Y, Burdon R, Canham C, Coulson T, Demes K, Dray S, Dyer A, Freckleton R, Gibson D, Newton E, O'Hara B, Hill C, Pearse W, Pettorelli N, Piper F, Raby C, Salguero-Gomez R, Suryawanshi K, Warren P, Wilson K (2014) A Guide to Data Management in Ecology and Evolution. British Ecological Society, London

Annex 1: Draft table outlining targets, goals, objectives and associated performance indicators for the Bring Back the Fish project for the Noosa River estuary

Goal	Objective	Indicators	Metric	Method	Planned Output	Frequency/Timing	Responsibility	Notes
ECOLOGICAL TARGET: to re-establish a self-sustaining population of S. glomerata that will create a resilient reef consisting of diverse biological communities, fish populations and their interactions.								
GOAL 1: Within the timeframe of the project build a resilient structure for the "Living Shellfish Ecosystem"	***OBJECTIVE 1. Deploy substrate to meet tolerance outlined in design and project outputs***	i 1. Total area of shellfish ecosystem restored – monitors habitat loss (burial) or spread (slumping)	Area (summed) of patches of living and non-living shellfish (or habitat substrate with and without live oysters) within the project footprint	Multi-beam bathymetry/field surveys and GIS	800m²	One survey post construction	TNC/ Contractors	
		i 2. Total restoration footprint – Total area of seafloor encompassing all deployed substrate	Total area of seafloor encompassing all deployed substrate (ha)	Multi-beam bathymetry/field surveys and GIS	1ha	One survey early post construction.	TNC/ Contractors	
		i 3. Total substrate deployed (t) or (m^3)	tonnes/m^3	Order and delivery dockets	400m^3	During construction	TNC/ Contractors	
GOAL 2. Within the timeframe of the project create a self-sustaining shellfish population	***OBJECTIVE 2. Demonstrate survival of target shellfish***	i 4. Survival of shellfish	Measure change against benchmark - >30%/m^2 on reef ((count live/(count live+dead))*100)	Diver surveys: shellfish metrics	30%/m^2 on reef	Before and after *S. glomerata* seeding	TNC	
		i 5. Physical conditions within tolerance ranges for target shellfish	Salinity, temperature, pH and dissolved oxygen within tolerance range of target shellfish	Water Quality Monitoring	Various	Monthly throughout project	?	

	OBJECTIVE 3. Demonstrate natural recruitment of target shellfish	i 6. Number of recruits of target shellfish increased from baseline	Measure against benchmark: % Recruitment > mortality (count/m^2)	Diver surveys: shellfish metrics; Settlement Panels	% Recruitment > mortality (count/m^2)	Before and after *S. glomerata* seeding	TNC	
	OBJECTIVE 4. Demonstrate a density of target shellfish similar to pre-defined reference system	i 7. Total shellfish deployed	Total number of individuals deployed	Data collected by Project Mgr in consult with Hatchery Mgr	TBD	Once following *S. glomerata* seeding	TNC/ Hatchery	
		i 8. Total number of live target shellfish (#/m^2).	Measure against benchmark: Density of target shellfish, on average > benchmark for the pre-defined reference system (i.e (count/m^2).	Field surveys: shellfish metrics	TBD	Before and after *S. glomerata* seeding	TNC	Mean density on remnant reefs is 300 m^2 [25]
GOAL 3. Within the timeframe of the project demonstrate the creation of habitat that benefits fish	***OBJECTIVE 5. To demonstrate more fish post ecosystem restoration***	i 9. Total biomass/abundance of fish (g.m^2 or g.m^3 /ind.m^2)	Measure against benchmark: BACI (g/m^2 or g/m^3)	RLS and/or stereo/single BRUV	Total biomass > baseline	Before and after *S. glomerata* seeding	TNC/ Rec Fishing Volunteers/DPRID	
		i 10. Abundance of recreational/ commercially important fish	Measure against benchmark: BACI (g/m^2 or g/m^3)	RLS and/or stereo/single BRUV	Biomass > baseline	Before and after *S. glomerata* seeding	TNC/ Rec Fishing Volunteers/DPRID	
GOAL 4. Within the timeframe of the project demonstrate that construction of the reef	***OBJECTIVE 6. To demonstrate an increase in biodiversity***	i 11. Richness: increased mobile epifauna richness compared to control and before monitoring (Total number of species)	Change compared to baseline and control (#/m^2)	Diver surveys: RLS; intertidal surveys; oyster baskets	Richness > control/ baseline (#/m^2)	Before and after *S. glomerata* seeding	TNC	

[25] McLeod, I. M., Boström-Einarsson, L., Creighton, C., D'Anastasi, B., Diggles, B., Dwyer, P. G., ... & McOrrie, S. (2019). Habitat value of Sydney rock oyster (Saccostrea glomerata) reefs on soft sediments. *Marine and Freshwater Research*.

enhances marine biodiversity		i 12. Benthic functional groups: Increased benthic functional diversity in contrast to control and before monitoring	Change compared to baseline and control (#/m^2)	Diver surveys: RLS; intertidal surveys; oyster baskets	Functional Groups > control/ baseline (#/m^2)	Before and after *S. glomerata* seeding	TNC	
GOAL 5. Monitor water quality to demonstrate that construction of the reef enhances marine ecological health	***OBJECTIVE 7. Explore the capacity for the developing ecosystem to reduce water turbidity***	i 13. Turbidity/susp solids around restoration site reduced	Change compared to baseline and controls for turbidity (NTU/mg.L) and water clarity (Secchi depth)	turbidity/secchi disk	Secchi depth > baseline	Monthly. Baseline and throughout project. Unlikely to see change until reef matures.	?	
Goal	**Objective**	**Performance indicator**	**Metric**	**Method**	**Planned Output**	**Frequency/Timing**	**Responsibility**	
SOCIO-ECONOMIC TARGET: To create opportunities for the local community, recreational users and businesses in the Noosa Shire through shellfish reef restoration.								
GOAL 6. Within the timeframe of the project demonstrate the benefit of shellfish reefs to local economy	***OBJECTIVE 8. To qualitatively demonstrate benefits to the local economy***	i 13. Stories/ testimonials. Qualitatively describe benefits to the local economy.	TBD	Written, recorded (audio & video) of testimonials collected by Project staff.	#stories/ testimonials / mentions	Ongoing throughout project	TNC	
	OBJECTIVE 9. To demonstrate delivery of jobs	i 14. No of local full-time jobs to deliver project	Summarise number of local jobs used in Project	Data collected by Project Mgr	>baseline	Ongoing throughout project	TNC	
		i 15. Number of local contractors engaged	Summarise number of local contractors/businesses used	Data collected by Project Mgr	>baseline	Ongoing throughout project	TNC	

		i 16. Total no. of full-time jobs within the entire project (local + national + International)	Summarise total number of FTE used in project	Data collected by Project Mgr	>baseline	Ongoing throughout project	TNC	
GOAL 7. Within the timeframe of the project engage the community in long-term stewardship of the shellfish reef	***OBJECTIVE 8. Demonstrate engagement by the local community***	i 18. Total number of community events	No of community events for the project (i.e. friends of the reef meetings, fundraisers, public information meetings, volunteer events)	Data collected by Project Mgr	> the number of planned events at the inception of the project i.e. >3 public consultation meetings	Ongoing throughout project	TNC	
		i 19. Attendees at public consultation meetings	No of attendees at public/consultative forums	Data collected by Project Mgr	>100	Ongoing throughout project	TNC	
		i 20. Community and partner organisations engaged	Number of community and partner groups engaged	Data collected by Project Mgr	> baseline	Baseline and at end of project		
	OBJECTIVE 8. Demonstrate media engagement	i 21. Media engagement	No of times the project is mentioned in the media - excludes project organisation's (projects facebook page/Twitter account) social media	Media Monitoring. Data collected by Project Mgr	>5	Ongoing throughout project	TNC	

GOAL 8. Within the timeframe of the project improve knowledge, education and practical skills in marine restoration for practitioners, users and community members	***OBJECTIVE 9. Demonstrate improved knowledge and education for individuals in marine restoration***	i 22. Improved knowledge and education for individuals and end users	Number of students (secondary, tertiary and postgraduate)	Data collected by Project Mgr	Project to set target ?		TNC	
		i 23. Improved educational resources for individuals	Number of resources available to individuals (videos, practitioner reports, academic articles, workshops, conference presentations, podcasts, infographics etc.)	Data collected by Project Mgr	Project to set target ?		TNC	
	OBJECTIVE 10. Demonstrate improved practical skills for individuals to undertake marine restoration	i 24. Individuals and end users improve practical skills in marine restoration	Number of interns or work placements	Data collected by Project Mgr	Project to set target ?		TNC	
	OBJECTIVE 10. Demonstrate involvement opportunities for community members to undertake marine restoration	i 17. Total no. of volunteers	No of community volunteers contributing to citizen science or restoration activities	Data collected by Project Mgr	20 volunteers	Ongoing throughout project	TNC	
		i 18. Volunteer hours donated	No of volunteer hours donated over project	Data collected by Project Mgr	>100 hrs	Ongoing throughout project	TNC	
Goal	**Objective**	**Performance indicator**	**Metric**	**Method**	**Planned Output**	**Frequency/Timing**	**Responsibility**	
PROJECT EFFICIENCY TARGET: To deliver the project on time and within budget and additional funding is leveraged to support project deliverables								
Goal 9. Demonstrate responsible fiscal	***OBJECTIVE 10. How has financial investment***	i 23. Total financial investment	Summarise leverage investment/co-investment include in-kind	Data collected by Project Mgr	TBD	Ongoing throughout project	TNC	

management throughout the project	***been leveraged***	leveraged (including In-kind)						
	OBJECTIVE 11. Project delivered within budget	i 24. Project outputs delivered within budget	Cumulative expenditure report, Annual progress report	Data collected by Project Mgr	TBD	8 month cumulative and annual report	TNC	
Goal 10. Demonstrate Technical Advisory input throughout the project	***OBJECTIVE 12. Demonstrate effective technical advice provided throughout project***	i 25. TAG meetings coordinated quarterly and attended by key personnel	Summarize TAG meeting details, # attendees	Data collected by Project Mgr	TBD	Quarterly	TNC	
	OBJECTIVE 13. Restore each site to meet environmental conditions set in approvals	i 26. Permit conditions met	To be determined once conditions have been set through approvals	Data collected by Project Mgr and Contractors as required	TBD	TBD in consultation with compliance officers	TNC/ Agencies/ Contractors/ Experts	
Goal 11. Demonstrate effective project management throughout project delivery	***OBJECTIVE 14. Demonstrate timely and effective project management and delivery***	i 27. No of project milestones delivered within specified timeframe	% delivered on time	Data collected by Project Mgr	Milestones delivered effectively on time	Ongoing throughout project	TNC	

Annex 2: Draft monitoring Timeline (TBC prior to pilot substrate deployment)

Monitoring Objectives	YYYY			YYYY						YYYYY		
	Jul-Aug	Sept-Oct	Nov-Dec	Jan-Feb	Mar-Apr	May-Jun	Jul-Aug	Sept-Oct	Nov-Dec	Jan-Feb	Mar-Apr	May-Jun
ECOLOGICAL TARGET: to re-establish a self-sustaining population of S. glomerata that will help create a resilient ecosysetem consisting of diverse biological communities, fish populations and their interactions.												
OBJECTIVE 1. Restore the shellfish ecosystem to meet tolerance outlined in design and project outputs												
OBJECTIVE 2. Demonstrate survival of target shellfish												
OBJECTIVE 3. Demonstrate natural recruitment of target shellfish												
OBJECTIVE 4. Demonstrate a density of target shellfish similar to pre-defined reference system												
OBJECTIVE 5. To demonstrate more fish post restoration												
OBJECTIVE 6. To demonstrate an increase in biodiversity												
SOCIO-ECONOMIC TARGET: To create opportunities for the local community, recreational users and businesses in the Noosa Shire through shellfish restoration restoration.												
OBJECTIVE 7. To demonstrate benefits to the local economy, recreational fishers and the community												
OBJECTIVE 8. Demonstrate engagement by the local community												
PROJECT EFFICIENCY TARGET: To deliver the project on time, within budget and funding is leveraged to support project deliverables												
OBJECTIVE 9. How has financial investment been leveraged												
OBJECTIVE 10. Project delivered within budget												
OBJECTIVE 11. Demonstrate effective technical advice provided throughout project												
OBJECTIVE 12. Restore the sites to meet environmental conditions set in approvals												
OBJECTIVE 13. Demonstrate timely and effective project management and delivery												

Annex 3: Monitoring methods: Ecological

An overview of monitoring methods deployed in the TNC's shellfish restoration program is provided below together with the associated key performance indicators. The monitoring methods described here are adapted from the *Shellfish Habitat Restoration Monitoring and Assessment Handbook*[26]. Some methods may be adapted, or omitted, as practically and efficiency demands.

Mapping restoration sites and monitoring sampling sites

Method: Multi-beam sonar

To map the dimensions, bathymetry monitoring area of subtidal shellfish restoration sites, multibeam sonar is often used. Using this method, a multibeam sonar 'towfish' is deployed from a vessel and transects are run in a grid pattern over the potential, or pre-determined restoration site/s. Echo soundings using multibeam sonar is are accurate to 0.1 m. The survey grid is provided in ASCII format to Chart Datum at both 5 m and 25 m grid spacings, or is determined using one of the following formulas:

Side-scan Sonar Lane width = Range – (Altitude + Overlap)

Altitude is the altitude (height) of the 'towfish' scanning unit above the seafloor (this would be a value equal to 10% of the range), and overlap is the desired overlap between lanes (overlap of 10%).

Multi-beam Sonar Lane width = Total Range – Overlap

The total range is determined by the frequency used (generally 3 times the water depth but check manufacturer's specifications) and desired overlap is ideally 10 percent of the total swath width).

The results of the scans are then presented for interpretation.

Method: aerial/satellite imagery/GPS

For mapping the total area and monitoring areas of shallow-subtidal and intertidal restoration sites, multi-beam sonar is not a practical survey method. Instead, aerial/satellite imagery or drones and a GIS are employed. Alternately, for intertidal/shallow subtidal sites, the edge of the reef can be walked around using a handheld GPS logging the track and the area can be calculated by the internal area of the track.

Determining shellfish restoration impact by area

Method: Physical measurement

The vertical growth of the shellfish ecosystem can be measured by periodically placing a ruler (or meter stick or graduated rod) vertically on the site, with careful contact at the sediment surface, and then using another ruler (or other thin, flat, rigid object) to lie horizontally on top of the shell and against the stick to make the height observation. The average of these measurements is taken to determine the mean height.

Key Performance Indicators

i1. Total area of restoration substrate deployed (m^3) – Total area of patches/rows of substrate, with and without live oysters, deployed within the project footprint.

i2. Total restoration footprint (m^3) – Total area of seafloor encompassing all substrates deployed in a given restoration site and/or all sites throught the estuary.

i3. Total restoration substrate deployed (t) or (m^3) – As deterined by the quantity of substrate, usually rubble/rock + dried oyster shell + spat on shell + adult oysters (or combinations thereof) that is deployed from the vessel, or set on the seabed at a given restoration site, or deployed across all restoration sites.

[26] The Nature Conservancy et al, Oyster Habitat Restoration Monitoring and Assessment Handbook

Measuring shellfish survivorship and growth (Shellfish metrics)

Shellfish restoration, in this project, primarily relies on the natural recruitment of rock oyster spat onto the restoration substrate. Scientists have determined that the Noosa River estuary is primarily 'substrate limited', meaning there is insufficient substrate, of suitable configurations and locations, in the estuary, on which can settle, bind together and form self-sustaining shellfish ecosystems.

Fortunately, surveys indicate that there in sufficient numbers of rock oysters growing individually, or in small clusters, in the estuary to provide oyster 'spat', or juvenile oysters, to colonise the restoration substrates deployed by the project.

Relying exclusively on natural oyster spat recruitment, and growth, on the restoration substrate, however, would be risky. Rock oysters face many recruitment limitations in the estuary. Rock oysters spawn seasonally, and the quantity of spat released into the estuary can vary significantly between seasons. High suspended sediment loads in the estuary readily smother juvenile oysters, causing high mortalities of settled individuals.

Other oyster and non-oyster species, including pearl oysters, hairy mussels and fast-growing macroalgae, readily settle on the same substrates as rock oysters, thus providing direct competition for colonization space. These other rapid colonizers do not in themselves create the vertical relief, and habitat complexity, that rock oysters provide.

Pathogens, which infest and kill oysters are also ever present in the estuary sediments, and a multitude of vertebrates and invertebrates, from stingrays to finfish, shorebirds to gastropods, predate directly on oysters.

These limitations have collectively prevented the natural restoration of shellfish ecosystems in the Noosa River estuary to date, so restoration efforts must augment the natural recruitment and growth of oysters and associated species.

In response, it is often necessary for the project to seed the restoration sites with live adult and/or juvenile oysters. Juvenile oysters may be settled onto shell in a hatchery. Adult oysters may be translocated from oyster growing areas, as individual oysters or 'clumps', and set on the restoration substrate using direct hand-setting or vessel deployment techniques.

Method: Hatchery-produced juvenile oysters

For hatchery-produced live oysters, destined for restoration deployment, an initial average density of juvenile oysters (spat) is calculated by the hatchery by counting how many spat have settled onto 50 individual shell 'culch' (dried, sterile oyster shell put in a tank for the purpose of spat settlement). This count gives an estimated total number of total individual juveniles will be deployed onto the restoration substrate from the hatchery-cultured oyster batch. These estimates of 'live spat on shell', are provided pre-deployment to monitor the impact of translocation on oyster survivorship.

Method: Translocation of adult oysters

Where aquaculture-produced rock oysters have been grown out to adult size, these may be available locally, from hatcheries or oyster farms. These need to be collect, in a timely manner, housed in suitable transport containers and translocated to the restoration site in a timely way to minimize stress and mortality. Individual oysters, and even clumps of oysters may be scattered onto the restoration substrate from a vessel, or laid, by hand, by suitability qualified divers, or through placing the oysters onto the substrate, again by hand, at low tide.

At the time of collection, a sample of oysters are counted, or weighted, and the total number, or weight of the oysters, to be used in the restoration effort determined. This counting allows for survivorship post deployment to be measured and reported. The precise locations where adult oysters are set on each site may be determined using GPS coordinates and digital mapping software.

Method: Survivability and Growth - In-water sampling

Shellfish are collected by sampling two transects per site with five quadrats (0.25 m^2) on each side of the transect line (i.e. 10 quadrats per transect).

During sampling, divers collected all bivalve shellfish within the quadrat area. If the shellfish were on hard substrate, divers collected 10 cm into the substrate. All shellfish are placed into mesh collection bags and are carefully checked. The mesh collection bags are attached to the shotline and pulled to the surface for measurement on the research vessel or nearby shoreline.

Using calipers, shellfish are measured for height (the distance from the hinge axis to the distal margin of the shell), length (the distance from left and right distal margins) and width (thickness of both valves) to the nearest millimetre (see Figure 1). Oysters are returned to the restoration substrate after sampling. Oyster density is calculated by Equation 1. Twenty adult oysters (≥2 years old) per transect are shucked and visually assessed for gravid condition for each survey.

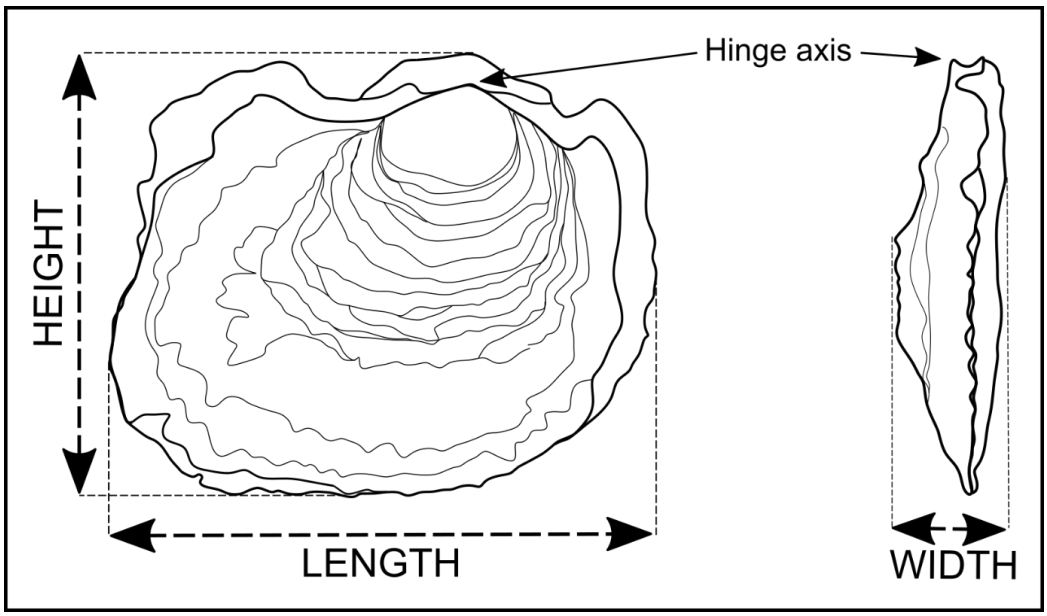


Figure 1: Measurement guide for bivalve shellfish

Key Performance Indicators

i4 Survival of shellfish – The percentage of live shellfish per m^2. If survival is ≥ the number of dead shellfish then the population is stable or growing

Equation 1: $shellfish.m^2 = (shellfish\ per.0.25m^2) * 4$
Equation 2: $Shellfish_i = mean\ shellfish\ per\ m^2 * area\ of\ reef(m^2)$
Equation 3. $Percent\ survival = \left(\frac{Live\ shellfish.m^2}{Live+dead\ shellfish.m^2}\right) * 100$

i5. Physical conditions within tolerance ranges for target shellfish

i6. Number of recruits increased from baseline – Count of recruits per m^2. Recruits are either counted in situ or defined as oyster <10mm. If recruitment is greater than the number of dead shellfish, then the population is being maintained by natural recruitment.

i7. Total shellfish deployed

i8 Density of live shellfish – the number of live shellfish, including recruits, per m^2. The mean density (Equation 1) of live oysters provides a measure when compared to the benchmark of 50 shellfish per m^2 that defines a viable population density similar to that found on natural oyster reefs (Gillies et al. 2017).

Measuring natural oyster recruitment

Method: Settlement Panels

Settlement panels units constructed, as per Figure 2, are deployed to monitor rates, and composition, of spatfall and recruitment of oysters onto the restoration substrate. Settlement panel units are deployed at both impact and control sites. The panels are initially deployed and then replaced twice through the spawning season.

The plates may be inspected in water or above water, as described below:

Sampling in-water

1. Label the bags according to their location – Northern most block = 1, Highest pole = High
2. Navigate to the plates, take photos as you approach the plates
3. Move on any large mobile critters off the plates (e.g. urchins, fish)
4. Snip the cable tie at the top and ease plate assemblage off the pole
5. Gently place the plate assemblage into the labelled bag with the top of the plate facing the labelled side of the bag
6. Close bag, place in catch bag and continue sampling until finished

Sampling above-water

1. Take the plates out in the order shown on the data sheet
2. Place them right way up
3. Keeping both plates in the same orientation, place them side by side
4. Place a label by the plate noting site, orientation and height, photograph the panel and label for both sides of each panel.
5. Examine it for oysters and mussels and measure and record note the species and the lengths on the data sheet
6. Repeat the steps above working through all the plates

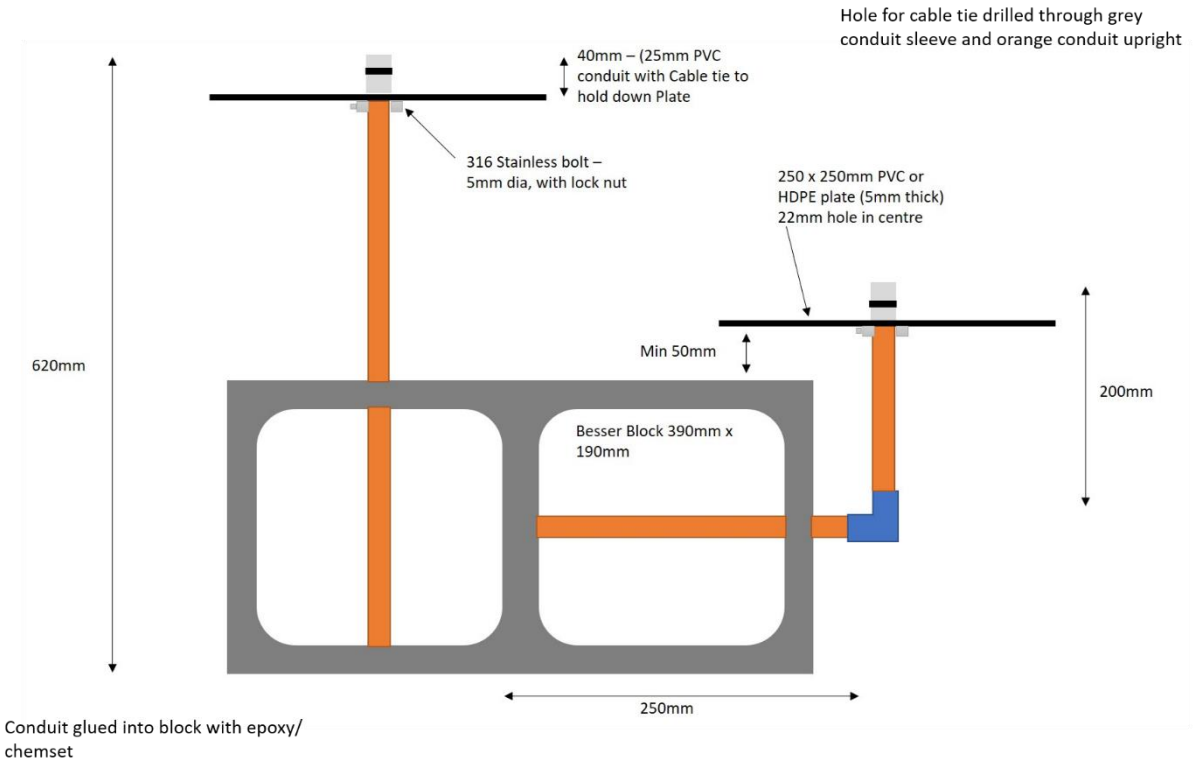


Figure 2: Diagram of settlement panel unit

Monitoring species interactions with restoration sites

Method: Reef life survey

Visual census techniques provide an effective, non-destructive way to monitor species, which inhabit or visit the restoration sites because large amounts of data on a broad range of species can be collected within a short dive period, with little post-processing time required.

The surveys include visual observations of mobile fish, cryptic fish, mobile epifauna, encrusting invertebrates, algae and benthic substrate.

The method is based on the *Reef Life Survey* approach and includes:

- Fishes to be surveyed in two 5m wide by 5m high "blocks" parallel along 40m transects at each site.
- Invertebrates and cryptic fishes to be surveyed in two 1m wide "blocks" on either side of the transect line.

  Photo Quadrats: Digital photo-quadrats (~30cm of substrate) are taken at 2.5 m intervals along the transect line for algae, sessile invertebrates and benthic substrate (e.g. sand and seagrass).

For detailed Reef Life Survey methodology see (https://reeflifesurvey.com/reef-life-survey/about-rls/methods/)

Additionally, fish biomass is calculated by using a and b from the Length-Weight relationship of specific species from Fishbase (http://www.fishbase.org/search.php).

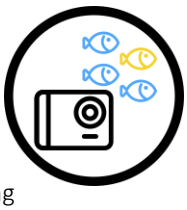
Key Performance Indicators

i9. Total biomass/abundance of fish (g.m2 or g.m3 /ind.m2) – Total biomass of the fish assemblage over the area of survey.

i10. Abundance of recreational/ commercially important fish – Biomass of species of fish that are of interest to fishers (Snapper, King George Whiting, Flathead).

i11. Richness: increased mobile epifauna richness compared to control and before monitoring (Total number of species) – Count of species found on the reef; a key measure of biodiversity.

i12. Benthic functional groups: Increased benthic functional diversity in contrast to control and before monitoring – Increased benthic functional diversity in contrast to control and before monitoring



Method: Baited/ remote underwater video system (B/RUVS)

Baited/ Remote Underwater Video Systems (B/RUVS) are temporary stationary, seafloor camera stations that use either bait (to attract the fish in their vicinity) or no bait and record species that are utilising the habitat in the vicinity. Unbaited RUVs are useful in estuarine systems where multiple structured habitats are in close vicinity (i.e. mangroves, seagrass and shellfish reefs) this ensures that the fish observed in the videos are from the habitat that is being samples and not being attracted from other nearby habitats using bait. B/RUVs can be used as single or stereo BRUVs i.e. using one or two cameras. Stereo BRUVs give the added benefit of being able to accurately measure the length of fish from video.

Utilising B/RUVS for sampling provides:

- Precise length measurements and therefore biomass estimates with analysis of paired images when cameras are used in stereo-pairs.
- Recording of detailed images of habitat types, which can be incorporated into the analysis.

- Capture of information on recreationally important species and large, mobile animals such as sharks, rays and sea snakes, that normally avoid scuba divers or towed video cameras.

BRUVS

Single or stereo-BRUVS will be deployed at each monitoring site with a soak time of 60-minute periods to quantify differences in fish abundances, species and sizes (if stereo-BRUVs are used). Nominally, BRUV drops should be separated by >200 m radius from the camera (if deployed at the same time) to ensure independence of sampling due to the bait plume. For national recommended BRUV sampling methods see:

https://www.nespmarine.edu.au/sites/default/files/FieldManuals_NESPMarineHub_Chapter5_BRUV_v1.pdf

RUVS

Single RUVS will be deployed at each site concurrently in all structured habitats requiring monitoring for 1 hour and 25 minutes at high tide. At each site, the targeted habitats (e.g. restored and remnant shellfish ecosystems, seagrass meadows, mangroves and bare sediment) need to be adjacent to each other with the whole study site ranging from 0.5 to 1 km^2 a minimum distance between habitats of 20 - 50 m should be maintained. If undertaking multiple camera drops within a habitat a minimum distance of 5 m should be maintained to ensure independence. Cameras are deployed (looking away from the sun) 1 m away from and facing the targeted habitat. Visibility can be measured by a visibility meter at each site and habitat to ensure similar visibility between sampling locations.

The video footage will be analysed using SeaGIS EventMeasure (see http://www.seagis.com.au/event.html). In video analysis, overestimates of abundance can occur through double counting fish. This occurs when the same individual/s are viewed at different time points throughout a deployment. To overcome this, counts of the maximum number (MaxN) of individuals of any one species seen over the recording period are used[27].

Key Performance Indicators

i9. Total biomass/abundance of fish (g.m2 or g.m3 /ind.m2) – Total biomass of the fish assemblage over the area of survey.

i10. Abundance of recreational/ commercially important fish – Biomass of species of fish that are of interest to fishers (Snapper, King George Whiting, Flathead).

i11. Richness: increased mobile epifauna richness compared to control and before monitoring (Total number of species) – Count of species found on the restoration site; a key measure of biodiversity.

[27] Langlois T, Williams J, Monk J, Bouchet P, Currey L, Goetze J, Harasti D, Huveneers C, Ierodiaconou D, Malcolm H, Whitmarsh S. 2018. Marine sampling field manual for benthic stereo BRUVS (Baited Remote Underwater Videos). In Field Manuals for Marine Sampling to Monitor Australian Waters, Przeslawski R, Foster S (Eds). National Environmental Science Programme (NESP). pp. 82-104.

Annex 4: Monitoring methods: socio-economic

Where relevant, surveys and/or semi-structured interviews are used to collect information of the social and economic benefits of restoration activities and level of community satisfaction with the project.

Surveys/interviews investigate:
1. Community awareness of the restoration project
2. Community use of the restoration sites
3. Community satisfaction with the restoration project
4. Demographics and motivators of respondents

Method: Social-response surveys

In-person interviews with key stakeholders are undertaken to gain feedback and to ascertain overall support for restoration efforts. Online surveys may be used to access some groups and/or give to all contractors, involved in the restoration works, to record the total number of people and hours worked on the project. The economic and social impacts of the restoration works in terms of job creation, volunteers, community attendance at events/meetings, are also be collected and reported. Media presence of the project is also tracked and reported.

Key Performance Indicators

i14. Stories/ testimonials. Qualitatively describe benefits to the community

i15. No of local full-time jobs to deliver project

i16. Number of local contractors engaged

i17. Total no. of full-time jobs within the entire project (local + national + International)

i18. Total number of community events

i20. Community and partner organizations engaged

i21. Media engagement

i22. Improved knowledge and education for individuals and end users

i23. Improved educational resources for individuals

i24. Individuals and end users improve practical skills in marine restoration
i25. Total no. of volunteers

i26. Volunteer hours donated

Purpose: Why are we collecting the data?

The project collects key data to:

- Demonstrate the importance and value of shellfish restoration, resources and services to the general public, stakeholder groups and decision-makers, which can help generate greater support for shellfish restoration programs.
- To measure the effectiveness of shellfish restoration in achieving its socio-economic target, goals and objectives.
- To gather public views and perceptions to support adaptive management and improve the way shellfish restoration sites are managed in the future.
- To assess the positive and negative impacts of management measures
- To build stakeholder participation and awareness of the project's objectives
- To identify threats, problems, solutions and opportunities

Annex 5: Six-monthly report card template

Bring Back the Fish

Restoration and conservation of shellfish reefs in the Noosa Estuary

Six month Report Card

Date

Project overview:

Summary text here….

Overview of progress against deliverables:

Summary text here….

Overview of unforeseen issues arising and project adaptation:

Summary text here….

Project outcomes and media completed since last report:

Summary text here….

Anticipated upcoming media and events:

Summary text here….

Detailed tracking:

Summary text here….

Deliverables	Measurable outcomes	Tracking	Progress and notes
(A1.1) Hiring of full time Project Manager and allocation of TNC and NSC support staff to the project	• PM in place		
(A1.2) Delivery of Project Plan (this Plan), communication plan, and risk assessment(s)	• Project Plan completed and endorsed • Comms Plan completed and endorsed • Monitoring and Evaluation Plan completed and endorsed		
(A1.3) Establishment of a Project Technical Advisory Group for reef restoration and associated activities	• TAG in place • Evidence of Kabi Kabi engagement		
(A1.4) Participation and delivery of public education and engagement forums and media statements	• community engagement forums • 3 media statements released		
(A1.5) Annual and six-monthly project reporting	• 3 six monthly status updates • 3 annual reports		
(A2.1) Shellfish restoration suitability model incorporating physical parameters of oysters and public and industry usage, access etc. to identify priority sites for restoration.	• Shellfish restoration suitability model which incorporates industry, Kabi Kabi and public interests.		
(A2.2) Obtain necessary State Government permits/authorities including particular resource allocation	• All relevant permits secured		

authority, for shellfish ecosystem restoration		
(A2.3) Community, industry and stakeholder consultation sufficient to gain majority support for shellfish restoration locations.	• Records of public and stakeholder consultation, including one-on-one meetings, open forums, media, etc.	
(A3.1) Community, industry and stakeholder consultation to identify most appropriate community volunteering opportunities (e.g. shell recycling, oyster gardens, oyster watch, video monitoring).	• Records of public and stakeholder consultation, including one-on-one meetings, open forums, media, etc.	
(A3.2) Establish at least one community volunteering program identified from the above process which takes into account current and future resources, management and interest.	• Record of volunteer hours dedicated to community volunteering programs, such as: shell recycling, oyster gardens, oyster watch, video monitoring.	
(A4.1) Restoration at two sites (approx. 40m-50m shore length per site) which test reef substrate, configuration and deployment and oyster growth and survival.	• At least two (2) sites with at least overall 80 m shore length of oyster ecosystem restored, and being actively monitored.	
(A4.2) Restoration across multiple further sites, as determined by restoration suitability	• In addition to the two initial sites, a number of sites comprising a minimum of a	

modelling and outcomes of community consultation.		further aggregated 600m^2 surface area of restored shellfish ecosystem in the Noosa River estuary.
(A5.1) Run workshop with Noosa Council to identify ongoing focus areas for TNC support.	•	Workshop completed.
*(A5.2) Provide technical/peer review on minimum five plans/reports/studies if requested by Noosa Council.	•	Minimum 5 peer review reports completed during the three-year term of this Agreement, if requested by Noosa Council. If Noosa Council requests a peer review, TNC will provide a minimum of 3 experts who are qualified in the relevant area of expertise for Noosa Council consideration and Noosa Council's acceptance of 1 expert for the peer review.
*(A5.3) Facilitate a minimum of three study tours of relevant sites in line with objectives and scope of the program in Australia/US if requested by Noosa Council (flights and incidentals covered separately by Noosa Council, accommodation and	•	Minimum three study tours completed during the three year term of this Agreement, if requested by Noosa Council.

in country travel covered by this Grant).		
*(A5.4) Review and feasibility of opportunities for sustainable commercial and recreational fishing management options for the Noosa River.	• Conservation Action Plan and Community Workshops completed as required.	
*(A5.5) Facilitate access to TNC conservation networks and researchers if requested by Noosa Council.	• A number of new contacts/networks to assist Noosa Council with ongoing and future marine conservation activities.	
(A5.6) Promote Noosa Council's Noosa River Plan and shellfish restoration project in at least one national and one international conference.	• Presentation to at least one national and one international conference.	
(A5.7) Promote Noosa Council's Noosa River Plan and shellfish restoration project to corporate, philanthropic and state/federal government audiences to establish further support for conservation activities that support the Noosa River Plan	• A number of new corporate/ government/ philanthropic alliances and new in-kind support/financial funding contributions.	
(A5.8) Assess feasibility of seagrass restoration in Lake Cooroibah as a method of reducing sediment resuspension and	• Habitat mapping report, restoration suitability model, PhD study or similar	

increasing
invertebrate
biodiversity

Summary of financial expenditure:

Summary text here….