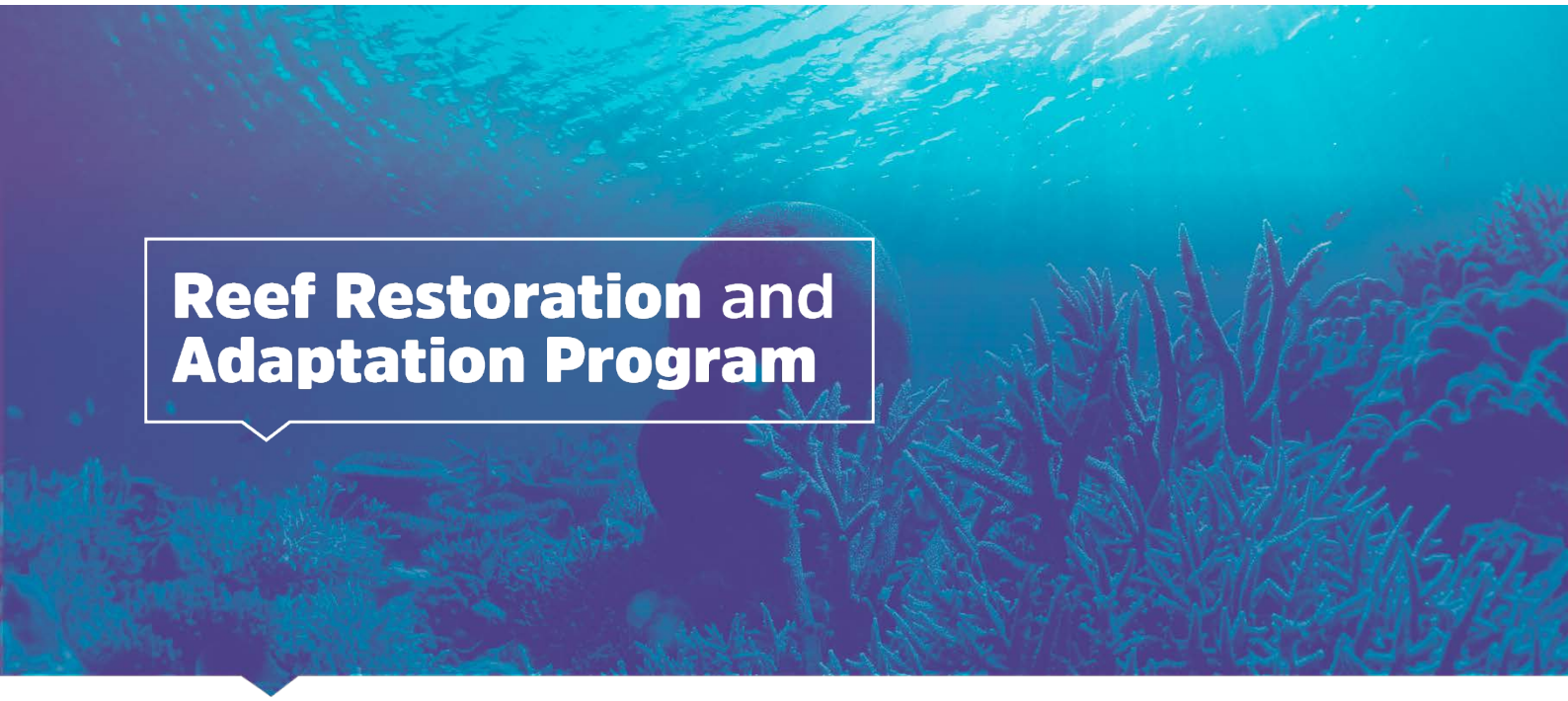

R5: INTERNATIONAL ENGAGEMENT AND PARTNERING

A report provided to the Australian Government by the Reef Restoration and Adaptation Program

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Disclaimer

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1. PREAMBLE

The Great Barrier Reef

Visible from outer space, the Great Barrier Reef is the world's largest living structure and one of the seven natural wonders of the world, with more than 600 coral species and 1600 types of fish. The Reef is of deep cultural value and an important part of Australia's national identity. It underpins industries such as tourism and fishing, contributing more than $6 billion a year to the economy and supporting an estimated 64,000 jobs.

Why does the Reef need help?

Despite being one of the best-managed coral reef ecosystems in the world, there is broad scientific consensus that the long-term survival of the Great Barrier Reef is under threat from climate change. This includes increasing sea temperatures leading to coral bleaching, ocean acidification and increasingly frequent and severe weather events. In addition to strong global action to reduce carbon emissions and continued management of local pressures, bold action is needed. Important decisions need to be made about priorities and acceptable risk. Resulting actions must be understood and co-designed by Traditional Owners, Reef stakeholders and the broader community.

What is the Reef Restoration and Adaptation Program?

The Reef Restoration and Adaptation Program (RRAP) is a collaboration of Australia's leading experts aiming to create a suite of innovative and targeted measures to help preserve and restore the Great Barrier Reef. These interventions must have strong potential for positive impact, be socially and culturally acceptable, ecologically sound, ethically and financially responsible. They would be implemented if, when and where it is decided action is needed, and only after rigorous assessment and testing.

RRAP is the largest, most comprehensive program of its type in the world; a collaboration of leading experts in reef ecology, water and land management, engineering, innovation and social sciences, drawing on the full breadth of Australian expertise and that from around the world. It aims to strike a balance between minimising risk and maximising opportunity to save Reef species and values.

RRAP is working with Traditional Owners and groups with a stake in the Reef, as well as the general public, to discuss why these actions are needed and to better understand how these groups see the risks and benefits of proposed interventions. This will help inform planning and prioritisation to ensure the proposed actions meet community expectations. Coral bleaching is a global issue. The resulting reef restoration technology could be shared for use in other coral reefs worldwide, helping to build Australia's international reputation for innovation.

The $6M RRAP Concept Feasibility Study identified and prioritised research and development to begin from 2019. The Australian Government allocated a further $100M for reef restoration and adaptation science as part of the $443.3M Reef Trust Partnership, through the Great Barrier Reef Foundation, announced in the 2018 Budget. This funding, over five years, will build on the work of the concept feasibility study. RRAP is being progressed by a partnership that includes the Australian Institute of Marine Science, CSIRO, the Great Barrier Reef Foundation, James Cook University, The University of Queensland, Queensland University of Technology, the Great Barrier Reef Marine Park Authority as well as researchers and experts from other organisations.

2. EXECUTIVE SUMMARY

Coral reef restoration is a global challenge. During 2018, two international conferences[1] were dedicated to addressing this challenge, with several hundred scientists, managers and practitioners engaged in discussions and workshops. The urgency is real and the desire to make a difference is strong.

The Australian Government's $100M investment in reef restoration and adaptation science, through the Reef Trust Partnership, is the single largest investment in this area, putting Australia at the forefront of the global challenge. However, Australia cannot do this alone. It is a challenge that will need broad investment and the combined experience and knowledge of the global community. Australia has an imperative and a responsibility to collaborate with the global community. We need to share our findings, and recognise the existing global efforts by building on, and adding value to, existing structures, collaborations and efforts.

This report summarises a strategy to increase global investment in this challenge and foster better coordination and international collaboration around a broad suite of restoration science, training and implementation activities.

Based on extensive consultation with key international partners, including the National Oceanic and Atmospheric Agency (NOAA), The Nature Conservancy, the Reef Resilience Network, the Coral Restoration Consortium and many international scientists, the following strategies are recommended:

1. Establish an Australian partnership with the Coral Restoration Consortium/Reef Resilience Network to facilitate best practice and research exchange and commence globalisation of the Coral Restoration Consortium.

2. Encourage international governments, through Australia's role as co-chair of the International Coral Reef Initiative (ICRI), to invest in research and development (R&D) programs in their countries, enabling international researchers to collaborate and engage with the work progressing in Australia. This includes establishing an ICRI working group in 2019 to explore areas of common R&D need and opportunities for collaboration.

3. Target international and domestic philanthropy and industry with co-investment opportunities.

4. Engage with, and guide, global challenge and prize initiatives in coral reef restoration, to encourage innovation and collaboration and leverage the Australian Government funding.

Bilateral action is best achieved through Australia's current co-chair role in ICRI. Targeted domestic and international philanthropy and fundraising are existing commitments by the Great Barrier Reef Foundation.

The investment required to realise this strategy relates to establishing a dedicated Australian node of the Coral Restoration Consortium/Reef Resilience Network and the ICRI bilateral development activities.

[1] Great Barrier Reef Restoration Symposium 2018, a collaboration between the Tropical Water Quality Hub of the Australian Government's National Environmental Science Program and RRAP and Reef Futures 2018, convened by the Coral Restoration Consortium.

3. INTRODUCTION

The Australian Government's $100M investment in reef restoration and adaptation science makes the Reef Restoration and Adaptation Program (RRAP) the largest single effort in the world addressing the challenges of reef restoration and adaptation. This investment will build on the outcomes of the $6M RRAP Concept Feasibility Program, to ensure a well-coordinated, multi-institutional approach.

Being the largest, concerted investment in reef restoration in the world, it also has the potential to have a significant global impact and put Australia at the forefront of coral reef restoration. To maximise this impact, and ensure Australia is fulfilling its role as a global leader, it is important to consider ways to engage globally, learn from international best practice and facilitate and promote nationally- and globally collaborative efforts. It is proposed this can be achieved through international partnerships, consortia and funding structures.

3.1 Objective

This report is focused on fostering better international coordination and collaboration around a broad suite of restoration science, training and implementation. It provides a concept to improve global coordination and collaboration in reef restoration. It considers aspects ranging from the need to better coordinate existing programs and share best practice, to catalysing investment in R&D and progressing a step-change to significantly increase scale and cost-effectiveness.

4. ANALYSIS AND FINDINGS

Most of the current projects, programs and initiatives focused on reef restoration or reef resilience and adaptation fall into one or more of the following three categories:

- Research and development
- Best practice and training
- Implementation or deployment.

Key to all three is a need to improve international collaboration and coordination. Findings by an expert committee for the US National Academies of Sciences, Engineering and Medicine, *Interventions to Increase the Resilience of Coral Reefs*, also note the need for better international coordination of efforts in both R&D as well as the sharing of best practice.

4.1 Research and development

An increasing number of reef scientists and research groups worldwide are focusing on aspects of reef restoration and adaptation. Australia is already at the forefront of a lot of this research. Examples of research areas where active collaboration between Australian and international partners is actively occurring include:

- Improved access to genetic and reproductive material year-round (Craggs Research Group, Horniman Aquarium; Hagedorn Research Group, Smithsonian Institute; Albright Research Group, Californian Academy of Sciences).

- Genetics and functional genomics to improve stress tolerance and ensure viable genetic diversity in restoration programs (Baker Research Group and Taylor-Knowles Research Group at University of Miami; Palumbi Research Group at Stanford University; Baums Research Group at Pennsylvania State University; Voolstra and Aranda Research Group at KAUST).
- Adaptation and improved health through adjustments to associated microbes (Voolstra and Aranda Research Group at KAUST, Peixoto Research Group at Federal University of Rio de Janeiro, Vega-Thurber at Oregon State University).
- Development of settlement surfaces for coral larvae to improve recruitment and survival (SECORE, Mars Foundation).
- Remote sensing to improve large-scale monitoring and underpin decision-support models (Asna Research Group, Arizona State University; The Nature Conservancy).

We have advanced our understanding of how to best grow corals and manipulate genes and associated microbes, improved our models and data relating to reef connectivity and sequenced the genomes of close to a dozen coral species. There is, however, a continued need to mobilise more research efforts towards key knowledge and technology gaps.

Currently, most international research is focused on incrementally improving existing methods, despite the fundamental scale and cost limitations inherent to many of these methods. Investment in new delivery methods that are more readily scalable is limited, with even less investment in developing the required engineering systems. An increased effort in these areas is essential for future success. It will require new skillsets and capability from outside the traditional reef restoration community. Internationally, there is significant untapped capability. The challenge is to mobilise capacity to work with international and Australian scientists and engineers. For example, the US Army Corps of Engineers is the lead agency restoring America's Everglades. This is the most expensive and comprehensive environmental repair attempt in history. While different from the Great Barrier Reef context, it illustrates the new type of capability required to meet the global coral reef challenge.

4.2 Best practice, capacity building and training

Incorporating recent scientific and/or practical findings into best practice and training is an important consideration moving forward. Organisations such as Reef Ecologic, Reef Restoration Foundation and the Mars Foundation are already producing materials specifically for the Great Barrier Reef. Indeed, it is very clear that with increasing interest and focus on coral reef restoration, a plethora of 'best practice' manuals and tutorials have and are being produced worldwide, each with a slightly different focus, scope or need. However, many of these efforts are short-term, under-resourced and will quickly become redundant unless they are developed and resourced to be 'living documents', i.e. have the capacity and resourcing to be updated as more information and knowledge becomes available.

While best practice and training is often highly location- and needs-specific, some common overarching concepts could be more effectively coordinated. For example, more transparent and consistent processes and criteria to monitor and evaluate reef health and related impacts and improvements are required to provide a common understanding and language.

There are obvious benefits to consolidating training and global best practice material in a single location, where they remain accessible, visible and, most importantly, maintained and controlled

for quality and rigour. Organisations such as the Coral Restoration Consortium (which is now a chapter under the International Coral Reef Society) and the Reef Resilience Network (hosted under The Nature Conservancy in the US) have good structures to implement such coordination and management. However, these organisations and networks need increased resources to do so and would benefit from regional nodes to increase reach and capacity. Great Barrier Reef-specific needs and requirements could be nested under this proposed structure, through the establishment of an Australian partnership with the Coral Restoration Consortium.

4.3 Implementation and deployment – considerations of scale

Achieving increased scale of coral reef restoration requires major resourcing and step-change, which is clearly articulated in the RRAP Concept Feasibility Program reports and recommendations. It requires interventions with delivery methods designed to be logistically feasible and cost-effective at a large scale.

Internationally, the challenge is to get past the point where substantial investment only occurs after it is proven that restoration can be done at scale and to increase awareness that reef restoration is of economic and national interest. At this point, Australia is the only country committed to investing in assessing and developing new interventions to 'proof-of-concept'. Hopefully, we will be the catalyst for other, well-resourced countries to follow.

It is noted, however, that most countries with coral reefs do not have the capacity to mobilise this level of funding. It is increasingly important that countries such as Australia take the lead and develop technologies to the point where they have the potential to develop into a sustainable industry, to augment and encourage further government investment. It is also increasingly important that restoration program design considers best practice and contributes findings to address key information and technology gaps.

4.4 Funding

Global funding (and foundational resourcing) is limited and highly fragmented, which, to date, has made it difficult to progress significant scale and impact improvements to reef restoration. A lack of investment in large-scale projects, due to a perceived risk of failure, is a common challenge hampering the progress of most ecosystem science and conservation programs.

To resolve this fragmentation, and increase investment, a structured approach that recognises the different types of funding is required. Broadly speaking, investment requirements can be split into three categories:

A. **R&D global priorities:** Areas where there is a broad (often global) need for R&D. For example, the fundamental research to better understand genetics and bleaching tolerance.

B. **R&D local priorities:** R&D required for interventions to be deployed locally. For example, taking the fundamental genetics understanding described above, which may have been undertaken via a global consortium, and applying it to Great Barrier Reef species and testing the outcomes or developing interventions and associated delivery methods that are location-context-specific (such as the targeted scale and extent of access to industrial capability).

C. **Deployment:** Funding the deployment of interventions at the targeted scales.

From a Great Barrier Reef perspective, types b) and c) are an Australian responsibility; however, there is significant potential to refine and develop partnerships to address areas of common global need.

The global nature of the issues being addressed by RRAP, and associated reef programs in other countries, and the anticipated transferability of outcomes, opens the possibility of international funding models to promote global partnering and to address common priorities. Funding can be considered in many ways, from the traditional donor model, which includes philanthropy, corporate donations, development aid and large government grants, to some of the emerging trends in areas such as re-insurance and user-pays schemes.

Regardless of source, there is a strong interest among all groups to ensure funds are allocated where they have the biggest impact and the best chance of leverage and co-investment. Key to progressing this is developing a global strategy and setting out a process to identify and agree on priority reef restoration research, development, training and implementation needs. Realising this vision remains a major challenge and requires strong leadership, ideally by global organisations such as ICRI and International Coral Reef Society.

Extensive engagement with US-based philanthropies, including the Paul Allen Foundation and the Zuckerberg-Chang Initiative, has confirmed an interest in funding such internationally-endorsed ‘priority projects’. They also expressed interest in funding the more innovative and technological ideas, such as cryo-preservation/genetics, assisted evolution, genetic function, genes of interest and gene transformation. However, it is difficult to unite donors in a shared goal or larger vision. Most prefer to offer smaller grants to groups they are used to working with, retaining their freedom to choose programs and their visibility as a major donor. A potential circuit breaker would be a coordinated, highly visible proposal by researchers already funded by some of these donors, where there are clear benefits in joining forces. The consortium progressing coral genetics programs is a good example.

A successful global effort will need to be underpinned by robust resource mobilisation from public and private sectors, including novel sustainable funding mechanisms and facilitating political will and public awareness and support. Achieving this would require improved coordination and collaboration between large program efforts; promotion and efficient use of large funding opportunities; improved visibility of reef programs; and development of large, collaborative and impactful global efforts. The $100M investment by the Australian Government will position RRAP as the uniting and catalysing coordinator.

By articulating a bold vision, with adequate resources, it is possible to catalyse a ‘call to action’ for a new form of reef restoration movement. Through its coordinated and multi-institutional vision, RRAP has the capacity to act on the need to form global consortia around key R&D programs. This would ensure a more coordinated, better-resourced and outcomes-based program of work. It would not be limited to fundraising from philanthropy and corporate partners but would include encouraging other governments to match the Australian investment. International government investment would enable researchers to not only focus on delivering new interventions and delivery methods for their local context but provide the resources to partner in addressing areas of global R&D priority.

Finally, it is worth noting that many major prize and challenge organisations, such as XPRIZE and Conservation Xlabs, are looking to bring innovation and novel thinking to coral restoration. As part of its fundraising focus, the Great Barrier Reef Foundation proposes to actively engage with and co-fund (where appropriate) these efforts, when they align with the articulated goals and objectives of RRAP or when there is potential to direct these efforts towards mutually beneficial outcomes. The current XPRIZE 'Saving Coral Reefs' is an excellent example of investment in a global effort that could be used as a catalyst to encourage collaboration among science, technology, implementation and best practice.

5. RECOMMENDED STRATEGY

The proposed International Engagement and Partnering strategy recommends:

- Establishing an Australian partnership with the Coral Restoration Consortium/Reef Resilience Network to help capture and share global best practice, accelerate training and access to resources and provide a clear global interface for other restoration and adaptation activity.
- Actively encouraging international governments, through bilateral channels, including the ICRI network, to invest in domestic R&D programs, enabling international researchers, managers and practitioners to collaborate more effectively on a global level.
- Targeting international philanthropy to support areas of R&D in which they have already shown an interest.
- Targeting domestic philanthropy/industry to fund Great Barrier Reef-specific R&D.
- Engaging, guiding and co-investing in global challenge and prize initiatives for coral reef restoration to encourage innovation and collaboration and to leverage funding.

These activities, designed to engage Australia more actively into the broader global community, would facilitate identification and delivery of priority global R&D and increase investment in both domestic and global restoration and adaptation. These recommended activities are expanded upon in the following sections.

5.1 Coral Restoration Consortium/Reef Resilience Network, Australia

To progress coordination and stronger connections between R&D, best practice and training, and restoration action, we propose to expand the concept of the Coral Restoration Consortium and the Reef Resilience Network to Australia http://crc.reefresilience.org/. By mirroring this structure and purpose, it will forge a strong link between ongoing efforts in the US and Caribbean with those in the South Pacific and Eastern Indian Ocean. This would be the start of a more global structure of the Coral Restoration Consortium and would connect with the existing international network of the Reef Resilience Network.

An Australian node would not only ensure ongoing and active information transfer and exchange but facilitate and foster an environment of collaboration and open communication between science and practice from the start in Australia.

It is proposed the Australian node would also support and help establish an international research consortium to progress the science and engineering behind major global R&D challenges, for example the genomics approach to increased thermal stress tolerance in corals. This would entail

developing proposals for collaborative research programs suitable for international philanthropic donors.

5.2 Bilateral collaborations

As the co-chairs of the ICRI, Australia and RRAP are in a strong position to galvanise global support for coral reef restoration. The Great Barrier Reef Marine Park Authority is hosting the ICRI secretariat. The Australian Institute of Marine Science (AIMS), CSIRO and the Great Barrier Reef Foundation are all ICRI members, with a strong presence during the Australian chair. As such, this is an ideal forum to progress global outreach at government and non-government levels. The proposed ICRI plan of action has an articulated coral reef restoration agenda. Further, the secretariat has formally agreed to establish a one-year ad hoc committee to foster increased collaboration between member countries in reef restoration and associated R&D. Through this mechanism and ongoing bilateral discussions (such as annexes to bilateral science and technology agreements), Australia will engage with international governments to determine and agree to high-level (global) reef restoration and adaptation outcomes, the new capabilities required to deliver these outcomes and the priority R&D investment required. The process is designed to better articulate the value and benefits of investing in transformational R&D, such as that proposed by RRAP.

Engaging international governments and their R&D agencies would begin with countries with which we share mutual interests, either through domestic investment or by increasing development aid in coral reef restoration. This includes the USA and France. Similar efforts would commence with the UK, Japan, Monaco, Indonesia, the Philippines, Korea and Germany. Other countries would be included as opportunities for meaningful engagement were identified. This may include, but is by no means limited to, China, Norway, India, Malaysia, Mexico and the Middle East.

It is expected that governments that have the fiscal capacity to do so would fund their own science organisations to do reef R&D work. International providers would thus draw on their own country's funds and engage in their own R&D projects. However, these agencies may also choose to contribute to joint R&D projects with Australian providers.

5.3 Expanding funding opportunities

The Australian Government, via the Reef Trust Partnership administered by the Great Barrier Reef Foundation, allocated $100M for reef restoration and adaptation science. It is expected this funding would be directed by the priorities recommended by the RRAP Concept Feasibility Program.

A core aspect of this arrangement is that the Great Barrier Reef Foundation has developed a strong co-investment strategy under the Reef Trust Partnership. The complete Great Barrier Reef Foundation Collaborative Investment strategy is available here[2].

[2] In addition, R&D partners have indicated that they would co-invest in the RRAP R&D Program with a further $100M (cash and in-kind) targeted.

In addition to this direct funding, two other avenues are being progressed:

- International R&D collaborations and engagement in mechanism such as XPRIZE, offsetting the direct Australian investment requirements.
- Work via ICRI to encourage additional international government investment in domestic restoration and adaptation R&D, allowing increased partnerships with the Australian effort and increasing overall investment levels.

If done well, RRAP should position Australia as the leader of a new industry that meets critical national and international needs in tackling the impacts of climate change, and other stressors of coral reefs, by improving ecosystem resilience.

6. INVESTMENT REQUIREMENTS

Much of the proposed investment in international engagement and partnerships would occur through established avenues, such as existing research collaborations, ICRI and the role of the Great Barrier Reef Foundation. However, establishing an Australian node of the Coral Restoration Consortium/Reef Resilience Network would require some investment towards staff, communications and network/conference/workshop costs. The node would need to be hosted by an existing organisation or institution, which would provide infrastructure and general employment support. In the US, the hosting organisations are NOAA and The Nature Conservancy.

6.1 Capability and funding required to support proposed strategies and plans

Below is the budget for the first 10 years of the International Engagement and Partnering Sub-Program and the ICRI working group support. This expenditure would be managed as a combined program along with the other RRAP R&D sub-program investment areas. Details of the full RRAP R&D Program investment requirements are in **R4: Research and Development Program**.

Table 1: Proposed International Engagement and Partnering Sub-Program budget for international collaborations ($'000).

Cost item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Salary Australian node coordinator	150	150	150	150	150	150	150	150	150	150
Salary admin support (0.5 FTE)		50	50	50	50	50	50	50	50	50
Meetings/workshop/ communication materials	50	50	50	50	50	50	50	50	50	50
Total	200	250	250	250	250	250	250	250	250	250

Total cost (10 years): $2.45M

A list of specific activities for this node is outlined in **Appendix B**, based on feedback from the existing Coral Restoration Consortium/Reef Resilience Network node coordinators.

ICRI working group support

Funding is required to support Australian activities directed through the ICRI. These efforts would be focused on raising international government awareness of the need and benefits of investment in restoration and adaptation R&D. Year one would support the delivery of the working group agreed at the December 2018 ICRI meeting. The terms of reference are provided in Appendix C.

Table 2: Proposed budget for the ICRI ad hoc committee ($'000).

Cost item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Budget	200	100	100	100	100	100	100	100	100	100

Total cost (10 years): $1.1M

7. RISK MANAGEMENT PLAN

Several identified risk areas would be managed under the RRAP risk management framework. These include:

- **Achieving the required coordination and information-sharing mechanisms**: The primary risk of establishing an Australian node, tasked with coordinating Australia's global collaborations, is lack of buy-in or failure to establish networks and procedures to leverage its value. This risk is limited by building on existing structures and networks, which have already gained international recognition, thus avoiding entering an already-crowded space with a new idea.

- **Gaining increased international government focus and investment in developing transformational restoration and adaptation capabilities**: This investment will only occur if there are strong value/benefit drivers. As a program, RRAP cannot predict or guarantee an outcome in this area. However, the strategy of using ICRI to undertake a process with government policymakers to identify future restoration and adaptation capabilities that would create value in their areas of jurisdiction maximises the likelihood of a positive outcome. If strong value drivers were identified, the likelihood of investment would be maximised.

- **Corporate and philanthropic funding:** Achieving the ambitious levels of investment will be challenging; nevertheless, the large Australian investment and focus in this area is creating strong interest and increasing the likelihood targets can be achieved. Further details of the strategies and plans can be found in the Reef Trust Partnership Collaborative Investment strategy.

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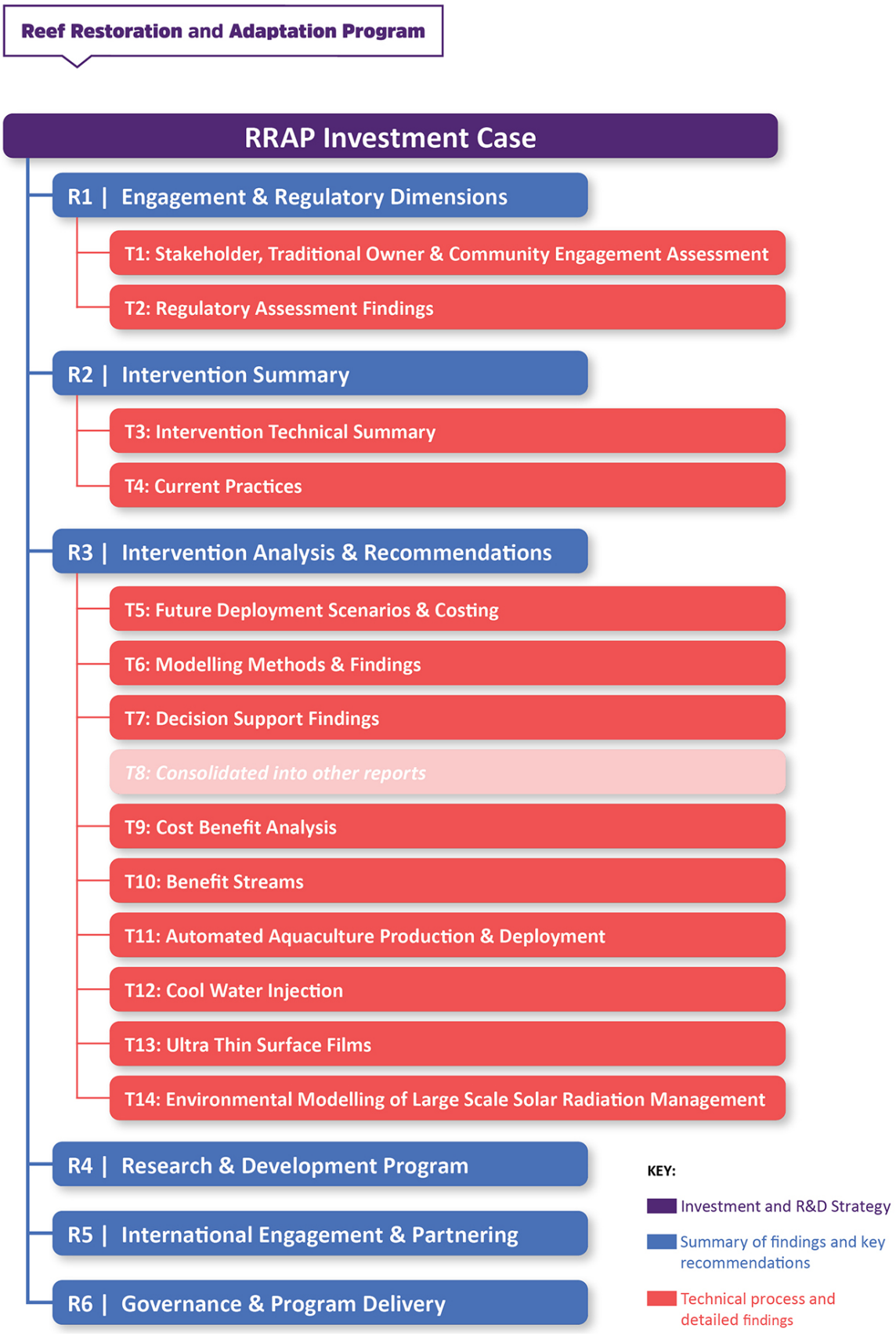
APPENDIX A – RRAP DOCUMENT MAP



APPENDIX B – AUSTRALIAN PARTNERSHIP WITH THE CORAL RESTORATION CONSORTIUM

Examples of actions/activities and responsibilities:

- Establish routine bi-annual in-person meetings between the Australian international program coordinator, the Reef Resilience Network Science Lead and the US Coral Restoration Consortium coordinator to facilitate this joint work.
- Support the establishment and coordination of key global research consortia.
- Support Great Barrier Reef Foundation fundraising activities around key global initiatives.
- Support and contribute to the existing Coral Restoration Consortium/Reef Resilience Network website:
    - Assist in maintaining and updating the Reef Resilience Restoration Toolkit module content based on new practices, science and resources from partners.
    - Host global databases, e.g. locations of nurseries and outplant sites, genotype of outplants database, yearly geographically and species-based spawning predictions.
    - Assist with updates and implementation of the restoration online course to ensure managers in the Great Barrier Reef and Pacific receive training in this field.
- Facilitate restoration learning exchanges, e.g. facilitate practitioners visiting each other and learning from each other.
- Facilitate feedback from Australian managers on the development of coral restoration design and decision guidance.
- Identify and form partnerships with experts to contribute to networking activities:
    - Support or connect with partners' in-person training that could be paired with a mentored, online course.
    - Assist in identifying capacity-building needs in restoration and opportunities for workshops or projects to address these needs.
    - Assist in designing a restoration training curriculum, including manuals and handbooks that would be jointly endorsed by the Reef Resilience Network, the Coral Restoration Consortium and Australia.

APPENDIX C – TERMS OF REFERENCES FOR THE AD HOC COMMITTEE ON RESTORATION

Adopted on December 7th, 2018 at the 33rd ICRI General Meeting (Monaco).

Background

In response to the recent disturbances affecting coral reefs, most notably the global mass coral bleaching event 2015–17, there has been a resurgence in interest in coral reef restoration techniques (Anthony et al., 2017). Since the adoption of ICRI Resolution on Artificial Coral Reef Restoration and Rehabilitation (2005), international reef restoration activities across the US, SE Asia and the Red Sea are growing in scale and improving in efficiency and effectiveness (Rinkevich, 2015, Hein et al., 2017). However, progress is slow and, at present, unlikely to achieve restoration at ecologically relevant scales or assist reefs to adapt to future conditions. Considering that current climate models forecast that sea temperatures will exceed the thermal tolerances of corals within the next 10–20 years, there is an urgent need to develop new methods and breakthroughs in the scale and rates of deployment and cost to meet current and future challenges.

Australia has established a Reef Restoration and Adaptation Program (RRAP) to develop new interventions and delivery methods to assist the Great Barrier Reef to recover from major disturbances and assist its adaptation to a changing climate. The resulting technology is expected to be used to help coral reefs worldwide. The program is currently in the concept feasibility program, with a targeted R&D program commencing in 2019.

For these and various other restoration and adaptation initiatives, it is essential to join forces, exchange knowledge and collaborate to maximise outcomes in the minimum amount of time. A virtual working group, under the auspices of ICRI, will provide a suitable vehicle to advance this R&D collaboration.

The **objectives** of the ad hoc committee will be to:

- Assess and document global needs and priorities for current and future reef restoration and adaptation programs.
- Assess and document global R&D priorities to deliver the methods, productivity and cost breakthroughs needed to support restoration and adaptation program objectives.
- Identify mechanism(s) to improve joint planning and delivery of reef restoration and adaptation R&D.
- Identify opportunities to partner on reef restoration and adaptation R&D activities.

Chair: Australia
Members: experts from the ICRI membership across reef-bearing regions of the world.
Duration: the ad hoc committee will last not more than one year, with the final report to be presented at the ICRI General Meeting in December 2019. The report will be available on the ICRI Forum.
Working procedures: the ad hoc committee will conduct its work via email, telephone, video conference and, when necessary, internet-based services.

Reef Restoration and Adaptation Program

GBRrestoration.org

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Reef Restoration and Adaptation Program, a partnership:

Australian Government | Australian Institute of Marine Science | Australian Government Great Barrier Reef Marine Park Authority | Great Barrier Reef Foundation | CSIRO | QUT | James Cook University Australia | The University Of Queensland Australia