Australian Government
Great Barrier Reef Marine Park Authority

Reef Authority

REEF 2050 INSIGHTS REPORT 2024

BMT

Report prepared by:

Dr Ingrid Baker[1], Dr Ann Peterson[2], Lydia Tobin[1], Dr Beth Toki[1] and Jeremy Visser[1],

for the Great Barrier Reef Marine Park Authority

Authors
Dr Ingrid Baker[1], Dr Ann Peterson[2], Lydia Tobin[1], Dr Beth Toki[1] and Jeremy Visser[1]

[1]BMT Commercial Australia Pty Ltd
[2]Eko Consulting

Report for
Great Barrier Reef Marine Park Authority

Disclaimer

This report was prepared by 2023 in good faith exercising all due care and attention, but no representation or warranty, express or implied, is made as to the relevance, accuracy, completeness or fitness for purpose of this document in respect of any particular user's circumstances. Users of this document should satisfy themselves concerning its application to, and where necessary seek expert advice in respect of, their situation. The views expressed within are not necessarily the views of the Great Barrier Reef Marine Park Authority and may not represent their policy.

Citation

Baker I, Peterson A, Tobin L, Toki B, Visser J (2024) Reef 2050 Insights Report. Report to the Great Barrier Reef Marine Park Authority, Townsville.

Comments and questions regarding this document should be addressed to:

Great Barrier Reef Marine Park Authority
235 Stanley Street (PO Box 1379)
Townsville QLD 4810, Australia

Phone: (07) 4750 0700
Email: info@gbrmpa.gov.au
www.gbrmpa.gov.au

Australian Government
Great Barrier Reef Marine Park Authority

Reef Authority

Contents

1. Executive Summary

The Great Barrier Reef Marine Park Authority (Reef Authority) prepares the Great Barrier Reef Outlook Report (Outlook Report) every five years, with a key objective to: 'provide a regular and reliable means of assessing reef health and management in an accountable and transparent way' (GBRMPA, 2019). Since the 2014 Outlook Report, the Queensland and Commonwealth governments have developed the Reef 2050 Long-term Sustainable Plan (the Reef 2050 Plan), which provides coordination of activities for the Great Barrier Reef (the Reef).

As part of the five-yearly Outlook Reports, the Reef Authority commissions an independent management effectiveness assessment that informs the Outlook Report's chapter seven (titled Existing Protection and Management). Alongside this assessment, the Reef Authority commissions a broad assessment of the Reef 2050 Plan, known as the Insights Report (this report) that informs the 2024 Outlook Report and future revisions of the Reef 2050 Plan. The intent of this Insights Report is to provide key insights from the 2024 management effectiveness assessment as this relates to the work areas and enablers for the Reef 2050 Plan.

The Insights Report utilises the management effectiveness assessment framework developed by the World Commission on Protected Areas. The framework consists of six elements: Context, Planning, Inputs, Processes, Outputs and Outcomes. These elements were used to assess the five work areas under the current Reef 2050 Plan:

- Work area 1: Limit the impacts of climate change
- Work area 2: Reduce impacts from land-based activities
- Work area 3: Reduce impacts from water-based activities
- Work area 4: Influence the reduction of international sources of impacts
- Work area 5: Protect, rehabilitate and restore.

The assessment concluded that Context, Planning, Inputs and Processes were *mostly effective,* while Outputs and Outcomes were *partially effective*.

Based on this assessment, the Reef 2050 Plan continues to provide an effective framework for the delivery of integrated management for the Reef but also presents opportunities for ongoing improvement. Table 1 presents a summary of what is working well in relation to the Reef 2050 Plan and the related work areas and enablers, what is challenging and what are the possible 'ways forward'.

Table 1: Summary of findings

Working well	• Contextual knowledge of current values, condition, trend, and stakeholders • Climate change work area incorporated into the Reef 2050 Plan • Investment into projects that aim to better understand and model impacts of climate change and trial interventions that will enhance Reef resilience and protect values • Shift in focus to address land-based activities including run-off and extractive uses of the Reef (e.g. fishing) • Traditional Owners are recognised as key rights' holders and partners in Reef management • Structural elements of governance (e.g. legislation, plans, policies etc • Coordination of planning across jurisdictions • Performance monitoring • Reef Joint Field Management Program, Reef Restoration and Adaptation Program, Reef Knowledge System, various legislation (refer Outputs section)
Challenging	• Addressing gaps in knowledge (e.g. heritage, coastal development, biodiversity, cumulative impacts particularly as related to climate change, technologies associated with decarbonisation and others) • Reef values are dynamic in the face of climate change and related impacts but are often addressed as static values that need to be 'restored' • Understanding the consequences of losing Reef biodiversity especially as this relates to impacts on ecosystem services • Effective engagement with diverse stakeholders, including Traditional Owners to enhance co-governance, equity and benefit sharing • Functional elements of governance (e.g. engagement, decision making, agility, flexibility, alignment) • While Outputs have largely been achieved (although with limitations relating to water quality targets and others) these have not always resulted in improved Reef outcomes (e.g. protection of Reef values and amelioration of threats) • Adequate and ongoing financing to address matters at the required scales (Reef-wide to local)

Ways forward

- Articulate the Reef values and what needs protection and prioritisation under a climate changed future and the likelihood that ecosystem function decline appears inevitable
- Develop strategic outlooks on how to manage climate change impacts over time
- Work towards more collaborative and empowering forms of engagement, particularly with Traditional Owners and improving equity and benefit sharing arrangements
- Expand monitoring and modelling in response to a climate-changed future to support decision making
- Consider adoption of regional governance models, especially to address the marine-terrestrial interface
- Continue to support and expand on international action to address marine debris and migratory species
- Enhance linkages between planned Outputs and expected Outcomes
- Clear and honest articulation of the state and expected trends and impacts to the Reef, including in relation to Reef resilience and related environmental, economic and social sustainability

2. Introduction

The Reef 2050 Long-Term Sustainability Plan

The Reef 2050 Long-Term Sustainability Plan (Reef 2050 Plan) was prepared as a response to the 2014 call from the World Heritage Committee for a strategic assessment and long-term plan for managing the Great Barrier Reef (the Reef). This document was called upon to provide a long-term plan for 'sustainable development that will protect the Outstanding Universal Value of the property' for the Great Barrier Reef World Heritage Area (World Heritage Committee Decision 35 COM 7B.10).

In 2020-21 the Reef 2050 Plan was restructured to establish a more high-level strategic document. This has included a shift to focus on climate change related action and an emphasis on Traditional Owners' expertise and involvement. Concrete improvements have occurred regarding management of anthropogenic impacts such as land-based run-off through various initiatives such as the Reef 2050 Water Quality Improvement Plan (WQIP). The WQIP serves as a guide for governmental, local and industry policy regarding water quality improvement initiatives in the Reef catchment. This alongside many other targeted initiatives and actions (*Sustainable Ports Development Act 2015*, net-free fishing zones, Queensland Sustainable Fisheries Strategy) have helped to reduce negative impacts to the Reef.

Beyond addressing specific threats to the Reef, the Reef 2050 Plan also serves as a framework for addressing actions and relationships relevant to managing the Reef. In this way, the Reef 2050 Plan supports and encourages cooperation between all interested parties, thus allowing for more targeted and effective management. Regular revisions, in line with the IUCN's management assessment framework, have been integrated into the design of this plan (Figure 1). These updates are vital as they can improve management effectiveness; assist in effective resource allocation; promote accountability and transparency; and help involve the community, build constituency, and promote protected area values (IUCN 2006). By regularly reassessing management effectiveness in the Region[1], targeted efforts can be made to conserve the Reef for future generations.

[1] Extends from mean low water to the Great Barrier Reef Region boundary (does not include Queensland islands and internal waters) (refer GBRMPA (2019, Figure 1.2).

The Reef 2050 Insights Report

As part of the five-yearly Great Barrier Reef Outlook Reports, the Great Barrier Reef Marine Park Authority (Reef Authority) commissions an independent management effectiveness assessment (Baker et al. 2024) that informs the Outlook Report's chapter seven (titled Existing Protection and Management). In addition, the Reef Authority commissions a broad assessment of the Reef 2050 Plan, known as the Insights Report (this report) that informs the 2024 Outlook Report and future revisions of the Reef 2050 Plan. The intent of this Insights Report is to provide key insights from the 2024 management effectiveness assessment as this relates to the work areas and enablers for the Reef 2050 Plan.

The Insights Report utilises the management effectiveness assessment framework developed by the International Union for the Conservation of Nature (IUCN) World Commission on Protected Areas (WCPA) (Figure 1). The framework consists of six elements (Table 2), namely Context, Planning, Inputs, Processes, Outputs and Outcomes: *Context* addresses values, threats, opportunities, stakeholders, management and the political environment

- *Planning* incorporates visioning, goals, objectives and strategies to conserve values and reduce threats
- *Inputs* address resourcing of staff, money and equipment to deliver appropriate outcomes
- *Processes* incorporate how the management actions are implemented – their adequacy or appropriateness
- *Outputs* address what was produced relative to the inputs
- *Outcomes* reflect the impacts that achieve defined goals, objectives and values.

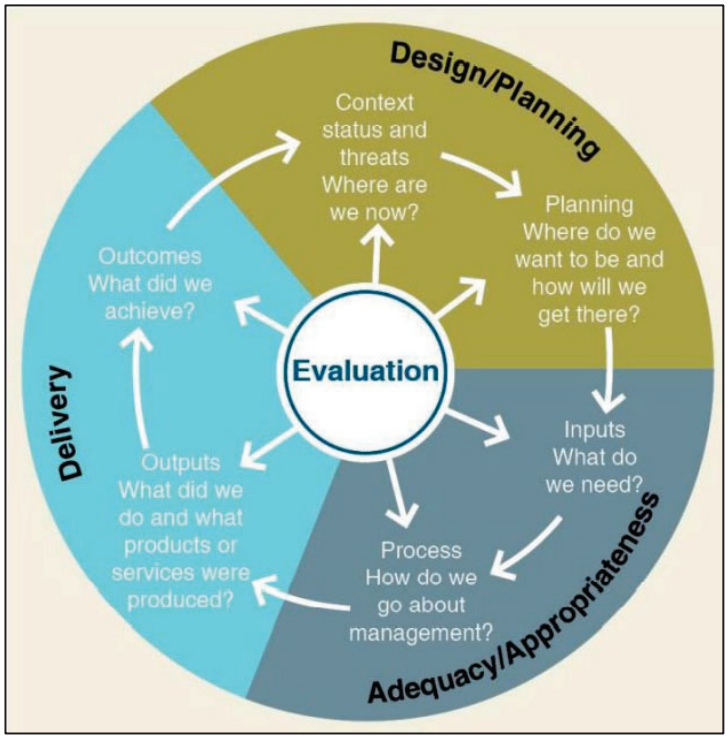

Figure 1: The Framework for assessing management effectiveness of protected areas

Source: Hockings et al. (2006)

These elements were used to assess the five work areas under the current Reef 2050 Plan (Table 3).

Table 2: Elements and criteria for evaluation. Source: Hockings et al. (2006)

Elements of evaluation	General topics addressed	Criteria assessed	Focus of evaluation
Context	What is the current situation? Assessment of importance, threats and policy environment	Significance Threats Vulnerability National context Partners	Status
Planning	Is the design of the area, planning systems and plans adequate? Assessment of protected area design and planning	Protected area legislation and policy Protected area system design Reserve design Management planning	Appropriateness
Inputs	Are resources for management adequate? Assessment of resources needed to carry out management	Resourcing of agency Resourcing of site	Adequacy

Processes	How is management carried out and does it meet relevant standards? Assessment of the way in which management is conducted	Suitability of management processes	Efficiency and appropriateness
Outputs	What were the results? Assessment of the implementation of management programmes and actions; delivery of products and services	Results of management actions Services and products	Effectiveness
Outcomes	What has been achieved? Assessment of the outcomes and the extent to which they achieved objectives	Impacts: effects of management in relation to objectives	Effectiveness and appropriateness

3. Methodology

The 2050 Insights Report has been prepared utilising the management effectiveness cycle (Figure 1). This has been applied across the five work areas (Table 3) of the Reef 2050 Plan. This Report also assesses performance across the Reef 2050 Plan's four enablers.

The work areas are structured around efforts to address key threats to the Reef, reduce cumulative impacts and protect and conserve the Reef and include:

1. Limit the impacts of climate change ('climate change')
2. Reduce impacts from land-based activities ('land-based activities')
3. Reduce impacts from water-based activities ('water-based activities')
4. Influence the reduction of international sources of impact ('international sources')
5. Protect, rehabilitate and restore.

The enables address activities that underpin effective delivery of the work areas and include:

A. Collaboration and partnerships
B. Science and knowledge
C. Monitoring, evaluation and adaptive management
D. Investment.

This approach differs from the 2019 Insights Report (Leverington et al. 2019), which focused on seven key themes and actions areas (governance, ecosystem health, biodiversity, heritage, water quality, community benefits and economic benefits) that were aligned to the 2018 version of the Reef 2050 Plan. These action areas were replaced following the 2020-21 update to the Reef 2050 Plan by the five work areas outlined above. This change in approach reduces the ability to compare trends since the 2019 Insights Report. However, it more accurately aligns the 2024 review to the current Reef 2050 Plan.

Each element of the management effectiveness framework (e.g. Context, Planning, Inputs, Processes, Outputs and Outcomes) comprised a series of questions (Table 4) that were answered in relation to each work area. The responses to these questions were rated on a scale from 1 (low) to 4 (high) (Attachment One, Section 14). The ratings were totalled for each work area across all six elements and a grade for management

effectiveness was allocated. These grades included ineffective, partially effective, mostly effective or effective.

Detailed information and ratings and grades for each element question are provided in Attachment Two (Section 15).

In answering each question, the reviewers relied upon evidence collected as part of the 2024 management effectiveness assessment (Baker et al. 2024) (refer section 2), including interviews, workshops and document and data review. The management effectiveness assessment is undertaken every five years and assesses Reef health and management, as legislated under section 54 of *Great Barrier Reef Marine Park Act 1975*. This assessment considers existing protection of values and management of protected areas, as well as how goals and objectives are being achieved and forms the basis for Chapter 7 of the Outlook Report. The management effectiveness assessment is based on the IUCN-WCPA Framework's six management elements, which are the basis of this Insights Report. In addition to the 2024 management effectiveness assessment the following documents specific to the implementation of the Reef 2050 Plan were reviewed:

- Reef 2050 Objectives and Goals 2021-2025
- 2020-2022 Activities Report for the Reef 2050 Plan
- Reef 2050 Plan Investment Framework
- Reef 2050 Water Quality Improvement Plan 2017-2027 and underpinning documents, including 2017 Scientific Consensus Statement and Reef Water Quality Report Cards
- Wetlands in the Great Barrier Reef Catchments Management Strategy 2016-2021.

The current Reef 2050 Plan also includes four enablers (Table 3) that are intended to support the delivery of the five work areas under the plan. As these enablers are not specific management activities, they have not been assessed using the management effectiveness framework. However, an assessment of the enablers in the context of insights from the 2024 management effectiveness assessment is provided in Section 11.

Table 3: Reef 2050 Plan work areas, enablers, goals and strategic actions

No.	Area	Goals	Strategic actions
Work areas			
1	Climate change	Australia contributes to an effective global response to climate change through the Paris Agreement, to hold the increase in the global average temperature to well below 2°C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels	1.1 Contribute to global efforts to reduce greenhouse gas emissions 1.2 Foster partnerships and stewardship for climate mitigation
		The capacity of Reef communities, Traditional Owners and industries to adapt to a changing climate is increased	1.3 Improve information and planning for community and industry climate adaptation 1.4 Build community and industry capacity and capability to adapt to climate change
		Species and habitats are supported to adapt to a changing climate	1.5 Trial innovations to assist species and habitats to adapt to climate change
2	Land-based activities	The quality of water is improved through increased effective land management practices in catchments	2.1 Implement the Reef 2050 Water Quality Improvement Plan to meet its targets and undertake a 5-yearly review
		Integrated catchment-to-Reef management reduces cumulative impacts	2.2 Implement the Wetlands in the Great Barrier Reef Catchments Management Strategy and undertake a review
		Lighting and recreational impacts on sensitive shoreline ecosystems and cultural sites are reduced	2.3 Improve practices in sensitive shoreline ecosystems

No.	Area	Goals	Strategic actions
3	Water-based activities	Biodiversity and heritage protection are enhanced and ecosystem resilience is supported through strengthened efforts to ensure water-based activities are sustainable	3.1 Improve policy, planning, strategy and decision making in relation to water-based activities 3.2 Expand and maintain in-park presence to protect the Reef and enhance user compliance with rules and regulations 3.3 Foster partnerships and collaboration with Reef users to encourage uptake of stewardship actions and behaviours
		Traditional Owners are supported to continue to manage sea Country	3.4 Strengthen Traditional Owner management of sea Country through agreement and partnerships
		The threats associated with legal and illegal fishing are reduced	3.5 Reform fisheries management and compliance to contemporary best practice 3.6 Implement measures that reduce impacts from fishing activities, verify data and improve understanding to strengthen management of fishing activities
		Noise pollution and artificial light impacts from sources within and adjacent to the Marine Park are reduced	3.7 Investigate and implement measures that reduce noise and light impacts
		New outbreaks of disease are reduced and incursions of introduced species and pests are prevented	3.8 Enhance marine and island pest surveillance and prevention (including biosecurity)
		Marine debris, rubbish pollution and at-sea disposal of waste is reduced	3.9 Implement domestic measures that reduce marine

No.	Area	Goals	Strategic actions
			debris and manage waste disposal
4	International sources	Australia actively engages in international forums and agreements to minimise international sources of impact to the Reef	4.1 Foster international efforts to reduce marine debris entering the reef 4.2 Promote international cooperation for the protection of migratory species
5	Protect, rehabilitate, restore	Outbreak of pests, introduced species and disease are reduced	5.1 Strengthen strategic management of established pests, introduced species and disease
		Key habitats are being actively rehabilitated or restored	5.2 Pilot and implement interventions that support the resilience of coral reefs, seagrass, other marine habitats and islands 5.3 Enhance protection, rehabilitation and restoration of key coastal and catchment ecosystems
		Historic and cultural heritage sites are being conserved	5.4 Implement historic heritage site conservation 5.5 Implement cultural heritage site conservation
Enablers			
A	Collaboration and partnerships	Adoption of best practice voluntary compliance and stewardship behaviours is maintained and increased	A.1 Foster connection, education and stewardship of the Reef
		Collaboration and effective partnerships between managers, partners and stakeholders are maintained and enhanced	A.2 Foster partnerships for Reef protection

No.	Area	Goals	Strategic actions
		Traditional Owner Indigenous heritage, rights and responsibilities are incorporated into all facets of management	A.3 Formally recognise Traditional Owner customary rights and interests A.4 Increase opportunities for Traditional Owner co-management and co-governance of the Reef A.5 Increase and strengthen capacity and involvement of Traditional Owners in protecting and managing the Reef
B	Science and knowledge	Science and knowledge are advanced, easily accessible and able to be used in decisions	B.1 Focus research on priority management needs B.2 Strengthen engagement of policy makers, managers, Traditional Owners and stakeholders in science and research B.3 Synthesise and communicate scientific evidence to non-technical audiences
		Traditional knowledge is protected and retained	B.4 Recognise and embed traditional knowledge in Reef science and research
C	Monitoring, evaluation and adaptive management	Comprehensive monitoring, evaluation and reporting supports informed and agile management responses	C.1 Strengthen coordination, integration and implementation of Reef monitoring and modelling activities C.2 Strengthen evaluation and adaptive management responses
D	Investment	Investment supports delivery of the Reef 2050 Plan	D.1 Deliver existing commitments to maximise outcomes under the Plan

No.	Area	Goals	Strategic actions
			D.2 Ensure future investment supports priority activities and successful implementation of the Plan D.3 Identify new opportunities for investment to address emerging issues D.4 Boost investment through partnerships, co-investment and innovative financing

4. Context

Context: Status and threats, where are we now?

Rating: Mostly effective

Context was rated overall as *mostly effective* across the five work areas. Context was also the strongest management effectiveness element in the 2024 management effectiveness assessment (Baker et al. 2024). Only the Climate change work area was assessed as *partially effective* with the other four areas being assessed as *mostly effective*.

Understanding

CO1 How well do the Reef 2050 Plan's actions, objectives and outcomes contribute to and effect understanding of: the values, current condition and trend, impacts and stakeholders of the Region?

The Reef 2050 Plan focuses on maintaining and protecting the Outstanding Universal Value (OUV) of the World Heritage Area by stating that this is one of four key principles for decision-making relating to planning, development and management (p.14). The principles state the need for values and ecological processes in poor condition to be restored and for values and ecological processes in good condition to be maintained. The Reef 2050 Objectives and Goals 2021-2025 identify 20 objectives, many of which refer to a value being 'healthy' and or 'resilient'. There is recognition of the importance of the Reef to Traditional Owners, local communities and the wider Australian community, both for extractive and intrinsic values.

Understanding, by managers, of values relevant to each work area is good and improving, although this is weakest for the Protect, rehabilitate and restore work area due to gaps in knowledge in relation to heritage (e.g. Indigenous heritage, underwater cultural heritage and heritage on islands), coastal development and biodiversity (e.g. ecological processes, population recruitment, and condition and trend which are relatively unknown for the majority of species, with a lack of long-term data over a broad area) (Australian Academy of Science 2023, DES 2021). However, understanding of biodiversity is improving due to increased investment in research and application.

In the water-based activities work area Sea Country values mapping is being undertaken in some accredited Traditional Use of Marine Resources Agreement (TUMRA) regions (e.g. Manduburra Traditional Owners in 2019-20) to better

understand the cultural values specific to Traditional Owner Sea Country. Indigenous rangers' programs enable Traditional Owners to be on-country to better understand values, threats and impacts and to guide management and uphold compliance across the Region. Despite this action, many Indigenous heritage values of the Region are in poor condition, including sacred sites, places important for cultural tradition, story, language, songlines and totems and Indigenous structures, technology, tools and archaeology (Aboriginal and Torres Strait Islander Heritage Strategy). Several projects and actions are in place to minimise the impacts on threats to Indigenous heritage including the Reef Joint Field Management Program (RJFMP) Restoration of Reef Islands Project (2020-25), which aims to identify and protect cultural values and incorporate training to protect and manage Reef island ecosystems. The project brings together science, research, mapping and Traditional Owner knowledge.

Knowledge of historic heritage is uneven with limited knowledge of the over 800 historic aircraft and shipwrecks in the Reef, most of which are not managed. Managers are aware of the key impacts on historic heritage, including climate change which is a major threat to underwater cultural heritage.

The Reef 2050 Plan has a specific focus on climate change. The Climate change work area has goals to respond effectively to climate change through the Paris Agreement. The plan focuses on enhancing the capacity of Reef communities to adapt to climate change and supporting species and habitats to adapt. Strategic actions are delivered through the Protect, rehabilitate and restore work area, with investment into projects that aim to better understand and model impacts of climate change and trial interventions that will enhance the resilience of the Reef, protect values, reduce risks and improve functional diversity.

The current condition and trend, and threats and direct impacts related to each work area are generally understood by managers. However, there are knowledge gaps across all work areas in relation to the cumulative and consequential impacts, particularly from climate change, coastal development and fishing. For example, the individual and cumulative impacts of recent cyclone disturbances have negatively affected Reef values but are not fully understood. However, these disturbances, and other extreme weather events, are expected to intensify in the future due to climate change.

Recognition of impacts and influences across the Reef is generally strong within the Reef 2050 Plan but there are gaps, including a lack of focus on coastal development more generally (as distinct to agricultural use, wetland management and point and non-point source runoff), and consideration of emerging areas for management in

shipping and maritime use, such as the rise of alternative fuels and technologies associated with decarbonisation of commercial and recreational fleets.

The recognition of international sources of impact to the values of the Reef provides a more holistic contextual understanding for the Reef to the extent these impacts are not covered under other work areas.

Key challenges relate to the dynamic nature of Reef values and the need for enhanced understanding and articulation of the outcomes and values that will be managed under climate change and the likelihood that ecosystem function decline appears inevitable (Baker et al. 2024). Practical challenges relate to the restricted ability of Traditional Owners to access Sea Country due to limited boats and resources to conduct values assessments and undertake protection and rehabilitation activities.

Consideration of context

CO2 Does the Reef 2050 Plan clearly and appropriately consider the values, threats and internal and external social and policy environment, including rights-holders and stakeholders?

The Reef 2050 Plan has a clear focus on considering the OUV of the World Heritage Area and a range of other values together with broader values offered by the Reef to Traditional Owners, local communities and the wider Australian community. This is clearest in the context of species, habitats and Indigenous heritage values. The Reef 2050 Objectives and Goals focus on maintaining or improving condition or ecological function over time and include adaptation and transformative change.

The current plan has a stronger focus on climate change due to an improved understanding of this key threat to the Reef. However, the 2022 Joint WHC/IUCN mission noted that the Reef's OUV is significantly impacted by climate change factors and that the Reef's resilience to recover from climate change impacts is substantially compromised. Climate change remains the most significant threat to the Reef. Several key knowledge gaps remain in relation to condition and trend and impacts, including understanding of the consequences of losing Reef biodiversity, in particular, the impacts on ecosystem services related to fisheries, coastal protection, recreational values and the like. A focus on reacting to and managing current threats has limited the capacity for managing agencies to develop a strategic view of how to manage climate change impacts over time.

The other key threats recognised within the Reef 2050 Plan include water quality impacts, coastal development and direct use. Within these, land-based run-off and

extractive uses of the Reef (e.g. fishing) are a primary focus under the current Plan, representing a shift from previous priority areas such as dredging and dredged material placement.

A key water-based activity is commercial marine tourism, although this is restricted in extent, with about 80 per cent of tourism visits occurring within about seven per cent of the area of the Marine Park. Impacts from this industry are understood and risks are being managed through improved management and education, new policies, guidelines and strategies (e.g. Tourism management action strategy 2021). The industry trains Master Reef Guides to deliver scientific and management information about Reef values and how visitors can make a difference.

Managers across the five work areas have a broad knowledge of key stakeholders, although there are gaps in engagement with Traditional Owner communities, especially in non-TUMRA regions.

Key challenges relate to the potentially changing nature of the Reef's values in the face of climate change and other threats and stressors and the need to identify 'realistic ecological, social and cultural outcomes under climate change and the likelihood that ecosystem function decline appears to be inevitable' (Baker et al. 2024). The Australian Academy of Science (2023:34) states that there are many 'unknowns' (e.g. Reef functions, stressors etc) and that central to addressing these issues is knowing what 'are the key GBR values and what needs protection' and prioritisation under a climate changed future. This may include guiding transition to novel ecosystems with different values from the previous state (Bay et al. 2023). There are continuing challenges relating to improving understanding of heritage values, especially Indigenous and underwater cultural heritage, and the impacts on these as a result of increasing threats and stresses; and stimulating culturally appropriate Reef tourism development for Indigenous operators that will promote local culture and protect heritage.

5. Planning

Planning: Where do we want to be and how will we get there?

Rating: Mostly effective

The element Planning was rated as *mostly effective* across for the five work areas. Planning was also graded as *mostly effective* in the 2024 management effectiveness assessment (Baker et al. 2024).

Planning issues

PL1 Does the Reef 2050 Plan help address issues relating to planning, including the appropriateness, coverage and quality of plans?

The main planning focus within the Reef 2050 Plan is on improving planning with respect to Climate change and Water-based activities, as well as facilitating the ongoing roll out of planning improvements to land-based management under the Reef 2050 Water Quality Improvement Plan 2017-2022 (WQIP) and the Wetlands in the Great Barrier Reef Catchments Management Strategy 2016-2021 ('Wetlands Strategy').

The WQIP and Wetlands Strategy are nested sub-plans to the Reef 2050 Plan, and both contain key actions associated with improving planning and compliance with land-use regulations, working within the current planning and permission system. These actions are being implemented progressively and are intended to improve both water quality performance for the Region and broader economic and environmental sustainability of agricultural activities.

The Reef 2050 Plan supports existing planning arrangements associated with water-based activities, including the marine spatial planning systems and the North East Shipping Management Plan, as well as the ongoing implementation of planning reform for fisheries under Sustainable Fisheries Strategy 2017-2027. Additionally, the Reef 2050 Plan provides actions related to current planning 'gaps' for water-based activities, including noise, lighting and marine and island pests. This represents a shift from dredging and port development focused planning arrangements as these have mostly been embedded through actions under previous Plans.

While the Reef 2050 Plan provides support for planning reform and enhancement through these measures, it does not include planning measures for other threats and priorities within the work areas. Specifically, there is no interaction between the Reef 2050 Plan and regional and local planning systems for coastal development (other than as related to agricultural land use practices). While local governments are supported through the Reef Guardian program to develop action plans, more resourcing is needed to better support the integration of measures that mitigate development impacts on Reef values within their statutory planning instruments. Additionally, the focus on international marine debris and migratory species does not integrate the international and national scales for these matters.

The Climate change work area represents a significant development for the Reef 2050 Plan, noting that this was not included within previous versions of the plan. However, given the cumulative impacts of climate change and other stressors, the Reef 2050 Plan and its associated plans and strategies may require stronger pathways to avoid significant negative impacts from climate change on the Reef's OUV (Carter & Thulstrup 2022). This was highlighted in the 2024 management effectiveness assessment where the existing planning systems were assessed to be potentially limited in their ability to address diverse threats (Baker et al 2024).

The key Planning challenges lie in establishing effective monitoring and review processes to assess the various planning systems and related plans that are in place to ensure that they are delivering on outcomes for the Reef, including effectively addressing climate change and other threats to the Reef at all levels of planning from national to local. This includes clear indicators for success and adaptive management (Carter & Thulstrup 2022).

Even with the recent advances in planning for climate change, the full breadth of current and future risks of climate change are not being appropriately considered in planning processes (Baker et al 2024). This is partly due to the perception of the static nature of values of the Reef and retrospective monitoring within adaptive management processes. Dynamic and shifting values, properties and indictors within adaptive management systems should now account for dynamic and uncertain future due to climate change. This deficit is amplified by a tendency towards reactionary management in the current system, where managing agencies are so focused on reacting to current threats that there hasn't been more of a strategic view of how to address, and plan for, climate change over time (Baker et al 2024).

Efficiency and consistency

PL2 Does the Reef 2050 Plan ensure planning is more efficient, reduces duplication and is consistent across jurisdictions?

The Reef 2050 Plan provides a useful umbrella document and framework to achieve integrated management of the Reef across government and associated agencies. This is particularly effective in the areas of water quality management where the Reef 2050 Plan and nested sub-plans provide a clear coordination of government responsibilities for management within the catchment. The Reef 2050 Plan also seeks to recognise and balance different interests within water-based activities, especially fisheries, for example through development of separate but interrelated actions for maximising fish stocks (which is primarily a state interest) and understanding interactions with species of conservation concern (which is a state and federal interest).

However, inefficiencies and duplication remain across jurisdictions in planning and permissions. This has been recognised in the Samuel (2020) Review of the *Environment Protection and Biodiversity Conservation Act 1999* and affects both the efficiency of managing direct use activities (e.g. port development) and providing for conservation of biodiversity. While there are ongoing reforms in this sector (e.g. the 2022 Nature Positive Plan), these have been initiated only in recent years and are separate to the Reef 2050 Plan.

The Reef 2050 planning framework for the Reef also has inherent inconsistencies associated with coverage of different jurisdictions, such as the non-inclusion of State islands in the federal Great Barrier Reef Marine Park planning framework; noting that a joint field management program for the marine and island national parks aims to integrate the two jurisdictions.

The management effectiveness assessment (Baker et al 2024) found that there was a need for more aligned planning within the current Reef management system. However, there are significant challenges in better aligning terrestrial and marine planning systems. Piecemeal planning processes have constrained the ability of managing agencies to effectively consider indirect and cumulative impacts on the environment in an integrated and coordinated way. This issue was highlighted for land-based planning and development matters in coastal areas, where managers expressed a lack of capacity and capability to effectively consider the implications of coastal development on Reef values.

There are also notable challenges in improving the alignment and integration of plans and processes across jurisdictions. This relates to the diverse stakeholders, including

users, who are involved in the Reef planning system and their potentially differing objectives (i.e. from the Reef Authority, other government agencies and sectoral groups). Stronger support to better integrate, coordinate and align plans and planning processes between and across marine and terrestrial jurisdictions within the planning system would assist in reducing the impacts of land-based activities on the Reef.

Improvements in legislation and policy

PL3 Does the Reef 2050 Plan contribute to appropriate improvements in legislation and policy?

The Reef 2050 Plan primarily seeks to work within the existing framework to deliver outcomes. However, in response to the Samuel (2020) review, there is ongoing reform of the *Environment Protection and Biodiversity Conservation Act 1999*, especially in relation to the assessment of projects and cumulative impacts and the establishment of regional plans and strategic assessments. This will have both direct and indirect effects on the management of the Reef. Additionally, the Reef 2050 Plan provides the umbrella under which recent legislative reforms for water quality have occurred as part of the Reef Regulations.

Key areas of policy reform under the Reef 2050 Plan relate to the enhancement of Traditional Owner-led management, together with enhanced management of water-based activities, including independent data validation (IDV) for fisheries and control of light pollution and noise. This sits alongside a broader range of policy and strategy updates that are occuring in other thematic areas for the Reef (e.g. commercial tourism, biodiversity). However, based on the Activities Report 2020-2022, work is still ongoing for policy reform under the Plan, with key outputs not yet introduced.

More developed areas relate to key strategies, such as the Wetlands Strategy, Sustainable Fisheries Strategy, Aboriginal and Torres Strait Islander Heritage Strategy 2019, and the Reef 2050 Traditional Owner Implementation Plan, which were developed under previous Plans and are now being implemented.

There is a need for legislation and policy to be more adaptive and resposive as new evidence emerges. This is of partivular note in the face of climate change, as indicated by the Reef 2050 Indpendent Expert Panel:

> ‘The present suite of policies for GBR management has served its purpose, yielding generally positive outcomes albeit with some weaknesses… however, …the current policy framework and funding to support new knowledge and

ultimately its transformation is not flexible enough to cope with the rapidity of global warming…' (Chubb 2023:2).

6. Inputs

Inputs: What do we need?

Rating: Mostly effective

The element Inputs was rated overall as *mostly effective* across the five work areas. Inputs was also graded as *mostly effective* in the 2024 management effectiveness assessment (Baker et al. 2024). In this report the work areas of Climate change, Land-based activities, Water-based activities and Protect, rehabilitate and restore were assessed as *mostly effective*, while International sources was assessed as *partially effective.*

Sustainability of resourcing

IN1 Has the Reef 2050 Plan been effective in improving the level or sustainability of resourcing for management of the Reef?

Over several years the Reef 2050 Plan has been a key instrument in consolidating and prioritising funding for activities in the Reef, including through the Reef 2050 Investment Framework. This has included identification of funding shortfalls associated with achieving key targets for Reef management and overall health.

Through the most recent Plan, there has been a significant increase in funding and resourcing arrangements to address a range of matters relevant to the Reef. These include a focus on reef health, habitat cover, species management, land-based run-off and Traditional Owner leadership, as well as improved funding for the RJFMP to support on ground activities and compliance management. Previous versions of the Reef 2050 Plan also supported the development of the Sustainable Fisheries Strategy which, through its ongoing implementation, has led to significant new funding for fisheries management.

The management effectiveness assessment (Baker et al 2024) found that funding, in general, has increased across most management areas, with notable improvements in the funding for water quality improvement, Reef management and conservation, Reef Restoration and Adaptation and strengthening partnerships and stewardship. Innovative funding strategies are being developed, including the Reef Recovery 2030 fundraising campaign (Reef Trust Partnership) that aims to attract private investment in Reef protection efforts.

While the Reef Authority may be generally well resourced to address Reef management issues, many other managers are not. For example, Traditional Owners are not sufficiently well resourced to enable effective engagement and participation in a range of programs, especially in relation to their TUMRAs. Also, while local governments are well supported through the Reef Guardian program to develop Action Plans, more resourcing is needed to better support the integration of measures that mitigate development impacts on Reef values within their statutory planning instruments.

There does not appear to be specific funding to support initiatives under the work area for international sources, as key activities to date have been business as usual engagement, rather than specific collaboration and assessments on marine debris and migratory species. Additionally, while there is adequate resourcing available for maritime incident response on behalf of the Australian Maritime Safety Authority (AMSA) and Maritime Safety Queensland (MSQ), there remains no dedicated funding for responding to the damage of such incidents to the Reef. This has been highlighted recently in the context of the *Shen Neng 1* grounding at Douglas Shoal where it has been necessary to rely on court-awarded damages to undertake rehabilitation actions.

While not specific to the Reef 2050 Plan, during the novel coronavirus pandemic, significant support was also provided to the marine tourism industry, noting the impacts they experienced during periods of national and international lockdown. Additional to supporting the industry, this has also led to greater engagement in reef restoration projects and research outcomes for the Reef.

The ongoing cost of addressing key threatening processes across the Reef Region, particularly regarding climate change and biodiversity is a key challenge. Existing and emerging programs require sufficient long-term funding to support their ongoing implementation.

Knowledge gaps

IN2 Does the Reef 2050 Plan help to identify gaps in knowledge and recommend action to remedy these gaps?

Several actions and goals within the Reef 2050 Plan are directed at improving knowledge of the Reef. This is generally directed to specific action areas and including species, reef health and coral cover, water quality, lighting and noise impacts, and the impact of fisheries on protected species. The Reef 2050 Plan also focuses on empowering Traditional Owner leadership of the Reef, including monitoring and review of the values of the Reef as a heritage asset.

One major output from these has been the 2021 Priority Monitoring Gaps Prospectus which helps inform priorities under the Reef Integrated Monitoring and Reporting Program (RIMReP). This includes identification of cost requirements to address these gaps and likely duration. The monitoring gaps identified consist of:

- Condition and recovery capacity of the Reef
- Inshore dolphin monitoring
- Sea cucumber monitoring
- Reef fish monitoring
- Biosecurity monitoring tools
- Island habitat monitoring
- Seabird monitoring
- Sustainable use and benefits
- Monitoring collective capacity and effectiveness of implementation
- Stewardship for the Reef
- Implementing the Strong People Strong Country framework.

While the Reef 2050 Plan also includes a focus on understanding international sources of marine debris and the international status and condition of migratory species, the plan does not consider national or international marine stressors which may directly or indirectly affect the condition of the Reef. This is likely to reduce the ability to fully understand and manage for these matters.

The management effectiveness assessment (Baker et al 2024) found that there was an overall gap in data and knowledge for Indigenous and historic heritage matters. Challenges were specifically identified in relation to improving digital spatial data and tools to assist historic heritage assessment and the need to improve information and data management and sharing. Other key challenges included incorporating a wide range of diverse knowledge sets across multiple sectors, in particular Traditional Knowledges, and monitoring of Traditional Owner reef use and well-being.

Additionally, while the Reef Authority may be generally well resourced to address Reef management issues, many other managers are not. For example, Traditional Owners are not sufficiently well resourced to enable effective engagement and participation in a range of programs, especially in relation to their TUMRAs.

Resource allocation

IN3 Has the Reef 2050 Plan helped to ensure effective allocation and use of the resources (for example through less duplication)?

As the Reef 2050 Plan has led to consolidation and prioritisation of funding, this has led to more effective allocation of resources to particular use areas.

Regarding Planning, the Reef 2050 Plan framework seeks to reduce duplication and inefficiency in delivery of actions, although some concerns remain. Through this framework, resource allocation has been more efficient, especially in areas related to management of land-based run-off and associated water quality concerns. These include the broader coordination of agricultural and land management activities under the WQIP, such as the Major Integrated Projects for the Burdekin and Wet Tropics (2021-2025).

7. Processes

Processes: How do we go about management?

Rating: Mostly effective

The element Processes was rated overall as *mostly effective* across the five work areas. Processes was also graded as *mostly effective* in the 2024 management effectiveness assessment (Baker et al. 2024). In this report the work areas of Climate change and International sources were assessed as *partially effective* with the other three work areas being assessed as *mostly effective*.

Standard of governance

PR1 Does the Reef 2050 Plan encourage better governance across the Region (including legitimacy, clear direction, performance, accountability, fairness and rights)?

The Reef 2050 Plan recognises the importance of good governance and requires that 'governance arrangements are transparent and accountable' (p. 36). The Reef governance system incorporates multiple governing authorities, diverse stakeholders and partners and complex cross-scale (international to local) and cross-sectoral dynamics (Turner et al. 2022). These diverse actors play different roles in decision making and the governance system is struggling to improve Outcomes for many aspects of the Reef and to protect its values in the face of diverse threats and cumulative impacts.

The Reef governance system is described as polycentric (Dale et al. 2016, Morrison 2019) with numerous nested sub-systems (i.e. social and ecological systems) (Morrison 2017, Smith et al. 2017, Turner et al. 2022). It is highly complex, especially in relation to the multi-scaled layering of institutions, regulations, plans and policies. In terms of the structural elements of governance, these define the formal and organisational components that make up the system and include the legal framework, managing agencies and policies and procedures that govern the operation of the system. The structural elements of governance that relate to the five work areas are well-developed, with a diverse array of legislation, plans, policies and programs across the work areas and comprehensive vision setting, monitoring and evaluation. However, deficiencies are evident in the quality of some regulatory and policy mechanisms relating to several work areas (e.g. dated plans and gaps).

The functional elements of governance refer to the practical aspects of how the governance system operates and include the processes and practices that shape how decisions are made, how resources are allocated and how services are delivered. Often the sub-groups within the governance system function as independent but interacting actors. There are varying levels of connections among the sub-systems and across multiple scales, with the Reef Authority and federal and Queensland governments playing a central decision-making role.

The Australian Academy of Science (2023:33) states that the governance system 'is not built with the agility required to adapt to rapidly evolving climate impacts'. Current work programs (at least 58) (Chubb 2023) are not currently at the required scale, coherence or responsiveness to the emerging threats to biodiversity and other Reef systems. Issues of concern related to centralised and siloed decision making, long time frames from policy changes to delivery and implementation, declining system flexibility and alignment with ancillary organisations and policies, including international policy, especially in relation to climate change (Australian Academy of Science 2023:17).

In relation to the Protect, rehabilitate and restore work area decision makers may need to enhance risk-based approaches to management and consider new questions in relation to issues such as biodiversity (Chubb 2023), e.g. which regions, reefs, corals, species, ecosystems will be the focus; how is biodiversity impacted across the Reef; and when and where should interventions take place. The current stressors on the Reef indicate the need for substantive review and consideration of more 'transformative' governance arrangements (Turner 2022). (Note: key functional aspects related to cross-jurisdiction consistency are discussed in the next section).

While there are key objectives relating to governance in the Reef 2050 Plan, it is difficult to assess progress due to the lack of comprehensive governance monitoring indicators in the RIMReP and in the Outlook Report. However, the 2021 Priority Monitoring Gaps prospectus identified Reef governance as a gap, including monitoring for policy and program coherence, impact and outcomes, assessing community involvement and satisfaction and a range of other issues. In response, the Reef Trust Partnership and RIMReP partners are funding the development of a governance monitoring program for the Reef, including an assessment of key governance indicators to assess governance effectiveness in relation to Reef 2050 Plan objectives. This will be a major step forward to enable more comprehensive and effective assessment of governance performance in future reporting.

Governance is not a specific element of the five work areas under the Reef 2050 Plan but forms a core element within Enabler A (Collaboration and partnerships) (refer

below), with strategic actions directed towards adoption of best practice, development of effective partnerships, and incorporation of Traditional Owner heritage, rights and responsibilities into management, with the ultimate aim of co-governance arrangements. These actions provide the basis for improved governance for the Reef overall as well as within the specific work areas. In particular, most work areas rely on partnership arrangements (e.g. Strategic Actions 1.2, 2.1, 2.2, 3.3, 3.4, 5.5) and/or involve the integration of Traditional Owner management and knowledge (e.g. Strategic Actions 2.1, 2.2, 3.4, 5.5).

The ongoing release of WQIPs every five years since 2003 and development of the Wetlands Strategy have supported improvements in governance for land-based activities. The Reef 2050 Plan also centralised decision-making and funding arrangements for restoration and rehabilitation measures for reef and island habitats.

Engagement by stakeholders and partners in the governance system across most work areas is mainly at the low end of the engagement spectrum (IAPP 2018) (refer Enabler A), with a focus on 'informing', 'consulting' and 'involving'. There is less focus on 'collaboration' and 'empowering' engagement. This emphasis impacts 'legitimacy', 'performance', 'accountability', 'fairness' and 'rights'. Siloed approaches, with limited knowledge sharing and collaboration among partners and within the Reef Authority are viewed as a limitation to effective governance across several work areas (e.g. commercial marine tourism and Traditional Use within the water-based activities work area).

Governance (and planning) systems relating to traditional use of marine resources are complex. There are numerous plans and strategies, including the Aboriginal and Torres Strait Islander Heritage Strategy (2019) (under review) that identifies actions to keep Indigenous heritage, including traditional use of marine resources, strong, safe and healthy. The Reef 2050 Traditional Owner Implementation Plan (2022) is providing support to further understand and agree on a range of governance concepts, including co-management and co-governance and clarification of Traditional Owner rights and interests. The Gurra Gurra Framework 2020–2026 guides the Queensland Government to reframe relationships with Traditional Owners by placing Country and people at the centre of policy, programs and service delivery; structurally enabling co-governance and co-stewardship, respecting community-led decision making processes and timeframes; exploring new ways of working through co-design and co-delivery; and emphasis on the need for cultural capability. The 2022 Co-management Principles Policy is a commitment by the Reef Authority to co-managing in partnership with Traditional Owners, including through decision-making, policy and plan development and management actions. While these are positive steps

Samuel (2020) notes that at the national level Indigenous knowledge systems have not been effectively incorporated into decision-making.

The Reef's multiscale governance is fragmented and experiencing difficulty in improving Reef biodiversity and health (Baker et al. 2024). The governance system across the work areas faces challenges in:

- addressing the methods or agreed processes to make decisions in times of high uncertainty
- enhancing the role and effectiveness of Advisory Committees and other groups involved in Reef governance
- enhancing inclusive engagement and pathways for integrating Traditional Knowledge and a more diverse range of social actors
- enhancing equity, particularly in relation to the engagement of women in decision making;
- ensuring effective consultation, engagement and benefit sharing arrangements with Traditional Owner groups, especially in TUMRA regions, that allow responses to be determined locally and aligned with customary laws/lores, capacity and management aspirations (DES 2021);
- enhancing on-ground management capacity and opportunities for Traditional Owners to access Country and to engage in various sectors including Indigenous-lead commercial marine tourism
- enhancing regional governance models that include Traditional Owners
- reducing fragmented and 'siloed' decision making that fails to respond holistically and places burdens on Indigenous peoples and other stakeholders (Australian Academy of Science 2023)
- enhancing system flexibility and ensuring consistency with ancillary organisations and policies
- better application of relevant international and national principles (e.g. relating to Climate change and Heritage and including ratification of relevant conventions in relation to cultural heritage).

In particular there are calls (Australian Academy of Science 2023, Bay et al. 2023, Morrison 2017, 2019, 2020, Dale et al. 2016) for new approaches to governance, in particular, to enhance the ability of managers to adapt rapidly to evolving impacts. Turner et al. (2022) call for a more transformative governance agenda through adjustments to day-to-day management, and more substantial institutional redesign or rethinking of principles and values underpinning governance goals.

Cross-jurisdiction consistency

PR2 Does the Reef 2050 Plan facilitate the consistent implementation of programs/policy across jurisdictions?

Cross-jurisdictional matters relate to governance, planning, management, policy and program implementation, compliance and regulation. These matters are shared among different levels of government and a range of other actors, stakeholders and partners. As noted in the Reef 2050 Plan (Section 3): 'The Reef 2050 Plan provides a strategy framework for action and is intended to guide governments, key sectors and individuals on actions they can take to contribute to improving the Reef's future'.

The Intergovernmental Agreement for the Reef sets a framework for joint coordination of planning and management across jurisdictions and incorporates complementary zoning, joint permitting, plans of management and consistent management of the RJFMP and the Reef 2050 Plan. The Reef 2050 Plan framework is intended to provide a central point for directing key actions for the Reef that reduce inconsistency and duplication. Ultimately the effectiveness of the governance system for the Reef, at least in part, depends on the integration of planning and related plans within the system and the linkages among the key actors within the system. In general, while decision-making powers are distributed among the key players, the Reef Authority plays a central role. Co-ordination among jurisdictions and their key actors is complex and not always effective.

In relation to Water-based activities such as commercial marine tourism, joint permits are implemented and streamlined through Permits Online – a permit system and bookings database. Complementary Zoning Plans and joint Marine Parks permits allow for greater consistency and efficiency for permit applications. However, while there are areas where this approach has led to improved consistency of action, some areas (e.g. land-based run-off) have been characterised by top-down governance approaches (Olvera-Garcia & Sipe 2020), rather than providing for collaboration between all levels of governments and industry partners (Dale et al. 2016, 2018). For example, while there are cooperative approaches between levels of government, there are gaps in the effective engagement of local governments, which are responsible for outcomes relating to land-use planning and development assessment within Reef catchments. Similarly, major development project assessment can be poorly coordinated between the Australian and Queensland governments, focusing on individual projects rather than effectively assessing cumulative impacts (e.g. in relation to carbon emissions and climate change impacts). The commercial marine tourism industry reported 'siloed'

approaches with limited knowledge sharing and collaboration among partners (Baker et al. 2024).

The development of the WQIP and Wetlands Strategy as specific management instruments under the Reef 2050 Plan has allowed for a more consistent approach across federal and state levels in relation to land-based run-off and catchment condition. Within the Water-based activities work area, the Reef 2050 Plan also seeks to bring together a range of existing management plans and frameworks (e.g. Sustainable Fisheries Strategy, North East Shipping Management Plan) to ensure Plan-specific actions support or complement these instruments (e.g. funding to RJFMP, development of IDV approaches).

However, as the Reef 2050 Plan does not propose reforms associated with legislative arrangements, there are ongoing inconsistencies, principally in areas of planning and permission where these operate at multiple levels. This includes inconsistencies between local-level planning for coastal development and regional planning for catchment management, differing regulatory considerations for fisheries management at state and federal levels, and overlap between state and federal approval requirements for coastal and maritime activities. Coordination amongst jurisdictions with differing priorities is often complex and difficult to deliver and requires substantial reform.

Overall, collaborative governance needs strengthening, especially to ensure alignment of planning (visioning, objectives and goal setting), policy and programs across government and relevant sectors; agreed priorities; more collaborative (rather than top-down) approaches; and greater jurisdictional coordination.

Performance monitoring

PR3 Is there effective performance monitoring to gauge progress towards the objectives of the Reef 2050 Plan?

Performance monitoring is well established within the Reef 2050 Plan, including a range of supporting monitoring systems such as the Paddock to Reef program informing the Reef Water Quality report cards. Indicators for Reef health are set under the Reef 2050 Objectives and Goals 2021-2025 and include a range of indicators related to coral reef habitats, seagrass, natural wetlands, islands and a range of important fauna (e.g. protected species, seabirds, bioculturally important fish and invertebrate species). In relation to biodiversity (within the Protect, rehabilitate and restore work area), there are over 90 monitoring programs operating within the Reef Region (e.g. AIMS long term monitoring program, Marine Monitoring Program).

Existing monitoring represents about 40 per cent of the environmental regimes of the Reef (Mellin et al. 2020) and is weighted towards about seven percent of the Marine Park and World Heritage Area, an area that is made up mainly of coral reefs (Australian Academy of Science 2023). There are substantive critical knowledge gaps, particularly in relation to ecosystem function and processes (Australian Academy of Science 2023), population recruitment, various species, groups of species and habitats. Cumulative impacts are challenging to quantify, assess and manage and are little understood in the Region. However, these impacts are beginning to be better understood through descriptive qualitative models (e.g. Bozec et al. 2022) and spatial mapping tools.

The Social and Economic Long-Term Monitoring Program (SELTMP) has continued as a means of monitoring the socio-economic impacts on the Reef over time. While SELTMP changed its methodology during the COVID-19 pandemic due to its limited ability to conduct public polling, it has continued via online forms and has expanded its scope to include catchment level impacts. Priority projects relevant to socio-economic issues have been identified (e.g. sustainable use and benefits, stewardship, governance and implementing the Strong People Strong Country framework). Overall, this research and related interventions represent key efforts toward long-term monitoring and the benefits this provides to addressing key biophysical and social knowledge gaps.

However, across many of the work areas, there are no specified targets set with direct linkage between actions and goals, and the broader objectives of the Reef 2050 Plan. For example the WQIP targets are not embedded in the Reef 2050 Plan. Specifically, goals across much of the climate change, water-based activities and international sources areas are not measurable or specifically adapted towards the achievement of the Reef 2050 Plan objectives.

There have been significant improvements in the design and updating of monitoring. The RIMReP is a monitoring framework for the Reef 2050 Plan that is striving to coordinate and integrate Reef-based monitoring and modelling programs to inform resilience-based adaptive management and reporting. The Priority monitoring gaps prospectus (2021) identified 11 priority monitoring gaps. The Reef Trust Partnership (RTP) and RIMReP partners are funding activities to address these and other gaps.

Ranger BoT (QUT) and Reefscan (AIMS) incorporate automated marine monitoring systems that will translate field data into comprehensive information about the state and health of critical marine ecosystems by employing autonomous surface and sub-surface high resolution benthic survey technologies to survey reef habitats and detect

crown-of-thorns starfish and to inform seagrass, and reef health monitoring, island pest programs and incident response. This will increase the area and depth range of coral reefs and other habitats (e.g. seagrass) that can be surveyed. There are a variety of monitoring programs relevant to the commercial marine tourism industry (e.g. Eye on the Reef Program). The Tourism Industry Activation and Reef Protection Initiative (2021-23) was part of the COVID-19 Relief and Recovery Fund, which enabled 17 marine tourism operators to undertake work on reef health and impact monitoring, crown-of-thorns starfish control, planting coral fragments and to facilitate on-country visits for Traditional Owners, and other work. The Tourism Reef Protection Initiative (Australian Government $1.2 billion investment) builds on existing programs to engage marine tourism operators to protect high-value tourism sites through to 30 June 2024.

Information sharing has improved. RIMREP's centrepiece is the interactive Reef Knowledge System that provides up-to-date information about the Reef to guide effective management decisions, including Reef health and Reef snapshot. A Data Management System is under development and there are new developments in citizen science on the Reef to engage community members to collect information to better understand and protect the Reef. For example, the Sightings Network uses a smartphone app that enables any user to report interesting/unusual sightings (GBRMPA 2022). However, the Australian Academy of Science (2023:29) highlights the need for researchers and managers to be 'honest brokers' and present the reality of the Reef's future in the face of climate impacts - '…although consistent and clear government messaging is needed, the government is not necessarily a trusted voice in many public spaces. Embedding key messages into grassroots communications is needed for efficacy'.

Monitoring of Reef governance systems are in their infancy (refer Processes).

Key challenges include:

- incorporating a wide range of diverse knowledge sets across multiple sectors, in particular Traditional Knowledges (Australian Academy of Science 2023)
- monitoring of Traditional Owner reef use and well-being
- expanding monitoring and modelling in response to a climate-changed future in order to support decision making (Australian Academy of Science 2023
- consolidating data from Reef-related projects
- effectively communicating findings to all stakeholders, in particular the general public.

8. Outputs

Outputs: What did we do and what products or services were produced?

Rating: Partially effective

Overall, outputs toward the Reef 2050 Plan goals were rated as *partially effective*. The work areas of Climate change and Land-based activities were assessed as *mostly effective* with Water-based activities and Protect, rehabilitate and restore being assessed as *partially effective* and international sources being the weakest with a score of *ineffective*. Of primary note is the perceived disconnect between many outputs and their applicability toward desired outcomes. Ouputs was rated overall as *mostly effective* in the management effectiveness report (Baker et al. 2024).

Delivery of outputs

OP1 Has the Reef 2050 Plan resulted in better delivery of outputs?

The strongest delivery of management outputs is related to Traditional Owners, water quality and land-based run-off, and direct uses of the Reef. As recorded in the Reef 2050 Plan's Activity Statements and management effectiveness assessment (Baker et al 2024), the range of outputs delivered between 2019 and 2024 through the Plan includes:

- Queensland Climate Action Plan 2020-2030
- Great Barrier Reef Blueprint for Resilience
- RRAP and the Great Barrier Reef Interventions Policy
- Range of land management/water quality protection initiatives, either through the Great Barrier Reef Foundation, the WQIP and Wetland Strategy, or the Reef Trust Gully and Stream Bank Erosion Control Program, or delivered directly by natural resource management (NRM) groups
- Increased investment toward the Queensland Land Restoration Fund
- Reef Protection Regulations under the Environmental Protection Act 1994
- Expansions to the RJFMP and Land and Sea Ranger Program
- Continued funding for regional report cards to monitor water quality targets in specific catchments.
- Funding for Major Integrated Projects reports for reef catchments

- Ongoing implementation of the Sustainable Fisheries Strategy, including development of stock assessments, harvest strategies and ecological risk assessments
- Development of an Independent data Validation approach for fisheries
- Various recovery and research projects focus on coastal and island habitats, together with reef rehabilitation projects
- Ongoing outputs relating to crown-of-thorns starfish control
- Support for marine debris clean-up activities (with Tangaroa Blue Foundation)
- Aboriginal and Torres Strait Islander Heritage Strategy, Traditional Owner Partnerships Strategy 2022-2027, Sea Country values mapping in some TUMRA regions
- Darumbal Traditional Use of Marine Resources Agreement (TUMRA).

Delivery of other outputs is ongoing but mostly noted to be on track. However, there remain some key exceptions. This includes initiatives such as the whole of Reef Report Cards, which have not been updated since 2020 due to lags in data reporting and review of land management targets. Outputs related to coastal planning, particularly regarding impacts of lighting have also not been delivered in line with Reef 2050 goals. One of the most substantial deficits for the purpose of this report are in reference to international sources of impacts. At present, recorded outputs for this area relate to 'business as usual' collaboration and representation within international forum, rather than specific delivery of activities related to understanding marine debris and migratory species. There has been a gap in the strategic actions under this work area.

One potential cause for delay or absence regarding desired outcomes is the outbreak of COVID-19 which began in early 2020 with lasting impacts to project delivery well into 2022. This pandemic had far-reaching implications particularly around access both for data collection and for outreach initiatives. Particularly affected were Traditional Owner groups, who were largely restricted in their access to sea country. This restriction led to limited outputs for goals such as supporting Traditional Owner-led approaches for systematic monitoring of the condition of Reef values.

Appropriateness of outputs

OP2 Are these outputs appropriate to achieve the goals and outcomes? Have the key outputs been identified?

Across most work areas, there is a strong connection between outputs and goals but not between these and overall objectives and outcomes. For Climate change and to Protect, rehabilitate and restore work areas, this principally is due to the lack of objectives specific to these areas, while for Water-based activities, most of the relevant objectives are only achieved indirectly through the delivery of listed actions.

For International sources, there is misalignment between listed actions in the work area, goals under the Reef 2050 Objectives and Goals 2021-2025, and the objectives and outcomes listed in the Reef 2050 Plan. For example, the work area strategic actions include engagement with international fora for migratory species and marine debris and the promotion of international research on migratory shorebirds. However, the example activities for the Activities Report relate more to existing international initiatives related to climate change and coral reefs.

The exception is for the elements of Land-based activities governed under the WQIP and Wetlands Strategy as these instruments provide a more direct connection between proposed outputs and related objectives. However, the targets focus primarily on short-term timescales to produce immediate results without long-term commitments associated with securing and maintaining these gains into the future. Thus, current outputs are not sufficient and more will need to be done in this area to attain set targets for Reef water quality.

9. Outcomes

Outcomes: What did we achieve?

Rating: Partially effective

The element Outcomes was rated overall as *partially effective* across the five work areas. This contrasts to the management effectiveness report where Outcomes were rated *mostly effective* overall (Baker et al. 2024). The work areas of Climate change and Land-based activities were assessed as *mostly effective* with the other three work areas being assessed as *partially effective.*

Vision and objectives

OC1 Is the Reef 2050 Plan on track to achieve its stated vision and objectives ***(and where it can possibly be measured based on the evidence collected – any goals)****?*

Due to the lack of direct connection between many work areas and plan objectives (as described in Outputs), many work areas do not show clear progress towards the Reef 2050 Plan vision and objectives. When assessing work areas against relevant goals, the following areas of progress are noted:

- Increasing knowledge base to support climate adaptation and resilience building approaches for the Reef
- Moderate progress towards achieving dissolved inorganic nitrogen and fine sediment reduction in catchment loads (based on 2020 Reef Report Card) but not sufficient to reach 2025 targets
- Improvement in fisheries management and stock levels, although some previously depleted or in decline fisheries are not yet back to sustainable levels
- Increasing recognition of the need for empowering engagement with Traditional Owners
- Reduction in marine debris through clean-up programs
- Site-specific rehabilitation and restoration activities
- Crown-of-thorns starfish reduction.

Several key areas demonstrate some progress towards goals or broader objectives under the Reef 2050 Plan, including: stability in wetland condition, reduction in lighting and recreational impacts, control of marine pests across the Reef (other than

crown-of-thorn starfish), participation in ongoing international action on marine debris and migratory species, and expansion of TUMRAs.

Some key challenges remain, however, regarding achieving the Reef 2050 Plan's stated vision and objectives. For climate change, current efforts are largely small in scale and have not yet led to significant roll-out of restoration and adaptation programs. These actions are also not considered to link directly with the outcomes desired under the Reef 2050 Plan. This speaks to the underlying issues around assumptions made during development of the Reef 2050 objectives and the lack of necessary flexibility to appropriately integrate a dynamic and uncertain future due to climate change (Baker et al. 2024, Chubb 2023:2). These underlying assumptions regarding baseline objectives need to be evaluated against the desired outcomes for the Reef under a climate change future. This issue exists for other work areas as well (Land-based activities, International sources impacts, Protect rehabilitate and restore) and represents a key challenge for Reef management. Also, a significant challenge remains in concentrating efforts toward coastal development challenges such as noise pollution and artificial light impacts that were consistently underrepresented in actions for all relevant working groups.

Conservation of values

OC2 Is it likely that values will be better conserved because of the Reef 2050 Plan?

Despite the lack of clear progress against many goals and objectives, the coordinating role of the Reef 2050 Plan is expected to lead to improved conservation of values across most work areas. This is due to the enhanced coordination and funding introduced by the Reef 2050 Plan towards a suite of value areas, including water quality, fisheries, protected species and degraded habitats, each of which are directly addressed in some way under the Reef 2050 Plan.

While actions under the Protect, rehabilitation and restore work area lack systematic prioritisation, they lead to improved outcomes for target habitats on a case-by-case basis. However, they have not led to broader improvement in Reef-scale biodiversity values. For climate change in particular, structural issues regarding governance may mean the system lacks necessary agility to adapt and evolve quickly (Morrison et al. 2022) and this is not addressed fully by the Reef 2050 Plan.

Within the International sources work area, the Reef 2050 Plan does not appear to be driving actions beyond 'business as usual' collaboration that would have already occurred. Strategic actions and activities are directed principally at ongoing engagement (primarily with existing state and national level initiatives) but lack specific

outcomes associated with directly reducing marine debris (domestically or internationally) or improving the international context for migratory species. Without dedicated efforts to improve upon existing state or national level projects a significant increase in conservation of Reef values cannot be said to be obtained through the REEF 2050 Plan.

Threat amelioration

OC3 Are threats being better ameliorated because of the Reef 2050 Plan?

While there is disconnect between some outputs and actions and the objectives of the Reef 2050 Plan, the work areas of the Reef 2050 Plan have been important in improving the amelioration of threats, albeit imperfectly. The Reef 2050 Plan also prioritises several threat areas not previously the focus of significant management attention, such as reducing fishing threats. However, there are also significant gaps in addressing known or emerging threats, including expected changes in fuels and decarbonisation technologies for shipping and other marine vessel use. Additionally, as per above, the International sources work area does not appear to have provided additional threat mitigation and amelioration activities.

Climate change remains the largest threat to the Reef with significant efforts required to provide effective threat amelioration and to support the ability of the Reef to adapt. Despite significant climate change policy progress at national, state and local levels, management of the Reef regarding climate change is subject to significant challenges (Walpole and Haden 2022). Irreversible impacts from climate change on the Reef's ecological and socio-ecological systems are probable and the exact impacts are undetermined (Australian Academy of Science 2023).

Responding to climate change threats to the Reef with the most effective action requires comprehensive knowledge of how climate change will impact the ecosystem, and different species across multiple emission scenarios and timeframes (i.e. near-term, medium-term and long-term timeframes). There are currently gaps in knowledge and understanding under all climate change scenarios, especially high-emission scenarios (Australian Academy of Science 2023). These gaps in understanding extend to knowledge about the efficacy of marine and terrestrial interventions under high emission scenarios, and the trade-offs between different interventions (Australian Academy of Science 2023).

Community benefits

OC4 Is it likely that community well-being and relationships will be improved because of the Reef 2050 Plan?

While the Reef 2050 Plan does not comprehensively address the management of all community benefits associated with the Reef, it has a strong focus on building relationships and partnerships with local communities, although these relationships are based mainly on informing, consulting and involving (refer below), rather than collaboration and empowerment. The Reef 2050 Plan's focus on building Traditional Owner leadership is working towards enhancing co-design, co-management and co-governance arrangements.

However, there some key issues remain regarding management of relationships for the Reef particularly regarding Land-based activities and Protect, rehabilitate and restore. For Land-based activities there is some disconnect between management actions and on ground managers (e.g. farmers) that is not fully addressed through the Reef 2050 Plan. Additionally, reporting as part of the SELTMP indicates lower public perception of their ability to influence management in the context of water quality. In reference to the Protect, rehabilitate and restore work area, there are concerns that current outputs focus only on local rehabilitation projects and are not sufficiently scalable to have substantial benefits for the larger reef community.

General action under each of the work areas will have indirect community benefits through value protection, threat amelioration or the direct engagement of the community in management activities. However, communities must be fully engaged and informed of the current condition and trends relating to the Reef and future impacts, particularly the cumulative impacts of climate change and impacts on ecosystem services and related understanding of environmental, economic and social sustainability in the future.

10. Insights for Reef 2050 Work Areas

Limit the Impacts of Climate Change

The Climate change work area represents a significant development for the Reef 2050 Plan, noting that this was not included within previous versions of the plan. Within this work area, there is a dual focus on supporting national and state level policy and planning for climate change mitigation and associated action, and the building of resilience and adaptive capacity for the Reef and Reef-communities to climate change.

Across the six elements, the Climate change work area scored *mostly effective* for Planning, Inputs, Outputs and Outcomes, and *partially effective* for Context and Processes.

The *partially effective* grade for Context represents a continuing gap in the understanding of direct, indirect and cumulative impacts of climate change to the Reef.

Despite this, the inclusion of climate change as a work area has led to increases in funding for the Reef in adaptation. Trialling of interventions and adaptation approaches is ongoing, with a high level of output delivery noted under the Activities Report 2020-2022. These outputs will have positive effects for the Reef, although the overarching threat of climate change remains the greatest risk to the Reef.

Reduce Impacts from Land-based Activities

The principal focus of the Land-based activities work area is on land-based run-off, including both point source and non-point source, together with management of wetlands and sensitive shorelines. However, the work area also includes coastal development across the Region.

The work area scored *mostly effective* across every element within the management effectiveness cycle. Across each of these elements, the main contribution noted is the improvement in planning arrangements and associated inputs introduced by the Reef 2050 Plan and the nested WQIP and Wetlands Strategy, which in turn has led to increased monitoring effort and project outputs. Although outputs are being delivered in these areas, interim targets are not being met across all key indicators and it is likely water quality outcomes for 2025 will not be achieved.

Balanced against a focus on land-based run-off and associated management arrangements, the work area does not significantly address other land-based activities, especially coastal development. While there is effective planning in place for coastal development, risks still remain from this sector that are not addressed or considered under the Reef 2050 Plan.

Reduce Impacts from Water-based Activities

Water-based activities encompasses a broad range of direct uses for the Reef, including Reef-dependent uses (e.g. commercial marine tourism, traditional use of marine resources, fishing, research) and Reef-associated uses (e.g. shipping, ports, defence). These areas represent a broad range of interests, impacting processes, and planning and management approaches for the Reef.

This work area was graded as *mostly effective* for Context, Planning, Inputs and Processes, and *partially effective* for Outputs and Outcomes. Strengths in the first four elements relate to the maturity of most direct use management systems and planning arrangements, together with a good understanding of key gaps, such as Independent Data Validations (IDVs) for fisheries and the lighting and noise impacts generated from shipping. However, there remain opportunities for improvement in the understanding of rates of traditional use of resources on the Reef as well as approaches needed to accommodate future decarbonisation and alternative fuel use in shipping fleets.

Weaknesses in outputs and outcomes reflect both a lack of direct connection between many strategic actions and associated goals and the overarching objectives and outcomes for the Reef 2050 Plan, and the lack of delivery on a range of these strategic actions, as reported in the Activities Report 2020-2022. Despite this, it is considered that ongoing actions in these areas will contribute to improved management for the Reef and associated values.

Influence the Reduction of International Sources of Impact

The International sources work area recognises the importance of international relationships in the management of impacts to Reef values. Specifically, the focus of the work area is on international sources of marine debris and international influences on migratory species. This complements other work areas that focus on control of pollutant runoff (Land-based activities), removal of marine debris (water-based activities) and restoration of wildlife habitat (protect, rehabilitate and restore).

Across the six elements, this work area was graded as *mostly effective* for Context and Planning, *partially effective* for Inputs, Processes and Outcomes, and *ineffective* for Outputs. The poor grading primarily reflects the limited focus of the work area. In particular, the work area does recognise the linkages between planned actions at the international scale with existing local and national-level activities which reduces the ability to deliver an integrated set of actions to address these risks.

More critically, the specific goals for the work area do not reflect implementation of the strategic actions.

Protect, Rehabilitate and Restore

The focus of the Protect, rehabilitate and restore work area is on direct interventions to achieve habitat and ecosystem outcomes, together with improved recognition and protection of historic and cultural heritage. This includes both traditional rehabilitation and restoration activities, together with trial interventions to test adaptation and resilience, particularly in relation to the cumulative impacts of climate change.

This work area was graded as *mostly effective* for Context, Planning, Inputs and Processes, and *partially effective* for Outputs and Outcomes. Higher scores in Context, Planning, Inputs and Processes represent improved arrangements for protection, rehabilitation and restoration activities under the Reef 2050 Plan. These include introduction of the Reef Restoration and Adaption Program and the Policy on Great Barrier Reef Interventions, the expansion of the RJFMP and its capacity to deliver on-ground works, and ongoing efforts at pest management, including the crown-of-thorns starfish management program, and island and reef rehabilitation. The Priority Monitoring Gaps Prospectus has further assisted in helping to prioritise management actions in this work area.

Lower scores in outputs and outcomes reflect the primarily local scale at which interventions and associated activities are currently occurring. The activities often lack sufficient scaleability to be implemented more broadly and are not yet able to achieve the necessary Reef-wide outcomes in relation to protection of Reef values and maintenance of environmental, economic and social sustainability.

11. Insights for Reef 2050 Enablers

Enabler A Collaboration and partnerships

Collaboration and partnerships, supported by sound governance arrangements, are critical to effectively deliver the plan. The focus of the plan is specifically on strengthening 'ground level' management through voluntary compliance and stewardship arrangements, together with establishing and improving formal partnerships.

The key stakeholders engaged in Reef management consist of government institutions and agencies at all levels, Reef Advisory Committees, Scientific Expert Panels and non-institutional actors that include Traditional Owners, various industry sectors, environmental NGOs, public interest groups, research institutions and universities, Reef users, the community and individual citizens (global to local), political parties, the media and others.

Across the five work areas, various activities occur across the stakeholder engagement spectrum (IAPP 2018). The main types of engagement in the Reef are: informing (e.g. education and stewardship programs, Reef Knowledge System); consulting (e.g. advisory committees); involving (e.g. RJFMP, trained community volunteers, Indigenous rangers, Master Reef Guides, Reef Guardians). There is growing evidence of collaboration (e.g. through joint research and monitoring programs, working with industry groups to deliver water quality outcomes and with Traditional Owners in management and on-Country work) and empowering engagement, including working towards co-management and co-governance with Aboriginal and Torres Strait Islander peoples

Partnerships are discernible, formalised and regularised relationships between organisations and are evident across all work areas and are utilised to improve Reef outcomes. These partnerships are increasing in number and diversity and are underpinned by often complex arrangements, including the nesting of partnerships, particularly in relation to land-based activities (e.g. NRM arrangements with regional bodies, local governments and NGOs). The key types of partnerships (Taylor, pers comm. 2023) include: knowledge-based reporting; integrated delivery; policy and planning; and working with Traditional Owners.

Key challenges for collaboration and partnerships across the Reef include:

- appropriate resourcing of effective engagement and partnering with Traditional Owners
- ensuring the most effective engagement of all Reef Advisory Committees in planning and decision making (i.e. beyond being mainly receivers of information)
- enhancing the engagement of local governments in diverse decision-making processes related to all work areas
- developing greater cross-sectoral and cross-scale collaboration and partnerships among stakeholders and reduced reliance on 'siloed' decision making
- ensuring adequate resourcing within the Reef Authority to provide a centralised point of distribution, data management and coordination of collaboration.

Enabler B Science and Knowledge

The Reef 2050 Plan recognises that the best available science and knowledge is required to manage the Reef.

Ongoing research and monitoring are critical in a time of rapid change and as a means to address diverse impacts on the Reef from multiple and often cumulative stressors. Information on research and monitoring is well documented in the Outlook Report process, updated Science and Knowledge Needs for Management (2021), ongoing work with renewing the Scientific Consensus Statement, and through the Marine and Coastal Hub of the National Environmental Science Program. The continual revision of these documents provides an up-to-date knowledge source for both policy makers and diverse stakeholder groups, including the general public. These processes and others have identified key knowledge gaps (e.g. Priority Monitoring Gaps prospectus, 2021). Programs and projects (e.g. Priority projects) have been developed to fill these knowledge gaps (e.g. monitoring of fish, inshore dolphin, sea cucumber, seabirds, and biosecurity among others). Greater adaptability and flexibility in relation to research and monitoring will be needed as research efforts are directed towards building Reef resilience in relation to a range of possible scenarios that address the predicted impacts of climate change and other threats (Baker et al. 2024).

While there are a diverse array of monitoring programs operating across land and sea, there are substantive critical knowledge gaps, particularly in relation to ecosystem function and processes, population recruitment, various species, groups of species and habitats, understanding of cumulative impacts. A variety of Reef rehabilitation projects are in place, including the Reef Restoration and Adaptation Program (RRAP), which is a collaborative long-term research and development program that aims to develop, test and risk-assess novel interventions to help build the resilience of the Reef under a changing climate. This program is new and issues remain around understanding the

feasibility for scaling up many of the proposed interventions that are currently being trialled at a local scale, as well as assessments of cost-effectiveness and socio-economic impacts (McLeod et al. 2022).

Several challenges remain, including:

- incorporating a wide range of diverse knowledge sets across multiple sectors, in particular Traditional Knowledges (Australian Academy of Science 2023)
- consolidating data from Reef-related projects
- expanding monitoring and modelling in response to a climate-changed future in order to support decision making (Australian Academy of Science 2023)
- identifying realistic values and outcomes for the Reef under a climate changed future and the likelihood that ecosystem function decline appears to be inevitable
- managing for coral resilience and understanding how multiple stressors affect different demographic processes and reef recovery
- prioritising actions and continuing to improve methods for understanding and responding to cumulative impacts, including understanding how permitted uses are cumulatively impacting Reef values
- enhancing communication among all players (e.g. scientists, farmers and graziers, governments, the general public and many others) to foster fully open and inclusive dialogue that explores Reef matters, particularly impacts and future Reef resilience and related social and economic sustainability (Bay et al. 2023, Australian Academy of Science 2023).

Enabler C Monitoring, evaluation and adaptive management

Monitoring, evaluation and adaptive management are essential to determine if management actions are effective and whether they need to be changed to achieve the desired objectives.

The five-yearly Great Barrier Reef Outlook Report process provides a comprehensive, regular basis for evaluation and reporting on management of the Reef. The Reef 2050 Plan provides an overarching strategy for the management of the Region and includes clear monitoring and reporting requirements. Following a 2020 review, the Reef 2050 Plan was updated for the period 2021-2025 after which it will be reviewed. The RIMReP also provides an improved framework for reporting on management actions under the Reef 2050 Plan and has been implemented in the current reporting period.

Reef Trust investments are delivered by various partners who report on project performance every six months through the online monitoring, evaluation, reporting and improvement tool (MERIT). Reef Water Quality Report Cards through the Paddock to Reef Program provide a useful evaluation of water quality management outcomes within the Reef, although there can be a lag time of a few years between data collection and reporting. Regional Report Cards are released annually and report on condition from freshwater to marine zones.

Annual Reef inshore water quality, coral and seagrass monitoring is also undertaken by AIMS and university partners as part of the Marine Monitoring Program on behalf of the Reef Authority to provide a broader understanding of the health of the Region. AIMS reports annually on the results from its Long-term Monitoring Program, which provides valuable data on Reef health. Indicators for Reef health are set under the Reef 2050 Objectives and Goals 2021-2025 and include a range of indicators related to coral reef habitats, seagrass, natural wetlands, islands and a range of important fauna (e.g. protect species, seabirds, bioculturally important fish and invertebrate species).

Enabler D Investment

Investment supports the effective and successful delivery of the Reef 2050 Plan. The development of the Reef 2050 Plan has led to significant increases in funding of actions associated with management of the Region, including for both Commonwealth and Queensland government agencies. These are focused primarily on targeting particular actions identified within the Reef 2050 Plan. Additional resources have also been received over the past several years to develop the RJFMP that provides a key compliance focus for the Reef Authority and QPWSP within the Region, as well as delivering conservation actions, checking for change, responding to incidents and welcoming people, as documented in the RJFMP Annual Business Plan.

Resourcing has improved or stabilised across the current reporting period. There have been substantive increases in funding for various Reef projects and associated research. In terms of staffing and skills, recent market demands have significantly impacted the ability to recruit new staff in 2022-2023, with some key positions remaining vacant at the time of reporting. Considerable.

The challenges facing the Reef are substantial and will require long-term investment into improved planning and governance and multi-scaled approaches (Reef-wide, regional and local) and this will require a wider discussion of the type of investments that will be needed into the future to address the diverse range of impacts outlined in this Report.

12. Conclusions

The Reef 2050 Plan provides a central, integrated framework for directing management actions across the Reef and associated Region. Based on an assessment against the management effectiveness elements of Context, Planning, Inputs, Processes, Outputs and Outcomes, the Plan continues to be *mostly effective*.

The Plan presents a strong **Context**, with a relatively good understanding of the values, condition, trends, threats and related impacts, and knowledge of relevant stakeholders. A key improvement has been the incorporation of a greater recognition of climate change and the impacts that this has on all work areas. However, climate change will continue to have diverse and cumulative impacts on the Reef with ecosystem functioning and decline appearing inevitable (Baker et al. 2024). There are knowledge gaps across many areas, in particular related to aspects of biodiversity, heritage (cultural and historic), coastal development, and in particular understanding of cumulative impacts. In particular, Context for the Reef is about understanding its values and what needs protection moving forward. However, due to the dynamic nature of the Reef, particularly in the face of climate change, it will be important for all stakeholders to better understand and clearly articulate the values (and outcomes) that will be prioritised and managed to enhance Reef adaptation and resilience. This may include guiding transition to novel ecosystems with different values from the previous state (Bay et al. 2023). Traditional Owners are key rights' holders and partners in Reef management and continued resourcing is required to enhance the ability of Traditional Owners to access Sea Country to conduct values assessments and undertake protection and rehabilitation activities. Greater understanding is also required in relation to emerging fuels and decarbonisation pathways for the shipping industry and commercial marine tourism industry.

Within this context, the Plan drives improved **Planning** primarily in the areas of water quality under the WQIP and Wetlands Strategy and the trialling of interventions and adaptation activities for the Reef. The Plan also recognises existing planning strategies and policies, such as the North East Shipping Management Plan and Sustainable Fisheries Strategy, and provides additional actions to support these (such as the introduction of IDVs for fisheries). However, there remain opportunities to support regional planning for coastal development and across nations to support action for marine debris and migratory species. There are also significant challenges to overcome in better aligning terrestrial and marine planning systems. For example, while local governments are well supported through the Reef Guardian program, more support is needed to integrate actions to mitigate impacts on the Reef through their statutory planning instruments.

Inputs within the Plan are strong, primarily as a result of the concentration of funding and associated resources that has been introduced through the Plan and nested sub-plans, and the RIMReP (e.g. the suite of projects informed by the Priority Monitoring Gaps Prospectus). By providing an integrated framework for Reef-related actions, the Plan has acted to both consolidate funding that was otherwise applied across multiple areas, and to highlight funding gaps and initiatives. Despite this, there are some knowledge gaps specific to particular management areas that need more attention, such as indigenous and historic heritage.

The Processes element focussed on the standard of governance, cross-jurisdictional consistency and performance monitoring. The Reef governance system incorporates multiple governing authorities, stakeholders and partners and complex arrangements but is struggling to improve Reef outcomes and to protect Reef values in the face of increasing cumulative impacts, particularly as a result of climate change. The structural elements of the governance system in relation to the work areas are generally well developed. The functional elements of the governance system, which relate to how the system operates and how decisions are made are less effective, being described as fragmented, lacking agility, flexibility and alignment with ancillary organisations and policies, with work programs not operating at the required scale, lacking coherence or responsiveness to emerging threats, having centralised and siloed decision making, with long time frames from policy changes to implementation (Australian Academy of Science 2023, Chubb 2023) and lacking effective engagement, including co-governance arrangements, with diverse stakeholders (Baker et al. 2024).

In terms of cross-jurisdictional consistency, the Intergovernmental Agreement sets a framework for joint coordination and there are mainly effective arrangements in place across most work areas. However, gaps are evident in relation to land-based activities and the engagement of local governments within Reef catchments across planning and permission systems where they operate at multiple levels (e.g. planning for coastal development and regional planning for catchment management, fisheries management).

Performance monitoring under the Plan is well established across most work areas and is supported by the RIMReP and monitoring programs under nested and supporting instruments (e.g. WQIP, Wetlands Strategy, Sustainable Fisheries Strategy). However, for many of the work areas there is no direct link between goals and the overall objectives for the Reef 2050 Plan and this creates difficulties in monitoring the effect of strategic actions (e.g. WQIP targets which are not embedded in the Reef 2050 Plan). In general, information sharing has improved and a Data Management System is under development.

Ongoing challenges for Processes relate to: enhancing equity across all work areas; ensuring effective engagement and benefit sharing arrangements, especially with Traditional Owners; addressing fragmented and siloed decision making; enhancing regional governance models; aligning planning policy and programs; incorporating diverse knowledge sets across multiple sectors, in particular Traditional Knowledges; expanding monitoring and modelling in response to a climate-changed future in order to support decision making; consolidating data from Reef-related projects; and clearly and honestly communicating findings to all stakeholders.

A significant number of Outputs have been delivered under the Plan, in accordance with the work areas. However, due to the lack of linkage between many of the work area goals and Reef 2050 Plan objectives, the contribution of the outputs to broader outcomes is uncertain. In particular, the strategic actions for the international sources work area do not appear to link to broader outcomes and do not go beyond business-as-usual engagement in international fora. Additionally, while adaptation and intervention trials for rehabilitation and restoration are producing localised benefits, these are often not scaleable and thus do not currently contribute in a significant way to Reef-scale outcomes.

Outcomes remain poor, including the protection of Reef values and amelioration of threats. However, there can be significant lag times between management actions for land management and the achievement of improvements within the environment, and there is difficulty in attributing broader outcomes for the Reef to localised rehabilitation activities. A key challenge lies with better connecting produced outputs with desired Reef outcomes. Current assumptions on which outcomes are based rely on static Reef values that may no longer align with the dynamic and uncertain future anticipated due to climate change (Baker et al. 2024). Given the inherent ambiguity around climate change impacts the articulation of goals and outcome must include a level of flexibility and adaptability that may not be possible due to the complex and decentralized governance systems (Morrison et al. 2020). Further to this is a limitation on effective innovation due to ‘siloed’ decision making, which disincentivizes innovation, particularly 'risky’ resiliency-based innovation, as all associated risk is carried by the individual agency. Despite this, the Plan has delivered enhanced outcomes across a variety of themes, especially in the conservation of Reef values. Climate change remains the most significant risk to the Reef with ongoing need for threat amelioration.

In conclusion, the Reef 2050 Plan continues to provide a good framework for the delivery of integrated management for the Reef. There are many strengths or aspects that are ‘working well’. There are diverse challenges and many possible ‘ways forward’ (refer Table 1).

13. References

Australian Academy of Science 2023, Reef Futures Round Tables Report, August 2023, viewed 10/08/2023, <https://www.science.org.au/files/userfiles/support/reports-and-plans/2023/reef-futures-roundtable-report-aug-2023.pdf>.

Baker, I., Peterson, A., Tobin, L., Toki, B., and Visser, J. 2024, Independent Assessment of Management Effectiveness for the Great Barrier Reef Outlook Report 2024, Great Barrier Reef Marine Park Authority, Townsville.

Bay, L.K., Gilmour, J., Muir, B., Hardistry, P.E. 2023, Management approaches to conserve Australia's marine ecosystem under climate change, *Science*, 381: 631-636. doi:10.1126/science.adi3023Dale, A., Vella, K., & Potts, R. 2013. Governance Systems Analysis (GSA): A Framework for Reforming Governance Systems. *Journal of Public Administration and Governance*, 3(3), 26, viewed 24/02/2023, https://doi.org/10.5296/jpag.v3i3.4385.

Bozec Y.M, Hock K., Mason R.A.B., Baird M.E., Castro-Sanguino C., Condie S.A., Puotinen M., Thompson A., and Mumby P.J. 2022. Cumulative impacts across Australia's Great Barrier Reef: a mechanistic evaluation. *Ecological Monographs* 92(1) doi:10.1002/ecm.1494.

Carter, E. and Thulstrup, H. 2022, Report on the Joint World Heritage Centre/IUCN Reactive monitoring mission to the Great Barrier Reef (Australia), from 21 to 30 March 2022, viewed 03/04/2023, <https://whc.unesco.org/en/documents/197090>.

Chubb, I. 2023, Reef 2050 Plan, letter to the Hon Tanya Plibersek MP and the Hon Leanne Linard MP, viewed 25/09/2023, <https://www.dcceew.gov.au/sites/default/files/documents/advice-on-climate-change.pdf>.

Dale, A.P., Vella, K., Pressey, R.L., Brodie, J., Gooch, M., Potts, R. & Eberhard, R. 2016, Risk analysis of the governance system affecting outcomes in the Great Barrier Reef, *Journal of environmental management* 183: 712-721, viewed 2/05/2023, https://doi.org/10.1016/j.jenvman.2016.09.013

Dale, A., Vella, K., Gooch, M., Potts, R., Pressey, R., Brodie, J., & Eberhard, R. 2018. Avoiding Implementation Failure in Catchment Landscapes: A Case Study in Governance of the Great Barrier Reef. *Environmental Management*, 62(1), 70-81, viewed 2/05/2023, https://doi.org/10.1007/s00267-017-0932-2.

Department of Environment and Science 2021, Queensland State of the Environment Report 2020, viewed 04/07/2023, <https://www.stateoftheenvironment.des.qld.gov.au/>.

Great Barrier Reef Marine Park Authority 2019, Great Barrier Reef Outlook Report 2019, Great Barrier Reef Marine Park Authority, http://hdl.handle.net/11017/3474.

Great Barrier Reef Marine Park Authority 2019, Aboriginal and Torres Strait Islander Heritage Strategy for the Great Barrier Reef Marine Park, viewed 05/03/2023, <https://elibrary.gbrmpa.gov.au/jspui/retrieve/9bbc9177-e617-4019-b003-1d70a1758167/GBRMPA_ATSI_HeritageStrategy.pdf>.

Hocking, M., Courrau, J., Dudley, N., Leverington, F. and Stolton, S. (2006), *Evaluating effectiveness: a framework for assessing management effectiveness of protected areas*, IUCN World Commission on Protected Areas, available: https://www.iucn.org/resources/publication/evaluating-effectiveness-framework-assessing-management-effectiveness.

Morrison, T. 2017, 'Evolving polycentric governance of the Great Barrier Reef', Proceedings of the National Academy of Sciences of the United States of America. Vol. 114 no. 15, E3013-E3021, doi: 10.1073/pnas.1620830114.

Olvera-Garcia, J., & Sipe, N. (2020). Examining how collaborative governance facilitates the implementation of natural resource planning policies: A water planning policy case from the Great Barrier Reef. *Environmental Policy and Governance*, 30(3), 115-127, viewed 2/05/2023, https://doi.org/10.1002/eet.1875.

Smith, D.C., Fulton, E.A., Apfel, P., Cresswell, I.D., Gillanders, B.M., Haward, M., Sainsbury, K.J., Smith, A.D. M., Vince, J., and Ward, T.M. 2017. Implementing marine ecosystem-based management: lessons from Australia. *ICES Journal of Marine Science,* 74(7): 1990-2003, viewed 02/05/2023, doi:10.1093/icesjms/fsx113.

Turner, R.A., Forster, J., Fitzsimmons, C. and Mahon, R. 2022, Expanding narratives of governance constraints to improve coral conservation, Conservation Biology, viewed 06/06/2023, doi:10.1111/cobi.13933.

14. Attachment One: rating and grading methodology

For each work area, the assessment is based on sixteen (16) questions (Table 4), grouped according to the six elements of the management effectiveness cycle (Figure 1):

Table 4: Elements and questions

Element	Questions
Context*	CO1 How well do the Reef 2050 Plan's actions, objectives and outcomes contribute to and affect understanding of the values, current condition and trend, impacts and stakeholders of the Region? CO2 Does the Reef 2050 Plan clearly and appropriately consider the values, threats and internal and external social and policy environment, including rights-holders and stakeholders?
Planning	PL1 Does the Reef 2050 Plan help address issues relating to planning, including the appropriateness, coverage and quality of plans? PL2 Does the Reef 2050 Plan ensure planning is more efficient, reduces duplication and is consistent across jurisdictions? PL3 Does the Reef 2050 Plan contribute to appropriate improvements in legislation and policy?
Inputs	IN1 Has the Reef 2050 Plan been effective in improving the level or sustainability of resourcing for management of the Reef? IN2 Does the Reef 2050 Plan help to identify gaps in knowledge and recommend action to remedy these gaps? IN3 Has the Reef 2050 Plan helped to ensure effective allocation and use of the resources (for example through less duplication)?
Processes	PR1 Does the Reef 2050 Plan encourage better governance across the Region (including legitimacy, clear direction, performance, accountability, fairness and rights)? PR2 Does the Reef 2050 Plan facilitate the consistent implementation of programs/policy across jurisdictions? PR3 Is there effective performance monitoring to gauge progress towards the objectives of the Reef 2050 Plan?

Outputs*	OP1 Has the Reef 2050 Plan resulted in better delivery of outputs? OP2 Are these outputs appropriate to achieve the goals and outcomes? Have the key outputs been identified?
Outcomes*	OC1 Is the Reef 2050 Plan on track to achieve its stated vision and objectives (and where it can possible measured based on the evidence collected – any goals)? OC2 Is it likely that values will be better conserved because of the Reef 2050 Plan? OC3 Are threats being better ameliorated because of the Reef 2050 Plan? OC4 Is it likely that community well-being and relationships will be improved because of the Reef 2050 Plan?

*Previous versions of the Insights Report included a focus on 'targets' as part of CO1, OP2 and OC3. As the current Plan does not include targets, this language has been replaced with 'actions' or 'goals', as appropriate.

Each question is assigned a rating on a four-point rating scale (1-4). This is the same scale as used the Outlook Report:

Rating	Per cent of optimal condition
1	0% to 20%
2	21% to 50%
3	51% to 80%
4	81% to 100%

Ratings for each question within the six elements of the IUCN Framework were added to provide a total for the element (e.g. Context, Planning etc.) and were converted to a per cent. A grade for management effectiveness for each work area across each element and overall was assigned based on a grading scale ranging from *Effective* to *Ineffective*:

Grade	Per cent
Effective	85% to 100%.
Mostly effective	66% to 84%
Partially effective	40% to 65%
Ineffective	less than 40%.

The ranges for each grade are not equal, reflecting a decision by the Reef Authority during the first Outlook Report to adopt a higher standard for management to be considered *Effective* within a World Heritage Area.

Note that this rating and grading system was not applied to the Enablers.

15. Attachment Two: assessment tables

CONTEXT

CO1 How well do the Reef 2050 Plan's actions, objectives and outcomes contribute to and effect understanding of: the values, current condition and trend, impacts and stakeholders of the Region?

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
3	3	3	3	3
The Reef 2050 Plan now has a strong focus on climate change, which represents a significant improvement on previous plans. Climate Change is highlighted as significant consideration within the supporting text	For land-based activities, the relevant values, conditions, trends, impacts and stakeholders are defined around land-based run-off (from both agricultural activities and urban and industrial land use), plastic pollution, and artificial light from coastal	For water-based activities, the relevant values, conditions, trends, impacts and stakeholders are defined in the context of Reef-dependent industries (e.g. commercial marine tourism, fisheries, traditional use, research, recreation) and Reef-	The focus on international sources of impact is specific to marine debris that enters the Reef from outside Australia and international migratory species. Actions within the Reef 2050 Plan are directed towards improved understanding of marine	The focus of protect, rehabilitate and restore is on management of pest species, including crown-of-thorn starfish, feral pigs, goats and invasive weeds (5.1), piloting interventions that support the resilience of coral reefs, seagrass and other marine habitats and

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
underpinning the Reef 2050 Plan's Vision statement. Climate Change is central to preliminary discussion on threats to the Reef. The Reef 2050 Plan recognises the significance of climate change to the Reef and the existing and emerging policy framework at state and federal levels to address this. Actions under the Reef 2050 Plan are directed toward supporting this broader framework as well as trialling innovations to support adaptation.	developments. The actions under the Reef 2050 Plan and the two nested instruments for water quality (Reef 2050 Water Quality Improvement Plan and Wetlands in the Great Barrier Reef Catchment Strategy) are based on a good understanding of land-based run-off and catchment conversion, especially for agricultural sectors, although there is some disconnect between management arrangements and the views of on-ground stakeholders, and	associated industries (e.g. ports, shipping, defence). There are several strategic actions within the Reef 2050 Plan that aim to improve understanding in these areas, including: an expanded role for the RJFMP to monitor changes, educate Reef users and uphold compliance (3.2), partnerships and collaboration with Traditional Owners and Reef users to improve understanding (3.3), strengthening Traditional Owner management of Sea	debris sources (4.1) and migratory species condition and trend (4.2). Most other international impact sources are covered in other work areas (e.g. climate change, water-based activities, and land-based activities). Generally, these actions provide good coverage of the key international matters not covered elsewhere. However, there is no focus on combining international understanding with the national context to better prioritise action.	islands (5.2), enhancing protection, rehabilitation and restoration of coastal and catchment ecosystems (5.3) and implementing historic and cultural heritage site conservation (5.4, 5.5). The intent is to address existing areas of damage that can be repaired as well as preventing the degradation of heritage sites. Each of these actions includes a focus on improving understanding of impacting processes and condition, which in turn provides a

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
However, there remain gaps associated with understanding the direct, indirect and cumulative impacts of climate change on the Reef in particular. The Reef 2050 Plan's vision statement recognises the need to limit global warming within the temperature goal outlined within the Paris Agreement.	uncertainty regarding legacy impacts of sediment discharges. Action 2.3 also aims at improving understanding of artificial lighting impacts and associated impacts to sensitive systems. However, there are opportunities to better integrate the current contextual understanding and the system for coastal development more generally.	Country through agreements and partnerships (3.4), improving understanding of fisheries bycatch impacts (3.6), investigating noise and lighting impacts (3.7) and enhanced pest surveillance (3.8). This provides a strong contextual understanding of the Reef. However, there are opportunities to expand understanding of direct use of the Reef further, together with an understanding of emerging areas, such as the use of		strong contextual understanding of the Reef. However, while there is a focus on improved understanding of how to address existing impacts (e.g. trialling of interventions through the Reef Restoration and Adaptation Program), the work area does not include investigations to prioritise management and rehabilitation actions to ensure a systematic approach with Reef-wide benefits.

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
		alternative fuels and decarbonisation approaches in the shipping industry.		

CO2 Does the Reef 2050 Plan clearly and appropriately consider the values, threats and internal and external social and policy environment, including rights-holders and stakeholders?

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
2	2	3	3	3
The Reef 2050 Plan recognises that climate change is the most serious and pervasive threat to the Reef and the global warming, and the associated impacts of a changing climate, are central to the Reef 2050 Plan's preliminary discussion on threats to the Reef.	Based on the coverage of the Reef 2050 Plan (and nested instruments) for land-based activities, there is good coverage of matters relevant to the context of the Reef. However, this is weakened in some areas by a perceived or actual disconnect between management actions and views of on ground implementing individuals	Based on the coverage of the Reef 2050 Plan for water-based activities, there is strong coverage of matters relevant to the context of the Reef. This is evident through specific management instruments, such as the North East Shipping Management Plan, Sustainable Fisheries Strategy, or through broader management systems in place for marine	As marine debris and migratory species are the main international matters not covered elsewhere, the Reef 2050 Plan, their coverage in the Plan recognises their specific importance. However, while the Reef 2050 Plan includes actions to further the understanding of these matters, these actions are not cast within the broader existing policy context, at	Based on the coverage of the Reef 2050 Plan for areas of protection and restoration, there is a good understanding of the broad priority values and threats to the Reef or an acknowledgement of the need to collect data to further understand these areas (e.g. historic and cultural heritage). There is also significant innovation being undertaken to

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
Discussion regarding the threat of climate change on the Reef largely focus on direct and indirect impacts of climate change, while discussion on compounding and cumulative impacts is lacking. The Reef 2050 Plan highlights that climate change is an international issue that requires a global solution. While some site-based management of regional and local pressures are within the Great Barrier Reef Marine Park Authority's direct	(i.e. farmers, land managers). There is also a lack of focus on legacy issues associated with the sediment already deposited on the Reef and associated resuspension and mobilisation that can occur.	tourism, defence, recreational and research activities. However, for traditional use information on use, threats and consideration of right-holders remains limited. In particular there is no monitoring in this sector at present.	either a national or international scale.	further understanding of resilience-building and adaption programs. However, there scale of efforts for protection, rehabilitation and restoration are insufficient to adequately achieve Reef-scale benefits.

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
control, a significant role in addressing the threat of climate change remains at the national and international level.				

PLANNING

PL1 Does the Reef 2050 Plan help address issues relating to planning, including the appropriateness, coverage and quality of plans?

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
3	2	3	2	3
The Reef 2050 Plan establishes goals and strategic action related to climate change for three main categories: mitigation; stakeholder capacity building; and adaptation.	Both the WQIP and the Wetlands Strategy set actions aimed at improving planning and compliance of land use and runoff activities, working within the current planning and permission system. The Reef 2050 Plan is also likely to indirectly support planning associated with coastal lighting through an improved understanding of	There is a major planning focus across the water-based activities work area, including a focus on enhancing existing planning mechanisms that are effective (i.e. shipping, spatial planning), supporting the implementation of planning reform for fisheries (including under the Sustainable Fisheries Strategy), and providing new planning	The strategic actions for the international source area focus on building and leveraging international efforts to manage marine debris and international migratory species; they do not directly address the local planning context for these matters, including any local contribution to marine debris and/or degradation of migratory species habitat.	The Reef 2050 Plan provides an integrated framework for guiding actions in pest management and habitat restoration and interventions, including existing plans and programs (e.g. Nest to Ocean Turtle Protection Program, Crown-of-horns Starfish Control Program, Queensland Land Restoration Fund). The Reef 2050 Plan indirectly

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
	impacting processes from lighting. However, the Reef 2050 Plan does not address coastal planning and development more generally, including any actions associated with integration of Reef-specific outcomes for planning systems.	arrangements for noise, lighting and marine and island pests. There are no strategic actions specific to dredging and port development as these have developed and implemented under previous versions of the Reef 2050 Plan. However, the Reef 2050 Plan does not address ongoing concerns regarding the complexity of planning in particular sectors, especially for commercial marine tourism.	Marine debris is covered under the water-based activities work area, in the context of cleaning up existing debris, while addressing potential land-based sources is covered through the land-based activities work area. However, in the absence of strategic actions that aim to synthesise the understanding of international and national sources of marine debris, it is difficult to ensure that subsequent planning will prioritise key action areas. This may require regional-scale planning that	supports heritage conservation planning through improved knowledge of heritage sites and values. However, much of the framework is not directed towards the actual development of new or enhanced planning arrangements.

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
			considers both national and international sources.	

PL2 Does the Reef 2050 Plan ensure planning is more efficient, reduces duplication and is consistent across jurisdictions?

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
2	2	3	4	4
Mitigation The Reef 2050 Plan references Australian emission reduction targets and Commonwealth political responses to achieve these commitments under the Paris Agreement. Identifies the implementation of the Queensland Action Plan	The Reef 2050 Plan and nested sub-plans reduce inconsistency by consolidating water quality management works across multiple programs into a single point. The nested sub-plans are developed jointly by Queensland and Commonwealth governments. As this is the key area at risk of inconsistency in planning, this provides a strong	Jurisdictional inconsistencies range across different water-based activities, with some recording ongoing inconsistencies or overlap between jurisdictions (e.g. port development, fishing) while others have more streamlined systems (e.g. shipping). The inconsistencies reported relate primarily to the planning system where there is duplication of	Representation at international fora is undertaken directly by the national government, with any subsequent actions implemented at national level through existing arrangements. The focus of the Reef 2050 Plan is on utilising the existing fora and associated national-level relationships to action international sources of impacts and therefore does not introduce any	As the Reef 2050 Plan provides the centralised framework for on-ground actions, there is a reduction in duplication and inconsistencies between separate agencies. While there are inconsistencies in spatial coverage for the different boundaries within the Reef (e.g. World Heritage Area, Commonwealth Marine Park, State Marine Park, islands), there is close

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
2020-2030 as a Strategic action. Strategic actions commit to the delivery of blue carbon initiatives and the adoption of low-carbon business practices and technologies; but does not identify roles and responsibility for their delivery. Adaptation Robust adaptation planning needs to be supported by thorough risk and vulnerability assessments, including understanding of the direct, indirect,	measure to reduce duplication. However, there are no action areas within the Reef 2050 Plan specific to addressing coastal planning and development and any potential inconsistencies with Reef planning.	approval responsibility at state and federal levels. These inconsistencies are not addressed under the Reef 2050 Plan. Where possible the Reef 2050 Plan does integrate with existing arrangements (e.g. Sustainable Fisheries Strategy, North East Shipping Management Plan) to avoid creating inefficiencies and overlap.	inconsistencies or duplications within the Australian system. It is noted however that the management of marine debris within Australian waters and of migratory species includes areas of overlap at national, state and local levels.	collaboration between the Reef Authority and Queensland Parks and Wildlife Service and Partnerships to deliver joint management actions across the region. This includes through the RJFMP.

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
compounding and cumulative impacts of climate change and the relationship of these impacts with other stressors on the Reef. Reef 2050 Plan provides strategic actions to develop adaptation interventions at the individual species and habitat level but does not consider broader adaptation planning processes to support the implementation of successful adaptation measures, nor the decision context needed for				

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
adaptation to be successfully implemented. Reef 2050 Plan focuses on direct impacts, such as marine heatwaves and rising sea levels and lacks a multi-hazard approach to adaptation considerations. The Reef 2050 Plan integrates with both federal and state-level planning for climate change. As this planning happens outside of the area of Reef-specific management, there is little scope within the Reef 2050 Plan to				

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
influence jurisdictional integration.				

PL3 Does the Reef 2050 Plan contribute to appropriate improvements in legislation and policy?

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
3	3	3	2	3
As per PL1, the main contribution of the Reef 2050 Plan is in strengthening the Blueprint for Resilience. It does not drive any changes in legislation or policy outside the Reef-context as this is primarily done at a national level.	The Reef 2050 Plan and nested sub-plans focus primarily on implementation of existing strategies for water quality improvement rather than proposing new policy and legislative reform, although the implementation of these instruments occurs in the broader context of improved legislation under the recent Reef Regulations. The Reef 2050 Plan is also likely to	The Reef 2050 Plan is likely to indirectly support policy development for noise, lighting and marine and island pest species through an enhanced focus on these areas. It also seeks to support the implementation of fisheries policy reform as introduced through the Sustainable Fisheries Strategy. The Reef 2050 Plan has also contributed to the development of the	There is high levels of policy and legislative consistency at national and state levels for marine debris and migratory species. The focus of the international sources work area, however, is on addressing international sources. Within this context, there are no strategic actions directed towards achieving regional	The Great Barrier Reef Interventions Policy has been developed in association with the Reef 2050 Plan to guide actions related to trialling and implementing interventions for the Reef. The ongoing implementation of interventions will assist in developing broader policy for resilience and management for the Reef.

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
	indirectly support policy development for coastal lighting through an improved understanding of lighting impacts. However, the Reef 2050 Plan does not provide for actions to support the Reef 2050 Planning system for coastal development.	Tourism Management Action Strategy and the Reef Authority's position statement on fishing. A current gap is in supporting or leading policy development associated with emerging fuels and decarbonisation pathways for shipping through the Reef.	policy outcomes or consistent approaches.	The Reef 2050 Plan also provides a broader context under which a range of policies, strategies and guidelines have been developed for restoration of the Reef, including the Crown-of-thorns starfish Strategic Management Framework, the Queensland Marine Turtle Conservation Strategy and the Aboriginal and Torres Strait Islander Heritage Strategy. Policy reform for historic heritage remains unaddressed, however, especially in relation to

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
				unidentified shipwrecks throughout the region.

INPUTS

IN1 Has the Reef 2050 Plan been effective in improving the level or sustainability of resourcing for management of the Reef?

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
3	3	2	2	3
The introduction of a climate change work area within the Reef 2050 Plan has led to a significant increase in funding towards climate change management specific to the Reef. Specifically, this has included funding for research and trialling of interventions together with	Significant investment in managing land-based run-off and wetlands has been introduced through the Reef 2050 Plan and the nested sub-plans. This has been the priority area for management for land-based activities. Corresponding investment in other land-based activities (e.g. coastal	A large number of actions related to water-based activities are delivered through programs and agencies parallel to the Reef 2050 Plan, such as funding for the Sustainable Fisheries Strategy and improved planning for control of marine pests once in internal waters, and management of shipping under the North	There does not appear to have been significant new or increased investment in the areas of marine debris or international migratory species as a result of the Reef 2050 Plan.	The Reef 2050 Plan provides a source of increased funding to address crown-of-thorns starfish and associated habitat recovery. The Reef 2050 Plan also provides a key catalyst for funding into habitat restoration trials and trialling interventions through the Reef

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
enhancements to the Blueprint for Resilience.	development) has not occurred.	East Shipping Management Plan. The Reef 2050 Plan has not led to materially increased funding for maritime incident response outside of that already provided by AMSA and MSQ. Through the Reef 2050 Plan, however, the is increased attention on prioritising the expansion of TUMRAs and improved Traditional ownership of Sea Country. Additionally, the actions under the Reef 2050 Plan have led to increased investment in development of		Restoration and Adaption Program. While the Reef 2050 Plan also supports increased engagement with Traditional Owners and conservation of cultural heritage, there is not a commensurate increase in resourcing associated with historic heritage.

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
		independent data validation for fisheries.		

IN2 Does the Reef 2050 Plan help to identify gaps in knowledge and recommend action to remedy these gaps?

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
2	2	3	2	4
A major focus for the climate change work area is on understanding different interventions that could be implemented to support adaptation of the Reef. This is based on an appreciation of gaps within this area. However, the Reef 2050 Plan does not directly address gaps in Reef-specific understanding of direct, indirect and	Both the WQIP and the Wetlands Strategy have a strong monitoring element aimed at understanding the effectiveness of management actions for reducing water quality impacts. There is also a nested Reef 2050 Water Quality Research, Development and Innovation Strategy under the Reef 2050 Plan aimed at improving understanding of water	Implementation of actions under the Reef 2050 Plan will improve understanding of impacts to the Reef, especially in the context of independent data validation of fisheries and lighting and noise impacts. Additionally, through a focus on engagement with Traditional Owners and the strengthening of Traditional Owner management of sea countries through	The Reef 2050 Plan is aimed at improving the knowledge base of the source of marine debris and the status and condition of migratory species internationally. It does not have specific focus on national-level contribution and status, however.	The Reef 2050 Plan is aimed at increasing the knowledge of habitat restoration initiatives and the values of cultural and historic heritage features. The Priority Monitoring Gaps Prospectus has allowed for improved understanding of knowledge gaps associated with rehabilitation activities while the Reef Restoration and Adaption Program

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
cumulative impacts from climate change.	quality impacts and management arrangements. Action 2.3 specifically addresses knowledge gaps associated with lighting impacts on the shoreline and seeks to enhance understanding of heritage values and sites. Knowledge gaps associated with the management of coastal development, however, are not addressed in the Reef 2050 Plan.	partnerships and TUMRAs, the Reef 2050 Plan provides an opportunity to better understand and integrate traditional knowledge for Reef management. However, knowledge gaps associated with emerging fuels and decarbonisation pathways for the shipping industry are not addressed in the Reef 2050 Plan.		provides the opportunity to trial different interventions. There are also strategic actions associated with better identification of historic and cultural heritage sites.

IN3 Has the Reef 2050 Plan helped to ensure effective allocation and use of the resources (for example less duplication)?

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
3	3	3	2	3
The Reef 2050 Plan provides a focal point for investment related to climate change research for the Reef, especially in the context of trialling interventions. Other resourcing to climate change matters is provided at a national level.	Indication is that resourcing under the Reef 2050 Plan is being appropriately allocated to reduce duplication. This is particularly clear through the separation of management focus on agricultural land (under the WQIP) and wetland and coastal areas (under the Wetlands Strategy). Prior to this work area within the Reef 2050 Plan,	The Reef 2050 Plan recognises existing funding across a range of water-based activities, including shipping, fishing, and traditional use, and provides additional resourcing in support areas (e.g. provision of funding for independent data validation for fisheries).	It is currently unclear how the actions for international sources under the Reef 2050 Plan align with other national programs associated with key threatening processes and migratory species (and Ramsar wetland) management. Thus, there is no clear framework to reduce resource duplication or promote efficiency	To the extent the Reef 2050 Plan has promoted more restoration and rehabilitation trials, it has the potential to improve resource efficiency for habitat management activities. However, it does not inherently ensure allocation of resources to management avoids duplication with habitat restoration initiatives that may be undertaken by

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
	there was minimal investment in resources associated with artificial lighting so there is no duplication with measures noted under the Reef 2050 Plan.			entities outside of the Reef 2050 Plan.

PROCESSES

PR1 Does the Reef 2050 Plan encourage better governance across the Region (including legitimacy, clear direction, performance, accountability, fairness and rights)?

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
2	2	3	2	3
Governance for climate change occurs across a range of international, national, state and local levels, with additional interests specific to the Reef. While there have been significant improvements in climate change management arrangements in Australia, they remain in a state of	The joint management approach encouraged under the Reef 2050 Plan promotes more effective governance for management of land-based run-off by ensuring consistent and complementary approaches by different government agencies. There is clear reporting	There are mostly effective governance systems already in place for most water-based activities in the Reef, with the Reef 2050 Plan recognising and integrating into these. The only areas without strong governance are emerging areas such as lighting and noise which will be indirectly developed	The international sources work area has a strong emphasis on improving international collaboration on marine debris and international migratory species. However, specific actions do not equate to improved decision-making processes and governance in these areas. There is also no focus on specific	The Reef 2050 Plan provides a strong centralised framework for decision-making and management action associated with restoration and rehabilitation actions. This includes the role of the Reef Restoration and Adaptation Program in centralising research on adaptation and

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
ongoing development. This flows through to the Reef as there is inability to create stronger region-specific governance. The Reef 2050 Plan does seeks to integrate various climate change strategies and actions together as well as empowering local actors but does not provide a strong basis for improved governance for climate change generally or specifically for the Reef.	and accountability under the nested sub-plans. Despite this, there are concerns associated with top-down approaches to governance, with limited engagement with smaller-scale agencies and individuals involved with implementation. Governance for coastal and catchment planning and development more broadly is still undertaken primarily at a local-scale and does not include broader consideration of regional needs and interests for the Reef.	through the implementation of the Reef 2050 Plan.	improvements to governance, such as the development of regional policy approaches to address marine debris.	intervention projects, allowing for a greater knowledge base for future management, and the joint approach of the Reef Authority and Queensland Parks and Wildlife Service and Partnership in delivering activities through the RJFMP. However, the remains concerns regarding the capacity of the Reef 2050 Plan and the Reef Authority (or other relevant institutions) to effectively have the flexibility to adapt to climate change related impacts and other

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
				pressures driving the needs for restoration and rehabilitation.

PR 2 Does the Reef 2050 Plan facilitate the consistent implementation of programs/policy across jurisdictions?

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
2	2	4	3	4
Most climate change-related programs and policies are at a national level and above the scale at which the Reef 2050 Plan operates. Thus, the Reef 2050 Plan does not have a key role in driving consistent implementation. However, the Reef 2050 Plan does provide a centralised framework for	The current Plan integrates various land-based programs into a consolidated set of plans/strategies. However, it does not aim to provide for a broader framework for consistency in coastal planning and development at a regional scale, except as it relates to agricultural activities within the catchment.	Within the water-based activities work area, the Reef 2050 Plan integrates well with a series of existing programs, policies and planning frameworks, such as the Sustainable Fisheries Strategy and the North East Shipping Management Plan. Where actions go beyond these frameworks (e.g. lighting and noise impacts, bycatch and protected species interactions) it is on the	As it is unclear how the focus on international sources of marine debris and international status of migratory species relates to national-level focus and programs, it is unclear the extent to which the Reef 2050 Plan provides for a consistent framework for application, especially noting state and national-level approaches to these matters.	As the Reef 2050 Plan is the central framework for Reef restoration and rehabilitation actions, it provides the program for this work. This includes research activities through the Reef Restoration and Adaption Program and the delivery of on-ground activities as part of the RJFMP. The Priority Monitoring Gaps Prospectus developed under the Reef 2050 Plan

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
the trialling of interventions for the Reef.		basis that these elements are not already covered in other Reef 2050 Plan work areas.		also helps to identify areas for further monitoring activities.

PR3 Is there effective performance monitoring to gauge progress towards the objectives of the Reef 2050 Plan?

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
2	3	3	2	3
There is not a direct linkage between the climate change work area and the objectives and outcomes of the Reef 2050 Plan. 'Monitoring' for climate change relates to activity statements against the actions and goals in the work area but do not measure overall changes in the Reef related to climate change pressures.	Ongoing water quality and management monitoring is undertaken to gauge the success of nested sub-plans. While water quality is not part of the formal objectives and outcomes framework for the Reef 2050 Plan, there are clear measures of success under these sub-plans. Additionally, the Reef 2050 Plan includes specific objectives related to wetland preservation which	Water-based activities are indirectly linked to several objectives and outcomes, including those related to the preservation of marine species and habitats. In the context of fisheries, there is an even closer link, with objectives under the Reef 2050 Plan aligning to those under the Sustainable Fisheries Strategy and related actions in this work area.	There is direct linkage between objectives and outcomes and the international sources work area with regards to internationally migratory species, but only to the extent populations status and condition are measured within Australia. There is not specific performance measuring associated with international levels, nor is this included in the goal	For coral, seagrass, wetlands and islands, there is a clear linkage between objectives and outcomes and this work area. Thus, the performance monitoring for these values supports and understanding of their improvement as a result of restoration and rehabilitation activities. Similarly, there are also objectives associated with improved understanding of

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
	link through to actions under the land-based activity work area and the Wetlands Strategy, together with associated performance monitoring.	For other areas, measurements are by activity statement and do not provide direct linkages back to the objectives of the Reef 2050 Plan.	framework for the Reef 2050 Plan. Performance monitoring for marine debris consists of activity statements only, with the key goal for this area measured only by participation in international fora.	heritage values which links to this work area. For other areas, especially pest management, measurement is by activity statement only.

OP1 Has the Reef 2050 Plan resulted in better delivery of outputs?

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
3	3	3	1	3
A large number of outputs are noted within the 2020-22 Activities Report for the climate change work area. Of these, those directly linked to the Reef 2050 Plan include the review of the Blueprint for Resilience, the initiation of the Reef Restoration and Adaption Program, and investments in the Queensland Land Restoration Fund. These represent improved	There has been a large number of outputs for this work area identified in the 2020-22 Activities Report the WQIP Regional Report Cards and Major Integrated Projects reports for Reef catchments, many of which are directly linked to the framework established by the Reef 2050 Plan and nested sub-plans. Some outputs have been slow however such as the Overall Reef report cards	Key outputs related to the Reef 2050 Plan are the expansion of the RJFMP, the development of an independent data validation approach for fisheries, and support for marine debris clean-up activities (with Tangaroa Blue Foundation). Most of the other outputs relate to activities occurring in parallel with the Reef 2050 Plan, including ongoing port planning activities	There has been minimal delivery of actions related to better understanding marine debris and migratory species.	The Reef 2050 Plan has helped to coordinate outputs related to crown-of-thorns starfish control, island and reef recovery activities, leading to improved delivery in these areas. Actions remain incomplete in relation to broader pest management and historic site conservation activities.

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
delivery of outputs for the Reef.	which have not been updated since 2020 due to ongoing target reviews and lag between actions and reporting. The Reef 2050 Plan has been effective in both prioritising actions and leading to greater coordination. Outputs related to coastal planning and the management of lighting effects, however, have not yet been delivered.	(carried over from previous Plans) and the implementation of the Sustainable Fisheries Strategy.		

OP2 Are these outputs appropriate to achieve the goals and outcomes? Have the key outputs been identified?

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
2	3	2	1	2
Works associated with the RRAP and associated trialling of interventions contribute to goals under the Reef 2050 Plan related to increasing the capacity of the Reef species, habitats and communities to adapt to a changing climate. However, there is no broader linkage between Reef-specific activities and overall objectives and	The nested sub-plans have clear performance targets and linked outputs which contribute to the delivery of the objectives and outcomes under the Reef 2050 Plan. However, the targets focus primarily on short-term timescales to produce immediate results without long-term commitments associated with securing and	Many of the outputs under the Reef 2050 Plan have direct linkage to goals, including reducing fishing threats and marine debris. However, other goals are only indirectly affected by proposed actions (e.g. goal for noise and lighting is to reduce impacts while action is primarily to investigate impacts and possible mitigation measures). Additionally, while water-based	There is a lack of clarity on specific outputs intended to be delivered under the international sources work area and how these are intended to link to goals, objectives and outcomes.	While there are clear goals associated with outputs for the protect, rehabilitate, restore work area, these mostly do not directly align to objectives which focus on species and ecosystem level outcomes.

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
outcomes for the Reef as there are no climate change specific outcomes. These are primarily set at a national level.	maintaining these gains into the future. There is also uncertainty regarding the outputs intended to be delivered associated with coastal planning and development and the management of lighting.	activities have direct link to many of the objectives under the Reef 2050 Plan, there is not a clear link between outputs proposed and these objectives.		

OUTCOMES

OC1 Is the Reef 2050 Plan on track to achieve its stated vision and objectives (and where it can possibly be measured based on the evidence collected – any goals)

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
2	2	2	2	3
Status of goals for climate change work area: *Australia contributes to an effective global response to climate change through the Paris Agreement, to hold the increase in global average temperature to well below 2°C above pre-industrial levels and pursue efforts to limit the*	Status of goals for land-based activities work area: *The quality of water is improved through increased effective land management practices in catchments* - based on current monitoring under the WQIP (2020 Reef Report Card) there is moderate progress	Status of goals for water-based activities work area: *Biodiversity and heritage protection are enhanced and ecosystem resilience is supported through strengthened efforts to ensure water-based activities are sustainable* - significant action has been taken in improving fisheries	Status of goals for international sources work area: *Australia actively engages in international forums and agreements to minimise international sources of impact to the Reef* - this is ongoing and mostly	Status of goals for protect, rehabilitate and restore work area: *Outbreaks of pests, introduced species and disease are reduced* - work to address crown-of-thorns starfish is ongoing together with island-specific management. Broader pest

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
temperature increase to 1.5°C above pre-industrial levels - efforts to improve Australia's response to mitigate climate change are ongoing and delivered primarily at a national level rather than under the Reef 2050 Plan. *The capacity of Reef communities, Traditional Owners and industries to adapt to a changing climate is increased* - trialling of interventions is ongoing together with enhanced partnerships and funding of activities associated with land	towards achieving targets for dissolved inorganic nitrogen and fine sediment but no real change in pesticide risk. Additionally, the progress that has been made is currently not on track to achieve 2025 or 2050 goals. *Integrated catchment-to-Reef management reduces cumulative impacts* - monitoring under the 2020 Reef Report Card indicated no change in wetland condition. *Lighting and recreational impacts on sensitive shoreline ecosystems and*	management with consequential benefits for fish stocks. However, work is ongoing in improving management of bycatch and protected species interactions so broader biodiversity and ecosystem resilience changes have not yet been achieved. Works are also ongoing to enhance heritage protection. Other areas are generally well managed. *Traditional Owners are supported to continue to manage Sea Country* - there is ongoing works to support Traditional Owner	represents 'business as usual'. The actions under the international sources work area do not link directly to objectives and outcomes under the Reef 2050 Plan except to the extent they relate to the population of migratory species. However, present activities and associated goals are not directly contributing to the achievement of this objective.	management is more limited. *Key habitats are being actively rehabilitated or restored* - a range of rehabilitation programs are being undertaken. These are currently limited in extent and have limited scaleability at present, however, and thus not targeted at Reef-wide outcomes. *Historic and cultural heritage sites are being conserved* - minimal action at present, outside of the expansion of TUMRAs.

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
manager contribution to climate change (e.g. Queensland Land Restoration Fund). However, this overall goal has not yet been achieved. *Species and habitats are supported to adapt to a changing climate* - trialling of interventions is ongoing but have not yet led to significant roll-out of restoration and adaptation programs. The actions under the climate change work area do not link directly to	*cultural sites are reduced* - minimal action at present. The actions under the land-based activities work area do not link directly to objectives and outcomes under the Reef 2050 Plan.	management of Sea Country and marine resources as well as works to expand TUMRAs. *The threats associated with legal and illegal fishing are reduced* - the roll-out of the Sustainable Fisheries Strategy is improving the threats to fish species. Further action is required to support improved management of bycatch and protected species interaction and habitats. *Noise pollution and artificial light impacts from sources within and adjacent to the Marine*		The actions under the protect, rehabilitate and restore work area have partial linkage to objectives and outcomes under the Reef 2050 Plan and will have provided some contribution towards achieving these.

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
objectives and outcomes under the Reef 2050 Plan.		*Park are reduced* - minimal action at present. *New outbreaks are reduced and incursions of introduced species and pests are prevented* - the Queensland Seaports eDNA Surveillance program has enhanced the understanding of marine pests in the Reef. However, work is ongoing to develop strategies and planning framework to address established pests. *Marine debris, rubbish pollution and at-sea disposal of waste is reduced* – marine debris		

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
		clean up efforts are ongoing, including work by local governments and natural resource management groups The actions under the water-based activities work area link directly to objectives related to managing fish population and increasing Traditional Owner engagement in management, and have indirect linkages to objectives associated with habitat and species health. Efforts are ongoing to achieve relevant fish population goals (e.g. 60%		

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
		population retention), with some stocks currently subject to recovery actions; in other areas, the contribution of the above actions to key objectives is uncertain.		

OC2 Is it likely that values will be better protected due to the Reef 2050 Plan?

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
3	3	3	2	2
The Reef 2050 Plan is likely to indirectly support the conservation of values through the improved understanding of interventions for adaptation and response to climate change impacts.	While work is ongoing to achieve the intended targets and outcomes for land-based activities, the improvements achieved will have consequential improvements to the water quality of the Reef lagoon and the condition of wetland habitats.	At present, the main conservation of values relates to improvements in fisheries management which is being delivered under the Sustainable Fisheries Strategy, rather than directly under the Reef 2050 Plan. However, this strategy was the result of previous Plans and will be supported by introduction of independent data validation as an action	Actions under the international sources work area do not provide a comprehensive approach to dealing with marine debris and migratory species condition outside of existing measures applied at state and national levels and therefore are not anticipated to significantly enhance conservation of Reef values.	Individual protection, rehabilitation and restoration projects lead to improved value protection at the specific location of the works. However, delivery is primarily at a local scale and lacks the necessary scalability to achieve Reef-wide management outcomes.

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
		under the Reef 2050 Plan. Thus, the Reef 2050 Plan is leading to improved protection of fisheries and associated values. For other areas, the linkage between actions and better value conservation is less clear. Management for commercial marine tourism typically has a shorter timeframe due to the diverse commercial interests which impacts the ability to evaluate long-term sustainability of the		

Limit the impacts of climate change	Reduce impacts from land-based activities	Reduce impacts from water-based activities	Influence the reduction of international sources of impact	Protect, rehabilitate and restore
		industry comparative to environmental values. Similarly, at present there is a lack of monitoring for traditional use which effects the ability to understand potential impacts to values.		

OC3 Are threats being better ameliorated because of the Reef 2050 Plan?

Climate change	Land-based activities	Water-based activities	International sources	Protect, rehabilitate, restore
3	3	2	2	2
To the extent the Reef 2050 Plan will lead to improved understanding on adaptation approaches and Reef resilience, it will have an indirect effect on ameliorating threats of climate change. However, climate change action more generally is delivered primarily at a national level.	While work is ongoing to achieve the intended targets and outcomes for land-based activities, the activities undertaken to enhance land management and reduce land-based run-off and point source discharges will lead to a reduction in threats to the Reef lagoon. Investigation of lighting impacts will have an indirect effect of ameliorating this threat to	Improvements in fisheries management under the Sustainable Fisheries Strategy reduces the threats from this industry. Further works are required to address threats associated with established marine pests, underwater noise and lighting. Note that as the Reef 2050 Plan does not consider emerging fuels and decarbonisation pathways for shipping, it does not set	While marine debris and migratory species are identified as important areas for international management, actions under the Reef 2050 Plan are not directed at actual reduction in threats within these areas, other than through ongoing collaboration through international forums.	As per OC2, threats are being reduced on a site-specific basis through actions under the Reef 2050 Plan but lack the scalability needed to deliver Reef-wide outcomes.

Climate change	Land-based activities	Water-based activities	International sources	Protect, rehabilitate, restore
	the extent it leads to further mitigation approaches.	out options for amelioration of potential emerging threats for water-based activities.		

OC4 Is it likely that community well-being and relationships will improve because of the Reef 2050 Plan?

Climate change	Land-based activities	Water-based activities	International sources	Protect, rehabilitate, restore
3	3	3	3	3
The Reef 2050 Plan does not directly address community well-being and interventions focus mainly on the environment. However, this will have an indirect effect on community wellbeing and benefits due to enhanced resilience for the Reef.	The Reef 2050 Plan and nested sub-plans include a focus on enhanced community engagement for land-based activities. However, there remains some disconnect between management actions and on ground managers (e.g. farmers) which is not being addressed through the Reef 2050 Plan. Additionally, reporting as part of the Social and Economic Long-Term Monitoring Program	To the extent fisheries management activities will lead to more sustainable fishing stocks, it will enhance long-term community benefits associated with recreational fishing. The Reef 2050 Plan also aims to provide greater empowerment of Traditional Owners and co-governance of the Reef.	As the international sources work area focus on international engagement and collaboration, it does not have direct impact on local community wellbeing and relationships.	The focus of the Reef 2050 Plan includes enhanced involvement of the community in rehabilitation activities, including greater Traditional Owner engagement and ownership of sea Country. Where implemented effectively, this will improve community relationships to the Reef. Localised rehabilitation projects will have benefits to the relevant local

Climate change	Land-based activities	Water-based activities	International sources	Protect, rehabilitate, restore
	indicates lower public perception of their ability to influence management in the context of water quality.			community. However, to the extent projects are not scaleable, there remains a gap in achieving Reef-wide outcomes for the community.

Australian Government
Great Barrier Reef
Marine Park Authority

Reef Authority

REEFAUTHORITY.GOV.AU