

Great Barrier Reef

Long Term Sustainability Plan 2050

Investment proposal

Water quality, catchment and coastal repair

■ first edition 200115

Reef Regions
GBR Natural Resource Management Organisations

Regional community participation to ensure a world class asset forever

January 2015



Mr David Claudie- Chairperson



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Executive Summary

Great Barrier Reef (GBR) Regional Natural Resources Management groups (Reef Regions) together with key peak bodies for the agricultural, local government, resources, development, tourism and conservation sectors all seek to ensure that natural landscapes and water quality is suitable for human uses and aquatic ecosystem protection.

This investment plan:

- builds upon the actions undertaken by government and GBR stakeholders via the Great Barrier Reef Long Term Sustainability Plan (LTSP) and corresponding GBR Strategic Assessment Reports and Reef 2050 program initiatives;
- utilises the information and data within respective GBR NRM Region Water Quality Improvement Plans (WQIPs; funding from the Australian Government Reef Programme) where they have been completed and extrapolated from past WQIP's for those regions where new WQIP are yet to be completed; and
- describes management interventions for rehabilitation of priority habitats and reductions of pollutant loads from diffuse and point sources. If resourced and implemented this plan will improve the water quality and ecological health of waterways, estuaries, wetlands and the GBR while ensuring community prosperity.

A fundamental concern to all GBR stakeholders is that current investment will not meet the LTSP vision for a sustainable GBR region, catchment and community. This Investment Plan offers a realistic cost for a specified abatement based on 9 years of experience and two generations of Water Quality Improvement Plans.

Reef Regions have a track record of delivery with and for the community and its assets. Our Reef assets are our people and their management of our natural resources on land, river, estuary, lagoon and coral reef. We see the *Great Barrier Reef as part of* an integrated ecological system from top of catchment to Pacific Ocean - healthy, productive and enjoyed by all.

To demonstrate our track record, we cite several outcomes from Reef Report Card 2008-2013 where the Reef Regions in conjunction with industry, stakeholders, government and community have proactively lead GBR practice land use reforms:

- 30% of grazier's adopting a better practice
- 49% percent of sugarcane growers adopting a better practice
- 59% of horticulture producers adopting a better practice

Leading to:

- 10% reduction in annual average total nitrogen load
- 11% reduction in annual average sediment load
- 28% reduction in annual average pesticide load.

Our work with regional communities is governed by a common focus -

“Improved GBR region and catchment health and community prosperity will only be realised where solutions to complex issues are tailored to reflect regional solutions and adaptive program design allows for local relevance, regional delivery and GBR wide outcomes.”

Our work is governed by 6 key principles –

- 1. Ecological sustainability is a people issue – people manage our natural resources*
- 2. The GBR Region comprises a linked suite of ecological units from catchment to estuary to ocean.*
- 3. Sustainability requires both innovation and enhanced profitability, in all industries.*
- 4. Long-term Reef sustainability involves activities and investments across all our communities and natural resources.*
- 5. Long-term Reef sustainability also requires stronger focus on our most degraded natural assets - our coastal zones, wetlands, estuaries and embayments.*
- 6. To achieve 2050 Reef sustainability will require efficient and effective evidence-based ongoing investment.*

In addition to the principles some fundamental commitments will be required to accelerate improvements in water quality and ecosystem health within the GBR region and its catchments. The commitments include but are not limited to:

- ◆ Sufficient resources for extension, capacity building, incentives, research, monitoring, modelling and practice validation.
- ◆ Continued and enhanced collaboration between industry leaders, government agencies, science providers and regional NRM bodies and the community.
- ◆ Leadership from urban and rural industry sectors to take lead responsibility in achieving targets.

This Investment Plan is a response to the draft Great Barrier Reef Long Term Sustainability Plan – 2050.

Reef Regions - Leadership Roles

Firstly, we outline our responses to those targets where the Reef Regions can play a leadership role. Based on our experiences to date, we provide estimates of the activities and resources required to meet the proposed targets.

The estimated investment required to achieve further improvements in GBR pollutant load reductions is \$785 million for the first 5 years, not including co-investment opportunities. This involves management practice changes in rural and urban landscapes and associated costs of extension programs, monitoring and R&D, and the commencement of a larger scale system repair program targeting degraded landscapes and landscape functions contributing to the current poor condition of GBR ecosystem health. Ongoing investment on that scale is likely required for subsequent years, with a bigger focus on system repair and coastal development. See Table 1.

Reef Regions - Partnerships Roles

Secondly there are multiple areas where the Reef Alliance can contribute as a collaborating partner. Each of these is identified, discussed and as appropriate key project areas are proposed.

Reef 2050 – Gaps and Opportunities

Thirdly, and equally importantly, there are areas and activities not yet fully explored in the draft Plan. As part of continuous improvement, we list and discuss some of these opportunities.

Next Steps

We look forward to further refining these estimates with government, industry, community and other participants in the LTSP process.

Table 1. Primary actions, estimated costs and outcomes for addressing further pollutant load reductions to the Great Barrier Reef.

Actions	Phase 1: 2015-2020 ¹	Estimated outcomes	Beyond 2020
1. Continued improvement in agricultural management practices	\$175 million	Predicted reductions incorporating existing achievements (2008-2013) in the order of: <ul style="list-style-type: none"> - Total suspended solids 15-20% - Dissolved inorganic nitrogen: 30-35% - Particulate nitrogen: 15-20% - Dissolved inorganic phosphorus: TBC - Particulate phosphorus: 15-20% - PSII herbicides: >90% 	It is possible that ecologically relevant load reduction targets could be met with further investment over the next 5 to 10 years. The required allocation beyond 2020 is likely to <u>increase</u> .
2. Water quality outcomes payments	\$180 million	Acceleration of achievement of load reductions by supporting actions that achieve water quality outcomes above current standards to be delivered through Reef Trust. <i>Intended to achieve pollutant load reductions beyond those identified above.</i>	
3. Urban diffuse management – primarily Water Sensitive Urban Design	\$25 million ²	Greatest gains are likely to be achieved in sediment and nutrient loads by stormwater management, but are yet to be quantified.	
4. System repair works – no regrets actions, and scoping large scale system repair works	\$200 million	These aspects have not been modelled and quantified with regard to water quality benefits but are likely to provide measurable improvements in the medium term. Of critical importance, system repair works will provide substantial benefit to ecosystem function and connectivity for overall GBR health outcomes.	
5. Additional supporting activities: Innovation program and additional R&D to understand management options and impacts, and greater gains	\$75 million	Activities contribute to the above outcomes and improve cost efficiencies to the above programs.	
Regional coordination, partnerships, monitoring, reporting and evaluation	\$120 million		
Communication and education program	\$10 million		
Total estimate	\$785 million		>\$1 billion

¹ Estimates are largely based on the following sources: Wet Tropics WQIP 2014, Mackay Whitsunday WQIP 2014 and Burnett Mary WQIP 2014. The information for the Cape York, Burdekin and Fitzroy regions is based on the previous WQIPs for Burdekin and Fitzroy (2008-2009), and achievements of the Reef Rescue 1 investment. These estimates require further consideration and revision using the outcomes of the WQIP development and updates being completed in 2015.

² This is indicative only and urban cost estimates have only been fully costed in the Mackay Whitsunday WQIP, Burnett Mary WQIP and an earlier estimate for the Black Ross WQIP. A nominal allocation has been applied to the other regions based on these assessments in the absence of further analysis at this stage. The Reef Urban Stormwater Management Improvement Group is considering a comprehensive estimate for managing urban diffuse pollutant sources in the GBR catchments. This will incorporate a range of actions targeting urban stormwater management, particularly addressing the principles of WSUD and promoting training and capacity building for local governments in managing water quality issues. Final details of the allocation will be finalised with the Local Government Association of Queensland.

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1. Who are the Reef Regions?

1.1 The Natural Resources Management regions

The Natural Resource Management Regions in the GBR catchments, from north to south are:

	Chair: David Claudie CEO: Bob Frazer	1300 132 262 admin@capeyorknrm.com.au www.capeyorknrm.com.au
	Chair: Mike Berwick CEO: Carole Sweatman	(07) 4043 8000 info@terrain.org.au www.terrain.org.au
	Chair: Mark Stoneman CEO: Scott Crawford	(07) 4724 3544 info@ngdrytropics.com.au www.ngdrytropics.com.au
	Chair: Royce Bishop CEO: Robert Cocco	(07) 4968 4200 reception@reefcatchments.com www.reefcatchments.com.au
	Chair: Ian MacGibbon CEO: Paul Birch	(07) 4999 2800 admin@fba.org.au www.fba.org.au
	Chair: Anthony Ricciardi CEO: Penny Hall	(07) 4181 2999 admin@bmr.org.au www.bmr.org.au

1.2 Reef Alliance Partners

Reef Regions actively work with The Reef Alliance, which came together in 2007-08 between Reef Regions, Industry and conservation, with a joint vision that people are central to solving Reef water quality and system degradation issues. People are the solution and should be given the opportunity to participate and where possible lead in improving Reef environments. Reef Regions work collaboratively with all industry bodies across the reef to deliver outcomes for reef health.

1.3 Reef Alliance history

Following the development of Water Quality Improvement Plans by the Natural Resource Management Groups in 2005-7, members of the Reef Alliance identified a suite of improved agricultural and grazing practices under an ABCD framework. These practices were both more sustainable in terms of reducing impacts on water quality and the Reef environment and increased profitability for the land manager.

At that time, the issues of climate change were just starting to come to the fore of public policy. The Alliance recognised there were dual issues of climate change and water quality for Reef health and that together, water quality and extreme sea surface temperatures have a “double whammy” impact on Reef health such as coral bleaching. The Alliance noted that water quality improvement was well within our power to make happen, whereas solving climate change was a global issue, way beyond our, or indeed just Australia’s individual powers. Both major parties supported a Reef Alliance proposal in 2007 as part of election commitments, one fully and the other to \$200M to fund incentives across the GBR to improve Reef

health. Reef Rescue I was created following that election. The Reef Report Card 2008-2013 demonstrates the success of the initiative over the first 5 years including:

- ◆ *2,548 of the 8,545 grazers managing 322,891 square kilometers of land adopted improved land management practices*
- ◆ *1,857 of the 3,777 sugarcane growers managing 4,032 square kilometers of land adopted improved land management practices*
- ◆ *568 of the 970 horticulture producers managing 595 square kilometers of land adopted improved land management practices*
- ◆ *154 of the 207 dairy producers adopted improved land management practices*
- ◆ *235 of the 600 grain growers managing 9146 square kilometers of land in the Fitzroy region adopted improved land management practices.*

Accompanying the Australian Government investment was the in-kind and cash provided by the recipients of the incentives. Estimates suggest this is valued at about \$150M over the 2008 – 2013 period¹.

Measurable reductions in nutrient and sediment loads lags beyond the practice change due to a range of factors including time for practice to take effect and the resilience within the biophysical system such as clearing out bedloads of sediments, that will vary depending on catchment, position in catchment, stream power and nature of events.

Clearly, still a work in progress and further investment is essential. Nevertheless the investment as managed by the Reef Alliance has strongly underpinned a marked shift in community attitudes towards improved profitability and sustainability and actions to repair and protect the Reef. Indeed, the Reef Alliance believes that with concerted effort and a much higher level of investment, substantial progress can be made towards meeting the Water Quality targets nominated in the *Great Barrier Reef Long Term Sustainability Plan – 2050*. Nevertheless, as outlined in later sections of this Investment Plan, and as already documented in our Water Quality Improvement Plans, improved practice alone will not be sufficient to meet the proposed 2018 targets.

Coupled with improved agricultural practice must be systems repair of our key ecological assets – especially our rivers, estuaries, wetlands and coastal embayments. These are the first order defences of deleterious water quality, especially assimilating nutrients and trapping sediments. As inferred in Themes 2 – Ecosystem Health and Themes 3 – Biodiversity within the *Long Term Sustainability Plan - 2050*, investment in repairing these assets must work in parallel with improving all land use practices.

It was members of the Reef Alliance that collaborated with the Great Barrier Reef Marine Park Authority and the Fisheries Research and Development Corporation in 2011 and 2012 and put the issue of systems repair firmly on the table as part of the kitbag of solutions required for Reef health and sustainability [Creighton, C 2013a),b), 2014].

¹ Australian Government (2014). Australian Government Reef Achievements (2008-2013).

<http://www.environment.gov.au/marine/gbr/publications/australian-government-reef-achievements-2008-2013>

2. Our Principles for Action

Reef Regions operate from six broad principles. These principles overlap and interact to ensure community lead and therefore sustainable improvement in attitudes and activities towards Reef health. These and summary explanation for each are these follows.

<p>1. <i>Ecological sustainability is a people issue. People use and manage natural resources.</i></p>	<p>Reef Regions are community based organisations including traditional owners, industries and urban communities. We are uniquely placed to foster sustainable uses and stewardship of the Reef’s resources.</p>
<p>2. <i>The Reef’s resources comprise a linked suite of ecological units from top of catchment to estuary to ocean.</i></p>	<p><i>Land, water, water quality and quantity and coastal ecosystems from creeks and rivers to wetlands, floodplains and estuaries to lagoon and reef and open ocean are all linked and must all be the focus of repair.</i> Reef Regions have a substantial track record in working with communities and commodities. This work fosters land, riparian, wetland, floodplain and estuary repair, improved water quality, connectivity and most importantly, building an ethos of stewardship.</p>
<p>3. <i>Sustainability requires innovation and enhanced profitability across all industries.</i></p>	<p><i>If improved practices are to be continued they must deliver dual dividends – both a sustainable landscapes and a profitable community.</i> Reef Regions work in partnership to develop innovative and profitable solutions to address water quality problems from all agricultural and urban uses and to ensure the protection and repair of natural coastal and catchment landscapes.</p>
<p>4. <i>Long-term Reef sustainability involves activities and investments across all communities and natural resources.</i></p>	<p><i>Deleterious runoff events, excessive nutrients, sediments and other pollutants can occur right across the Great Barrier Reef catchment.</i> Reef Regions have a substantial track in fostering social change, water quality and ecosystem improvements and seek to expedite future investment in works and activities across the entire catchment to continue these outcomes.</p>
<p>5. <i>Long-term Reef sustainability requires stronger focus on our most degraded natural assets - our coastal zones, wetlands, estuaries and embayments.</i></p>	<p><i>Functional coastal systems are the water-based components of the landscape that drive the net primary productivity and resilience of the coastal and marine ecosystems.</i> Reef Regions seek to substantially increase the focus and investment in systems repair – riparian, wetlands, floodplains, estuaries, salt marshes and seagrasses.</p>
<p>6. <i>Long-term Reef sustainability will require efficient and effective evidence-based ongoing investment.</i></p>	<p><i>A more consistent and comparable approach to reporting the outcomes of all investments would ensure that at each 5 yearly interval subsequent investment is soundly based on progress to date and likely benefits.</i> Reef Regions seek to collaborate with all parties and report collectively under the GBRMPA Outlook process to demonstrate progress, status of all the Reef’s assets and clearly demonstrates the likely return on future investment.</p>

2.2 Key Implications

A number of implications arise in the application of these principles including:

- ◆ ***all of commodities, all of land uses and all of Reef, users are important for the Reef's sustainability*** - There has been much research and monitoring investment to provide a biophysical basis to setting priorities for investment. None of these biophysical models recognise that its people that manage natural resources. Nor that cyclones and massive rain events can occur anywhere along the Reef catchments, causing deleterious amounts of sediments and nutrients to be exported to the lagoon and coral reefs. Picking winners for investment solely from a biophysical basis will not deliver Reef sustainability.
- ◆ ***our collective goal must be to strive for 100% social change regardless of catchment and location in catchment*** - Not only should our investment be social change focused, but our monitoring must start with the social component. Monitoring must first and foremost document improved practice as a surrogate for community attitude. Monitoring must also recognise the inherent variability in natural systems. Investing in expensive and resource intensive water quality monitoring for the purpose of detecting a short term signal of improvement will generally prove futile. As context, the Central Queensland region around Mackay Whitsunday south to the Fitzroy and north to Townsville is recognised by the Australian Bureau of Meteorology as having one of the most variable climates in Australia [Commonwealth Of Australia 2007]. Confounding issues that make trends difficult to detect include climate variability, shifting bedloads and residence times, not monitoring the peak of the event, event frequency, intensity and timing and changing land use.
- ◆ ***For innovation to transition beyond "B" practice category, all land uses will be essential*** - "B" category land use practice is broadly defined as the best well documented practice that delivers joint sustainability and profitability dividends. "A" practices are broadly defined as those practices likely to deliver further gains in sustainability and profitability but where the gains are not yet fully proven. As analysed in Regional Water Quality Improvement Plans, further improvements in practice will be essential if water quality targets are to be met. Investment in innovation needs to consider all land uses; just as the fishing industry has already invested in practice changes such as turtle excluder devices. For agriculture, pesticides, nutrients and soil loss all require further innovation to the next tier of "B" practices and improved soil health. As an example, from an economic and productivity perspective present estimates are that only up to about 28% controlled release fertiliser is profitable [pers. comm. Sugar Australia]. After that, while there are sustainability gains in a greater % of controlled release fertiliser, the overall profitability declines. A major initiative involving farmers, economists, extension staff, biophysical scientists, crop agronomists all in a major partnership and across the Reef's sugar landscapes could lead to a further tier of proven "B" practices that deliver higher levels of sustainability and profitability. Further examples of Innovation initiatives are provided in later sections.
- ◆ ***The focus investment must be on key biophysical assets*** – An investment focus on the aquatic to estuarine components of the Reef linked landscape makes sense. That is, the riparian fringes, the floodplains, their wetlands, the estuaries and their habitats that link terrestrial to marine. These are the areas of the entire Reef ecosystem that are most degraded, the areas where natural processes have been most disturbed and in the case of many wetlands, lost altogether. They are the basis for Reef net primary productivity and are the nursery areas for most of the species that not only drive the overall ecological health of the food chain, but also are key food resources for our indigenous, recreational and professional fishing industries.
- ◆ ***improving land use practice is unlikely to be enough*** – Recognising that in the Wet Tropics and Mackay Whitsunday up to 80% of fresh to brackish wetlands have been lost [e.g. Russell and Garrett 1988], that in the drier coastal areas major areas of salt marsh, extremely important for nutrient cycling and net primary productivity [e.g. prawn biomass] have been lost to ponded pastures. There are over 5500 barriers to aquatic to estuarine biotic flows and fluxes in the Wet Tropics and over 1500 barriers just on the Burdekin floodplain [e.g. Lawson et al 2010]. This will be challenging, will require a strategic

approach, and will need resolution with primary producers during the proposed 5 year investment period. It will need to be underpinned by rigorous coastal planning,

- ◆ ***Sustained investment is the basis for ensuring sustainability*** – managing, repairing and protecting the Reef is not a start – stop – restart activity. Secure sources of ongoing investment are essential, as is 5 yearly review of progress, and then readjustment of priorities and investment profile in the context of review findings. This is probably best done as a formal mandated process with at least a proportion of the ongoing sources of revenue preferably quite separate to the vagaries of annual consolidated revenue budgets.
- ◆ ***Reporting must be brought together as the framework for evaluating returns on investment to date and accompanied by a Business Case proposing the next 5 years investment*** – consistent and collaborative reporting is essential. Preferably reporting should be a joint activity across all institutions, community groups and agencies, all combined into a single 5 yearly report. We suggest the GBRMPA Outlook Report with its existing mandate and status and with an extension of mandate for this Report to also cover the condition, health and prognosis for Reef catchments and waterways. Equally importantly, accompanying this 5-yearly Outlook Report should be the combined Business Case proposing the next 5 years investment. This will ensure progress to date, outcomes achieved and the next phase of investment are all discussed simultaneously. Equally importantly, by adding a dimension of financial discipline and return on investment analysis to the decision processes will ensure increased cost effectiveness and efficiencies, recognising there are multiple demands on scarce financial resources and the better the processes the more likely will investment available deliver to Reef needs.

3. Achieving the Long Term Sustainability Targets - Role of Reef Regions

Reef Regions look forward to participating in the next phase of reef protection and management. Reef Regions propose three distinct roles to support the delivery of the Long Term Sustainability Plan Targets:

- 3.1 Leadership** - largely focused on the targets related to diffuse source water quality, agricultural practice and community engagement
- 3.2 Collaborator**- working with partners such as government and Industry
- 3.3 Partner and Supporter** – working with Traditional Owners

3.1 Reef Regions - Leadership Role

Targets in the *Long Term Sustainability Plan - 2050* where the Reef Regions proposes leadership in delivery are the targets relating to diffuse source water quality, agricultural practice, community engagement and associated activities. These are:

Theme 1 – Water Quality LTSP Targets	
Target WQT1 i)	By 2018: At least a 50% reduction in anthropogenic end-of-catchment dissolved inorganic nitrogen loads in priority areas
Target WQT1 ii)	By 2018: At least a 20% reduction in anthropogenic end-of-catchment loads of sediment and particulate nutrients in priority areas
Target WQT1 iii)	By 2018: At least a 60% reduction in end-of-catchment pesticide loads in priority areas
Target WQT2 i)	By 2018: 90% of sugar cane, horticulture, cropping and grazing lands are managed using best practice systems [soil, nutrients, pesticides] in priority areas
Target WQT2 ii)	By 2018: Minimum 70% late dry season groundcover on grazing lands
Target WQT2 iii)	By 2018: The extent of riparian vegetation is increased
Theme 5 – Community Benefits LTSP Target	
Target CBT2:	Community participation in stewardship actions to improve Reef health and resilience continues to grow

It should be noted these are the only very precise outcome targets in the *Long Term Sustainability Plan – 2050*, reflecting the considerable effort to date of the Reef Alliance in leading work towards Reef repair.

Work to date led by the Reef Alliance has included:

- ◆ defining a system of continuous improvement in agricultural practices where “A” is innovative, not yet fully proven practices and “B” are the best available proven practices that deliver both sustainability and profitability dividends;
- ◆ developing and updating the suite of Water Quality Improvement Plans [WQIPs]
- ◆ rolling out incentives to all land-based primary industries to foster the more rapid uptake of “B” level practices
- ◆ working with farmers and scientists towards defining the next suite of “B” practices, including *Project Catalyst* and *Game Changer initiatives*

- building commitment to repairing riparian and wetland landscapes and to restoring floodplain function,
- collating practice change information as is highlighted in the 2008-2013 Report Card

There is a significant difference between the *Long Term Sustainability Plan - 2050* targets and current progress. Certainly the *Long Term Sustainability Plan - 2050* targets are more ambitious than what the existing WQIP's predict for this 5-year period. The projections of water quality improvement set in WQIP's fall short of the 2018 proposed targets but seek a higher level of water quality improvement by in the longer term. There are 3 broad factors affecting the rate of practice change:

- i) the resources available for incentives. In the second 5 years of investment, 2013 – 2018, there are far less resources available than in Reef Rescue I 2008 - 2013, even after accounting for improvements in delivery and reduced transaction costs;
- ii) the rate of uptake of improved practices, especially as now virtually all the early adopters have already improved their practices and the effort must be in transforming the industry norms to the better practices; and
- iii) the limits of the practice systems for improvement without further innovation.

While the Reef Alliance continually strives for improved cost benefit efficiencies in terms of \$ expended / level of pollutant load reduction, to suggest we will generate a fivefold increase in N reduction, doubling of sediment reduction and 3 times reduction in pesticide load over this current 5 years (2013-2018) is very ambitious. To achieve the *Long Term Sustainability Plan - 2050* targets will require a marked ramped up level of investment for financial years 2015-16 and 2016-17. As to whether just providing more resources will solve the uptake level is also problematic. Change takes time and practice change has its limits as the sole determinant of end-of-river loads.

The quantum of resources to meet each of the targets is provided as a gross estimate in the following pages that provide responses to each section of the *Long Term Sustainability Plan – 2050* targets. These costs are shown in **Table 3.1.1** grouped by primary actions. The figures are 'best estimates' and extend beyond the rigor of the detailed planning and projections that have gone into the various Water Quality Improvement Plans and only reflect the government investment. Co-investment from landholders and other in-kind sources has been a minimum contribution of 50:50 in previous years, and will be encouraged to achieve a government: private allocation of 40:60 as a guiding principle but depending on the circumstances.

Table 3.1.1. Primary actions, estimated costs and outcomes for addressing further pollutant load reductions to the Great Barrier Reef.

Actions	Phase 1: 2015-2020 ¹	Estimated outcomes	Beyond 2020
1. Continued improvement in agricultural management practices	\$175 million	Predicted reductions incorporating existing achievements (2008-2013) in the order of: <ul style="list-style-type: none"> - Total suspended solids 15-20% - Dissolved inorganic nitrogen: 30-35% - Particulate nitrogen: 15-20% - Dissolved inorganic phosphorus: TBC - Particulate phosphorus: 15-20% - PSII herbicides: >90% 	It is possible that ecologically relevant load reduction targets could be met with further investment over the next 5 to 10 years. The required allocation
2. Water quality outcomes payments	\$180 million	Acceleration of achievement of load reductions by supporting actions that achieve water quality outcomes above	

Actions	Phase 1: 2015-2020 ¹	Estimated outcomes	Beyond 2020
		current standards to be delivered through Reef Trust. <i>Intended to achieve pollutant load reductions beyond those identified above.</i>	beyond 2020 is likely to <u>increase</u> .
3. Urban diffuse management – primarily Water Sensitive Urban Design	\$25 million ²	Greatest gains are likely to be achieved in sediment and nutrient loads by stormwater management, but are yet to be quantified.	
4. System repair works – no regrets actions, and scoping large scale system repair works	\$200 million	These aspects have not been modelled and quantified with regard to water quality benefits but are likely to provide measurable improvements in the medium term. Of critical importance, system repair works will provide substantial benefit to ecosystem function and connectivity for overall GBR health outcomes.	
5. Additional supporting activities: Innovation program and additional R&D to understand management options and impacts, and greater gains	\$75 million	Activities contribute to the above outcomes and improve cost efficiencies to the above programs.	
Regional coordination, partnerships, monitoring, reporting and evaluation	\$120 million		
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¹ Estimates are largely based on the following sources: Wet Tropics WQIP 2014, Mackay Whitsunday WQIP 2014 and Burnett Mary WQIP 2014. The information for the Cape York, Burdekin and Fitzroy regions is based on the previous WQIPs for Burdekin and Fitzroy (2008-2009), and achievements of the Reef Rescue 1 investment. These estimates require further consideration and revision using the outcomes of the WQIP development and updates being completed in 2015.

² This is indicative only and urban cost estimates have only been fully costed in the Mackay Whitsunday WQIP, Burnett Mary WQIP and an earlier estimate for the Black Ross WQIP. A nominal allocation has been applied to the other regions based on these assessments in the absence of further analysis at this stage. The Reef Urban Stormwater Management Improvement Group is considering a comprehensive estimate for managing urban diffuse pollutant sources in the GBR catchments. This will incorporate a range of actions targeting urban stormwater management, particularly addressing the principles of WSUD and promoting training and capacity building for local governments in managing water quality issues. Final details of the allocation will be finalised with the Local Government Association of Queensland.

Table 3.1.2 – provides details of the Reef Regions leadership role against each of the relevant LTSP Targets.

The totals of these various tables are then compared with the Targets in the Long Term Sustainability Plan - 2050 to demonstrate the likely level of improvement and the resources required by 2021.

There are many other activities towards improved Reef health where Reef Regions have contributed, usually in collaboration with the Qld Govt., Aust. Govt., GBRMPA; Local Govt. and the private sector. The directions for this broad suite of activities to deliver to the *Long Term Sustainability Plan - 2050* are covered below

Table 3.1.2 – Reef Regions Leadership role in LTSP Targets.

Theme 1 – Water Quality				
LTSP Target	Reef Regions Role	Leadership		
Target WQT1 i) By 2018: At least a 50% reduction in anthropogenic end-of-catchment dissolved inorganic nitrogen loads in priority areas	<i>Commentary</i>		<i>Suggested areas of additional investment</i>	
	<p>The current Water Quality improvement Plans [WQIP's] reflect the realities of the time it takes to affect change. That is, the targets set in WQIP's fall short of this LTSP target for 2018, and 2008-2013 reporting indicated a reduction of 16% DIN in the first 5 years. The WQIPs set a range of targets ranging from 20-25% reduction from the 2008-09 baseline by 2021. At the same time, the WQIPs seek a higher level of WQ target improvement outcome by 2050 (in the order of 60-80% depending on relative risk). The Reef Report Card 2008-2013 showcases what can be achieved over a 5-year period. All Reef Alliance members continually strive for better cost benefit efficiencies and routinely keep track of \$/ level of WQ pollutant load reduction as an indicator of transaction costs. However to suggest that we will generate greater than a threefold increase in N reduction over the 5 years 2013-2018 given we are halfway into second investment phase and with far less resources than previous, is probably far too optimistic and unachievable without substantial additional resources to create a major impetus for change across the land use sector. Even with additional resources, reflecting on the time it takes to effect change, this remains a “stretch goal”.</p>		<ul style="list-style-type: none"> Build on existing Reef Rescue II investment for the incentives program, markedly increasing the resources available, especially for cane and cropping areas generally – Wet Tropics, Burdekin, Mackay Whitsunday and Burnett Mary 	<ul style="list-style-type: none"> Part of \$355M for practice change (Item 1&2 in Table 3.1.1).
			<ul style="list-style-type: none"> Companion initiative to promote the LTSP target to all landholders and that this is the opportunity for all land holders to rapidly enhance their practices 	<ul style="list-style-type: none"> Special Initiative part of \$355M (Item 2 in Table 3.1.1).
			<ul style="list-style-type: none"> Major works programs for key Sewage Treatment Plants – where possible ensuring both tertiary treatment AND land application of waste products 	<ul style="list-style-type: none"> To be determined
<ul style="list-style-type: none"> Special initiative with all sugar mills, auditing their waste streams and improving land application and disposal practices 			<ul style="list-style-type: none"> To be determined. Aspects may be suitable in the proposed extension to the Reef Trust initiative (Item 2 in Table 3.1.1). 	

LTSP Target	<ul style="list-style-type: none"> Reef Regions Role 	<ul style="list-style-type: none"> Leadership 		
<p>Target WQT1 ii) By 2018: At least a 20% reduction in anthropogenic end-of-catchment loads of sediment and particulate nutrients in priority areas</p>	<i>Commentary</i>		<i>Suggested areas of additional investment</i>	<i>Resources</i>
	<p>The current Water Quality improvement Plans [WQIP's] reflect the realities of the time it takes to affect change. The targets set in WQIP's may fall short of this LTSP target for 2018 with a 10-20% reduction from the 2008-09 baseline by 2021, but, progress to 2013 indicated that 11% reductions had already been achieved to date. At the same time, the WQIPs seek a higher level of WQ target improvement outcome by 2050, (in the order of 50% reduction in the fine sediment fraction). To suggest that we will generate a doubling of sediment reduction over the 5 years 2013-2018 given we are half way into the second investment phase and working with less resources than the first phase, being Reef Rescue I, suggests that additional resources will be needed if we are to get anywhere near the LTSP target. Even with additional resources, reflecting on the time it takes to effect change, especially recognizing that best practice uptake in grazing landscapes are slower than in agriculture, this remains a "stretch goal".</p>		<ul style="list-style-type: none"> Build on existing Reef Rescue II investment for the incentives program, markedly increasing the resources available, especially for grazing landscapes – Fitzroy and Burdekin 	<ul style="list-style-type: none"> Part of \$355M for practice change (Item 1&2 in Table 3.1.1).
	<ul style="list-style-type: none"> Companion initiative to promote the LTSP target to all landholders and that this is the opportunity for all land holders to rapidly enhance their practices 	<ul style="list-style-type: none"> Part of \$355M for practice change (Item 1 in Table 3.1.1). 		
<ul style="list-style-type: none"> Major new initiative and additional target required for all named watercourses, as detailed in WQT2. 	<ul style="list-style-type: none"> Part of \$200M for system repair (Item 4 in Table 3.1.1). This initiative would greatly accelerate reduction in total suspended solids. 			
LTSP Target	<ul style="list-style-type: none"> Reef Regions Role 	<ul style="list-style-type: none"> Leadership 		
<p>Target WQT1 iii) By 2018: At least a 60% reduction in end-of-catchment</p>	<i>Commentary</i>		<i>Suggested areas of additional investment</i>	<i>Resources</i>
	<p>The pesticide targets are likely to be the most achievable in the timeframes. The current Water Quality improvement Plans</p>		<ul style="list-style-type: none"> Build on existing Reef Rescue II investment for the incentives program, markedly increasing the resources available, 	<ul style="list-style-type: none"> Part of \$355M for practice change (Item 1&2 in Table 3.1.1).

pesticide loads in priority areas	[WQIP's] reflect this possibility, Additional initiatives and stronger engagement with the chemical industry will be essential to progress to the final reductions and beyond for longer term ecologically relevant targets (in the order of 60-95% reductions depending on relative risk).		especially for cane and cropping areas generally – Wet Tropics, Burdekin, Mackay Whitsunday and Burnett Mary	
			<ul style="list-style-type: none"> Companion initiative linked in to the chemical industry to promote the LTSP 2050 target to all landholders and that this is the opportunity for all land holders to rapidly enhance their practices 	<ul style="list-style-type: none"> To be determined
	<ul style="list-style-type: none"> Reef Regions Role 	<ul style="list-style-type: none"> Leadership 		
Target WQT2 i) By 2018: 90% of sugar cane, horticulture, cropping and grazing lands are managed using best practice systems [soil, nutrients, pesticides] in priority areas	<i>Commentary</i>		<i>Suggested areas of additional investment</i>	<i>Resources</i>
	This target aligns with and drives the work to deliver the biophysical targets for nutrients, sediments and pesticides. One of the main issues not yet resolved is a consistency as to what defines “best practice”. There has been 7+ years investment of Australian Government resources around the concept of “B” practice as initiated by the Reef Alliance members. It is timely, with the introduction of the LTSP to solve this confounding issue and bring all practice definitions together in an agreed framework. Comments as to the achievability of the target and the resources required are as for WQT1.		<ul style="list-style-type: none"> Project to foster agreed definitions and application of “best practice”, building in the dual issues of profitability and sustainability. A complex area that will require strong leadership if we are to develop consistency and shared vision for “best practice 	<ul style="list-style-type: none"> Part of \$355M for practice change (Item 1&2 in Table 3.1.1).
LTSP Target	<ul style="list-style-type: none"> Reef Regions Role 	<ul style="list-style-type: none"> Leadership 		
Target WQT2 ii) By 2018: Minimum 70% late dry season groundcover on grazing lands	<i>Commentary</i>		<i>Suggested areas of additional investment</i>	<i>Resources</i>
	As with WQT2 i), this target aligns with and drives the work to deliver the biophysical target for sediments.		<ul style="list-style-type: none"> See WQT1 proposed investment plus proposed project to develop consistency and shared vision for “best practice”. 	<ul style="list-style-type: none"> Part of \$355M for practice change (Item 1&2 in Table 3.1.1). Relevant to Item 4.

LTSP Target	<ul style="list-style-type: none"> • Reef Regions Role 	<ul style="list-style-type: none"> • Leadership 		
<p>Target WQT2 iii) By 2018: The extent of riparian vegetation is increased</p>	<p><i>Commentary</i></p> <p>Major new initiative and additional target required for all named watercourses is proposed. This is because:</p> <ul style="list-style-type: none"> i) a large amount of the sediment load comes from riverbank erosion, ii) riverbank shading and large woody debris are essential components of the riverine ecosystem, and iii) because these named watercourses are already subject to specific mention under the Qld Water Resources Act. <p>This is best seen as a target shared across the three themes of Water Quality, Ecosystem Health and Biodiversity and as such warrants a major increase in focus and investment. Issues such as stock access can be managed by using fencing, watering points and crash grazing techniques.</p> <p>A more precise target is suggested – <i>To reduce stream bank erosion, by 2025 over 80% of named watercourses have intact or revegetating riparian vegetation.</i></p>		<p><i>Suggested areas of additional investment</i></p> <ul style="list-style-type: none"> • Build a major riparian revegetation / fencing / off-watercourse watering points companion initiative to the normal grazing practice program. Set targets of % named watercourses revegetated and controlled access for all regions. Rivers to be targeted prior to 2018 can be derived from the Water Quality Improvement Plans. Wherever possible, rivers with virtually intact riparian areas will be given priority to build on their otherwise excellent condition. For example, Broken River in the upper Burdekin has less than 4 km in its entire stream length that does not have good riparian vegetation. • Investment is suggested to be guided by 50% incentive and 50% landholder contributions as fencing and watering points improve stock management. Nevertheless, some landholders will perceive this initiative is predominantly public good. Further discussion on the proposed sharing of costs is also being progressed in some regions. 	<p><i>Resources</i></p> <ul style="list-style-type: none"> • Part of \$200M for system repair (Item 4 in Table 3.1.1). • Covering incentives for fencing and watering points and pioneer revegetation. Then evaluate progress & further invest as appropriate.

LTSP Target	<ul style="list-style-type: none"> Reef Regions Role 	<ul style="list-style-type: none"> Leadership 		
<p>Target WQT5: Use of cost effective and innovative measures and mechanisms to improve water quality from broadscale land use, urban, industrial and port activities [including dredging] is increasing.</p>	<p><i>Commentary</i></p>		<p><i>Suggested areas of additional investment</i></p>	<p><i>Resources</i></p>
	<p>Most importantly, the long-term health of the Great Barrier Reef requires practices well above the current “B” practices of proven sustainability and profitability. This will only be achieved through changing fertiliser and pesticide regimes and accompanying changing practices. Innovation is essential.</p>		<ul style="list-style-type: none"> Innovation in soil health and nutrition – combined major 5-year project across all cane growing areas and involving farmers, scientists and economists in partnership with the fertiliser industry. 	<ul style="list-style-type: none"> Part of \$355M for practice change, and \$75M for innovation and R&D program (Item 1,2,4 in Table 3.1.1). Estimate \$10M
			<ul style="list-style-type: none"> Innovation in pesticide and herbicide use, type and application - combined major 5 year project across all agricultural commodities and involving farmers, scientists and economists in partnership with the chemical industry. 	<ul style="list-style-type: none"> Part of \$355M for practice change, and \$75M for innovation and R&D program (Item 1,2,4 in Table 3.1.1). Estimate \$8M
			<ul style="list-style-type: none"> Dairy and intensive grazing industry innovation in pasture management, soil nutrition and slow release fertiliser regimes - combined major 5 year project across all areas and involving farmers, scientists and economists in partnership with the fertiliser industry. Note – all dairy is in high rainfall country and therefore the risk of losses from traditional fertilisers is exceptionally high. Proving up controlled release may deliver substantial reductions in nutrient load from this industry. 	<ul style="list-style-type: none"> Part of \$355M for practice change, and \$75M for innovation and R&D program (Item 1,2,4 in Table 3.1.1). Estimate \$4M
		<ul style="list-style-type: none"> Floodplain Optimisation – fostering smart water management for productivity and biodiversity outcomes with initial focus being 	<ul style="list-style-type: none"> Part of \$355M for practice change, and \$75M for innovation and R&D program 	

		the Burdekin floodplain	(Item 1,2,4 in Table 3.1.1). <ul style="list-style-type: none"> Estimate \$8M
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Theme 5 – Community Benefits				
LTSP Target	<ul style="list-style-type: none"> Reef Region's Role 	<ul style="list-style-type: none"> Leadership and Partnership roles 		
Target CBT2: Community participation in stewardship actions to improve Reef health and resilience continues to grow	<i>Commentary</i>		<i>Suggested areas of additional investment</i>	<i>Resources</i>
	<p>There are multiple extension, awareness and knowledge exchange activities together with community works that go beyond farmer practice improvement and urban dweller activities. There are at least two broad suites of activities within this Target. Firstly there are the issues of understanding – so all the community understands the behaviours required and equally importantly, understands the level of investment and change required to keep the Reef great.</p> <p>Secondly there is a range of positive activities that translate understanding into actions. This area has up till now been somewhat under-resourced and/or left to the meagre funds available to such as Landcare and Reef Guardian groups.</p> <p>Investment should preferably be ongoing to maintain a skills base of expert communicators and motivators and to provide the resources for consumables and incentives that demonstrate the behaviours required.</p>		<ul style="list-style-type: none"> Base capability within each NRM group is required. <p>Project based investments can include activities such as:</p> <ul style="list-style-type: none"> Coastal dune repair with special emphasis on seabird rookeries; Turtle friendly lighting for sites adjacent to turtle rookeries Rubbish removal Urban renewal programs Drift net and other marine debris removal Reef Guardian programs Community driven riparian restoration 	<ul style="list-style-type: none"> Part of \$355M for practice change (Item 1&2 in Table 3.1.1) (at least \$1.5M/ annum). Also benefits from actions in Item 5, Additional supporting activities. Part of \$200M for system repair (Item 4 in Table 3.1.1). Project by project budgets Allocation and establishing a pool of funds for projects on a competitive basis is suggested.

3.2. Reef Region – Collaborative Roles

As is to be expected, the majority of targets in the *Long Term Sustainability Plan – 2050* are where the Reef Regions collaborates with others to deliver the outcomes required.

Table 3.2.1 discusses each of the proposed targets individually as an input to finalising more precise and meaningful targets. Where appropriate, based on experiences to date, suggestions are made as to component projects. Likewise, estimates are given where possible as to the likely quantum of resources that might be required in the short term to undertake these projects and make significant progress towards the nominated targets.

Unfortunately many of the targets are not yet precise enough in content nor are they time bound so that it is as yet difficult to define the tasks ahead. Certainly at this stage it is not yet possible to provide detailed draft project specifications or indeed accurate estimates of resources likely to be required for most of the proposed targets.

The targets themselves are a mix of principles and intent, inputs, processes and outcomes. Some examples follow:

- **Principles and Intent** – e.g. EHT2, GT1 and GT3. For example, GT1 with its emphasis on transparency, accountability and community involvement is essentially a statement of the “way of doing business”.
- **Inputs** – e.g. EHT5, EBT2, GT5, CBT1 and CBT2. For example, CBT1 articulates that social and economic information will guide decisions and EBT2 seeks to ensure an understanding of relationships between Reef health and industries. These, as with CBT2 and the need for community participation are clearly necessary inputs to any major investment program.
- **Processes** – e.g. GT2 and GT4 articulate how Reef related issues would be part of Government business.
- **Outcomes** – e.g. EHT1, BT1, BT2, HT1 and HT2 that specify the desired state of the Reef, its health, biodiversity and heritage values.

All the Reef community will welcome more clarity in the targets. As a further example, BT3 singles out coral trout as an indicator of fishing effort, presumably at least in part due to the relationships between predators and Crown of Thorns outbreaks. Deleterious water quality probably has a much closer causal link with Crown of Thorns outbreaks. Secondly, if we seek to use fish as an indicator of Reef system health a species like Mangrove Jack [*Lutjanus argentimaculatus*] that ranges across the Reef estuarine, sometime freshwater, lagoon and marine ecosystems is possibly a far better indicator. If a companion target is required inshore then Barramundi might be a useful indicator. The life history of Barramundi [*Lates calcarifer*] is well documented, as is the genetics of the various subpopulations and its habit of ranging across freshwater, estuarine and nearshore environments [e.g. Jerry et al 2013].

Other targets such as CBT4, dealing with climate change may be misplaced in terms of Theme. Community action on a changing climate is certainly welcome, but the first step is to have enabling policy at both National and State levels. This is discussed further in Section 7.

Table 3.2.1 – Reef Regions Collaborative role in LTSP Targets.

Theme 1 – Water Quality			
LTSP Target	Reef Regions Role	Contribution to repair; Restoration / acquisition program to be managed through Qld Govt.	
Target WQT2 iv) By 2018: There is no net loss of the extent, and an improvement in the ecological processes and environmental values, of natural wetlands	<p>Commentary</p> <p>Both incentives and repair is required. The initial study into wetlands and estuaries [Creighton 2013] suggested an investment of \$60M as a first 5 year investment. Return on Investment analysis suggested that this investment just on increased fisheries productivity of selected species would be more than repaid in the same timeframe. About \$15M was contracted initially under Reef Rescue II, mostly in repair.</p> <p>This is best seen as a target shared across the three themes of Water Quality, Ecosystem Health and Biodiversity and as such warrants a major increase in focus and investment.</p>	<p>Suggested areas of additional investment</p> <p>Major new focused program on incentives and as needed repair / removal of drains, barrages etc. Much of the detail of priority sites is in Creighton 2013 and in Water Quality Improvement Plans.</p>	<p>Resources</p> <ul style="list-style-type: none"> • Part of \$200M for system repair (Item 4 in Table 3.1.1). • At least \$45M up to 2018 including acquisition and repair
LTSP Target	Reef Regions Role	Contributor; Local Govt. and industry lead roles.	
Target WQT3: By 2020, Reef-wide and locally relevant water quality targets are in place for urban, industrial and port activities and monitoring shows a stable or positive trend	<p>It is suggested that a revised target and timing is developed. There are significant areas where the technology already exists for major reductions in effluent loads. Table 3.1.2 demonstrates investments in urban landscapes and the likely return in reduced loads, especially total suspended solids.</p> <p>NRM Water Quality Improvement Plans only broadly include these various major point sources in their assessment and planning. To date resources available to Local Govt. to reduce point sources has been limited. One of the first steps is to complete the upgrading to tertiary standard all sewage treatment plants and where possible convert to land</p>	<ul style="list-style-type: none"> • Local Govt. led initiative on tertiary treatment of all sewage and where possible land application of effluent. • Local Govt. – NRM joint led initiative on other urban sources, installation of gross pollution traps, wetland sinks • Industry led initiative in partnership with Qld Govt. - a major review of all current permits and licences together with a Business Case on the priority areas for effluent minimisation. 	<ul style="list-style-type: none"> • To be developed • See Table 3.1.1, Item 3. • To be developed

	<p>application of effluent.</p> <p>For all industries, one of the first steps is a detailed audit of all existing permits and licences with a view to understanding both the nature of the issue and where there are opportunities to reduce loads. Priorities and investment can follow accordingly with activities well underway before 2020.</p>		
Theme 2 – Ecosystem Health			
LTSP Target	<p>💧 Reef Regions Role Contributor, especially inshore and islands.</p>		
<p>Target EHT1: Condition and resilience indicators for coral reefs, seagrass, islands, estuaries, shoals and inter-reefal shelf habitats are on a trajectory towards achieving at least good condition at regional and Reef-wide scales</p>	<p>This target covers many of the key habitat types for the Reef system and needs more precision in outputs so that progressively over time investment can demonstrate improvements.</p> <p>For example, the National Estuary Network has existing protocols for assessing the health of estuaries [National Land and Water Resources Audit 2002]. At the same time there is well documented evidence for variation in abundance of such as seagrasses and inter-reef habitats [e.g. Gretch and Coles 2010] . Work has also been done by the Reef Alliance to develop a plan for island repair.</p>	<p>💧 Island ecosystem repair</p>	<p>💧 To be determined</p>
		<p>💧 System repair for estuaries and wetlands goes across themes - covered previously – see Table 3.1.2 and WQ targets.</p>	<p>💧 See Table 3.1.2.</p>
LTSP Target	<p>💧 Reef Regions Role Limited if this refers to just coral reefs.</p>		
<p>Target EHT2: Key direct human-related activities are managed to address cumulative impacts and achieve a net benefit for the Reef</p>	<p>As above, more precision in the target is warranted. To a large degree the WQ targets already cover this target if it is intended to cover the entire Reef system. If this just refers to coral condition, links to the AIMS databases and processes for measuring coral condition is recommended.</p>	<p>💧 Possibly NA– covered by water quality theme</p>	<p>💧 NA</p>
		<p>💧 Coral specific health and trends – link to AIMS monitoring program</p>	<p>💧 To be determined</p>

LTSP Target	Reef Regions Role Contributor especially for repair; Govt. leadership for acquisitions /restoration.		
Target EHT3: There is no net loss of the extent, and a net improvement in the condition of terrestrial ecosystems, such as natural wetlands and riparian vegetation that contribute to Reef resilience and ecosystem health.	<p>Riparian and wetlands targets are discussed under WQT2 iii) and iv) respectively. Both are extremely important to overall Reef health.</p> <p>For terrestrial vegetation Landcare groups are particularly active on aspects such as wildlife corridors and expansion of remnants, including weed control. Nevertheless, from a Reef resilience and health perspective, the nature of terrestrial vegetation per se is immaterial as long as there are no deleterious flows and fluxes of nutrients, sediments and poisons. For simplicity and focus, perhaps this should either not be part of the LTSP targets or more clarity is provided in the target.</p>	Covered previously for both riparian and wetlands – both essential for Reef health	See WQ targets
LTSP Target	Reef Regions Role Contribute, through planning [e.g. Water Quality Improvement and Climate Adaptation] & community action.		
Target EHT5: Prioritise functional ecosystems critical to Reef Health in each region for their protection, restoration and management.	<p>Water Quality Improvement Plans already include key assets such as estuaries, wetlands and riparian. WQT2iii) and iv) and EHT1 refer.</p> <p>Further work in prioritising assets for protection, management and repair is essential for Investment Planning. This accords with Action EHA1. Suggest this target needs to be rephrased to set explicit outcomes for repair, protection and management of the functional ecosystems.</p>	Covered in WQT2iii) WQT2iv) and EHA1.	See WQ proposals

Theme 3 – Biodiversity			
LTSP Target	Reef Regions Role	Contributor, especially if indicators include non-marine.	
Target BT1: The trends in key indicator species populations and habitat condition are improving at Reef-wide and regionally relevant scales.	<p>Healthy populations of virtually all the key indicator spp. listed in Long Term Sustainability Plan-2050 are essentially the intended outcomes of better Reef system-wide protection and management.</p> <p>Nevertheless it is always useful to be tracking populations of key species and most importantly, analysing any trends to understand the causes of any changes and therefore shape and direct further investment.</p>	<ul style="list-style-type: none"> NA from Reef Alliance perspective for currently listed indicators – essentially outcomes of all Reef-system investment 	<ul style="list-style-type: none"> NA
LTSP Target	Reef Regions Role	Contributory in support of Oceanwatch.	
Target BT2: The populations of Indo-Pacific humpback and snubfin dolphins, dugong, loggerhead, green, and flatback turtles are stable or increasing at Reef-wide and regionally relevant scales	Fishing industry sustainability and aspects such as incidental catch are probably best approached, like all other industries, from a community perspective. To date there is limited information on the uptake of Turtle Excluder Devices and other by-catch minimisation strategies. Likewise there is no data on the positive or otherwise impact of netting closures on local dugong populations. Through a partnership with Oceanwatch, Reef Guardian fishers and QSIA the Reef Alliance members propose to establish a range of initiatives to report progress and where necessary implement further measures for Reef health.	<ul style="list-style-type: none"> Partnership with Oceanwatch – By-catch minimisation strategies, implementation and reporting 	<ul style="list-style-type: none"> To be determined
		<ul style="list-style-type: none"> Partnership with Oceanwatch – Recreational fishing and Reef sustainability 	<ul style="list-style-type: none"> To be determined
		<ul style="list-style-type: none"> Partnership with Oceanwatch – Outcomes of netting closures and other strategies to minimise impact on dugongs, dolphins and turtles 	<ul style="list-style-type: none"> To be determined

LTSP Target	◆ Reef Regions Role Contributor, especially inshore habitat essential for food resource.		
<p>Target BT3: Coral trout stocks are to be managed to maintain 60% of the unfished population.</p>	<p>There are several species that come under the broad title of “coral trout”. Work by Pratchett et al [2013] demonstrate that most populations are probably Reef wide from a life history / repopulation perspective with levels of common genetic makeup. The coral trouts generally do not have an inshore phase though juveniles are found nearshore. Much of their prey does have an inshore phase to their life history. Compare coral trouts to Mangrove Jack [Lutjanus argentimaculatus] with its nursery / juvenile phases inshore and recorded up to 130km upstream. Mangrove Jack is likely to be a better indicator of Reef system health than the coral trouts. From a population perspective work is required on all coral trouts and Mangrove Jack to place their populations within a net primary productivity context. It may turn out that prey food and therefore inshore health [habitats and water quality], not fishing pressure is a major determinant on the size of the total population.</p>	◆ NA from Reef Alliance perspective - Inshore health [habitats and water quality] covered by other targets	◆ See WQ targets
Theme 4 – Heritage			
LTSP Target	◆ Reef Regions Role Participant.		
<p>Target HT2: Non-indigenous heritage including natural, aesthetic, historic, scientific and social values are identified, conserved and managed in partnership with the community.</p>	<p>Key inshore Reef natural assets and community values are part of the Water Quality Improvement Planning process. To that extent Reef Alliance role is picked up through our responses to other targets.</p>	◆ NA from Reef Alliance perspective	◆ To be determined

Theme 5 – Community Benefits

LTSP Target	Reef Regions Role Major contributor via all practice improvement covers sustainability and productivity.		
<p><i>Target CBT1: A long-term social and economic monitoring program is guiding management decisions</i></p>	<p>The Reef Alliance strongly endorses the philosophy embedded in this Target. The Target also reinforces our 6 Principles. Nevertheless the overall investment in monitoring needs to be reviewed. Suggest that as the Reef is about people and their attitudes and behaviours this particular aspect of monitoring and its application to 5-year investment strategies may need to be given a higher priority than some of the other multi and various monitoring activities.</p>	<p>First step is an overall review of the appropriateness and effectiveness of all monitoring investments</p>	<p>To be determined</p>
LTSP Target	Reef Regions Role Participant e.g. through climate change adaptation strategies; blue & terrestrial carbon budgets.		
<p><i>Target CBT4: Climate change adaptation strategies recognise and avoid adverse impacts on coastal ecosystems essential for Reef health and resilience</i></p>	<p>Currently this is an area of very confused public policy. In time, a consolidation around three broad is likely:</p> <ul style="list-style-type: none"> i) Mitigation – and by repairing wetlands and seagrasses the Reef system can play a significant role in “blue carbon” [e.g. Lawrence et al 2012] as well as of course with terrestrial carbon via vegetation repair for riparian landscapes; ii) Minimisation – via smart energy systems and use; changing fertiliser strategies especially for NO_x; iii) Adaptation – with issues such as more variable climate, storm surge and biotic population shifts south, especially fish [e.g. Pratchett et al 2013; Jerry et al 2013, Welch et al 2014; Creighton and Sawynok 2013] in the short term well before 2050; and for the longer term issues such as sea level rise affecting biological assets and infrastructure. 	<p>Nil in very short term – more clarity required initially around public policy</p>	<p>To be determined</p>

Theme 6 – Economic Benefits			
LTSP Target	<p>Reef Regions Role Contributor, especially habitat repair for fisheries productivity and tourist experiences.</p>		
<p><i>Target EBT2: The relationship between Reef health and the viability of Reef dependent industries [e.g. tourism and fishing] is understood and considered in planning and development decisions.</i></p>	<p>All key activities covered - especially Water Quality, Ecosystem Health, and Community Benefits themes.</p>	<p>See especially WQ targets and commentary</p>	<p>To be determined</p>
Theme 7 – Governance for Plan Delivery			
LTSP Target	<p>Reef Regions Role Contributor – way of “doing business”.</p>		
<p><i>Target GT1: Implementation, reporting and review of this plan reflects principles such as transparency, ownership, accountability, responsiveness and strong community involvement.</i></p>	<p>The Reef Alliance is the key conduit to the community and to fostering continuing social change and actions, This target seems more a principle or” way of doing business’ under which to implement the Plan than a Target per se.</p> <p>Opportunities for increased community understanding and involvement covered in the Community benefits theme.</p>	<p>NA from Reef Alliance perspective. Part of the way Reef Alliance does business.</p>	<p>To be determined</p>
LTSP Target	<p>Reef Regions Role Assist in identifying issues requiring better policy and legislation.</p>		
<p><i>Target GT2: The vision, outcomes, objectives and targets in this plan are taken into account in relevant regulation, documents, policies and strategies of all levels of government.</i></p>	<p>There are many areas where policy and legislation could be improved. The final section of this Reef Alliance Investment Plan, by identifying some of the key gaps in the <i>Long Term Sustainability Plan -2050</i> contributes to this ongoing discussion and continuous improvement.</p>	<p>NA from Reef Alliance perspective.</p>	<p>To be determined</p>

Regional community participation to ensure a world class asset forever

LTSP Target	Contributor -lead role in preparing Water Quality Improvement and Climate Adaptation Plans . Reef Regions Role Leader in community engagement and social change.		
<i>Target GT3: Actions under the Plan are prioritised and tailored to reflect local or regional differences in risks and opportunities affecting the Outstanding Universal Value of the Reef</i>	Reef health is about people, their attitudes and behaviours. Through the NRM regions the diversity of community requirements and opportunities encompassed by our many local communities that make up the Reef region can be cost-effectively responded to and galvanised into action.	NA from Reef Alliance perspective.	To be determined
LTSP Target	Reef Regions Role Potential contributor, especially data on such as practice change.		
<i>Target GT4: Investment in actions is prioritised using evidence-based risk assessment to maximise benefits for Reef health and resilience.</i>	<p>Much, if not all of our science is still building an understanding Reef health and resilience as a total system. This is reflected in the Reef Water Quality Protection Plan Research, Development and Innovation Strategy 2013-2018. As the most basic example, there is as yet no available Reef and catchment-wide linked model founded in real time and based on empirical data that understands net primary productivity from river to estuary to lagoon to reef and open ocean, let alone to understand the causes of any changes to net primary productivity. The Strategy and its emphasis on science for solutions will help to fill some of the key knowledge gaps.</p> <p>Evidence-based risk assessment is therefore an aspirational goal at this time. In this context precautionary approaches that recognise the basic causes such as sediment or nutrient transport; or loss of fundamental ecosystems such as wetlands; or lack of at least “B” level practice; or inappropriate land use allocation; and then seeks to rectify these causes of Reef degradation are probably the best way forward while continuing to invest in science, especially multi-disciplinary</p>	See Research, Development and Innovation Strategy 2013-2018.	To be determined

	science focused on the 5 themes as outlined in the 2013-2018 Strategy.		
LTSP Target	<ul style="list-style-type: none"> Reef Regions Role Contributor – e.g. practice change data. 		
<i>Target GT5: A comprehensive integrated monitoring and reporting program is established and operational and the reporting informs the review and improvement of the Plan.</i>	<p>Targets such as CBT1, EHT1, BT1 & 2, all point to the need for an integrated monitoring, analysis and reporting program. As discussed in Section 5, efficiency and effectiveness is likely to be gained from a more integrated program that reports through the GBRMPA outlook process every 5 years.</p>	<ul style="list-style-type: none"> Requires assessment and review / re-focusing of existing investments in monitoring to minimise costs and maximise useful outputs. 	<ul style="list-style-type: none"> To be determined

3.3 Reef Regions – Support to Traditional Owner Targets

There is a suite of targets across the first six themes pertaining to Indigenous actions, involvement and empowerment.

All of the actions to deliver on these Targets can be most sustainably achieved through Indigenous leadership and where necessary, with guidance and/or support from other organisations. All support must be secondary to Indigenous leadership. Likewise, any estimate on resources required from here on to meet the *Long Term Sustainability Plan - 2050* Indigenous targets is best done through the various indigenous organisations.

To date there have been two main support organisations – the Great Barrier Reef Marine Park Authority and the Reef Alliance through individual projects managed in partnership with the Indigenous community by the Natural Resources Management groups.

For the following Indigenous leadership targets the narrative provides examples of potential projects based on the experiences and projects undertaken to date that have gained support from Natural Resources Management groups.

Table 3.3.1 – Reef Regions Supporting Role for Traditional Owner LTSP Targets

Theme 1 – Water Quality			
LTSP Target	<ul style="list-style-type: none"> Reef Regions Role - Collaborative leadership with Indigenous communities 		
<i>Target WQT4: Traditional Owners are engaged in on ground water quality improvement and monitoring</i>	Commentary	consideration	Resources
	A specific initiative for Cape York is required. The issue is erosion caused by feral hard hooved animals. An Indigenous partnership to deliver high levels of feral animal control, more indigenous tenures and additional management resources would not only reduce sediment load [WQT1] but would also aid in quarantine and animal health policies e.g. buffer against spread of brucellosis.	<ul style="list-style-type: none"> Specific initiative for Cape York and feral animals / erosion control. 	<ul style="list-style-type: none"> To be determined
Theme 2 – Ecosystem Health			
LTSP Target	<ul style="list-style-type: none"> Reef Regions Role - Contributor; Local Govt. and industry lead roles. 		
<i>Target EHT4: Traditional Owners have developed Indigenous Ecological Knowledge Management Systems for: protecting, and where appropriate, sharing of knowledge, innovations and practices; conserving and cultural use of</i>	Several NRM regions have engaged their Indigenous communities to identify relict fish trap arrangements. On Cape York there have been several fire management projects that capitalise on indigenous knowledge and seek to optimise both biodiversity and Indigenous values.	<ul style="list-style-type: none"> Coastal fish traps – mapping, management and repair 	<ul style="list-style-type: none"> To be determined
		<ul style="list-style-type: none"> Fire regimes for biodiversity and 	<ul style="list-style-type: none"> To be determined

<i>biocultural diversity; and use in decision making.</i>		ecological health	
Theme 3 – Biodiversity			
LTSP Target	♦ Reef Regions Role - Participant if required by Indigenous		
<i>Target BT4: Customary use of biological resources, in accordance with traditional cultural practices that are compatible with conservation or cultural use requirements are formally recognised and adopted in management arrangements.</i>	No commentary		
Theme 4 – Heritage			
LTSP Target	♦ Reef Regions Role - Participant if required by Indigenous		
<i>Target HT1: Traditional Owners have joint management responsibilities for the documentation and conservation of Indigenous heritage values.</i>	No commentary		
Theme 5 – Community Benefits			
LTSP Target	♦ Reef Regions Role - Minimal role		
<i>Target CBT3: The number of sea country initiatives, including benefit sharing agreements with Traditional Owners, is increased</i>	No commentary		
Theme 6 – Economic Benefits			
LTSP Target	♦ Reef Regions Role - Participant if required by Indigenous, especially in Cape York and Wet Tropics		
<i>Target EBT4: Traditional Owners' business capacity to generate economic benefits from effective use and management of Traditional land and sea country estates is increased</i>	Previous activities have included working with the communities at Yarrabah, Wet Tropics and most of the Cape York communities, both Reef and Gulf.		
LTSP Target	♦ Reef Regions Role - Participant if required by Indigenous, especially		

	in Cape York and Wet Tropics		
<i>Target EBT5: The number of employment opportunities for indigenous Australians in sea country management is increased.</i>	Commentary Previous activities have included working with the communities at Yarrabah, Wet Tropics and most of the Cape York communities, both Reef and Gulf.		

3.4 Reef Regions – Minimal Role

There are two Economic Benefit targets that we interpret as well beyond the Reef Regions remit.

Table 3.4.1 – Reef Regions Supporting Role for Economic Benefit LTSP Targets

Theme 6 – Economic Benefits	
LTSP Target	<p>Reef Regions Role - Minimal</p>
<p><i>Target EBT1: Cumulative impacts on the Reef from economic activities are understood and measures to ensure net environmental benefit approach for the Reef are in place</i></p>	<p>The Reef Alliance role in monitoring and collection and analysis of data to underpin Target EBT1 is already covered in Target CBT1.</p>
LTSP Target	<p>Reef Regions Role - Minimal</p>
<p><i>Target EBT3: Shipping within the Reef continues, is safe, risks are minimised, and there are no environmentally damaging incidents</i></p>	<p>Target EBT3 is principally a regulatory activity. In time, should this target extend to recreational boating and issues such as effluent management / holding tanks on all vessels, again regulations are likely to be the principal vehicle to ensure compliance. Nevertheless any enforcement is always more effective when accompanied by awareness campaigns that create an understanding of the rationale and the need for compliance. Natural Resources Management groups with their links to the recreational fishing and boating community are well placed to assist in this awareness-raising role.</p>

4. Additional Key and Enabling Activities

4.1 Investment for Implementation to 2050

The *Long Term Sustainability Plan - 2050* is silent on how best to secure the resources to ensure certainty of effort and outcome. Certainly, as suggested in Section 2, sustained investment is the basis for ensuring sustainability. Managing, repairing and protecting the Reef should not be a start – stop – restart activity.

Secure sources of ongoing investment are essential, as are 5 yearly reviews of progress, and then readjustment of priorities and investment profile in the context of review findings. This is probably best done as a formal mandated process with at least a significant proportion of the ongoing sources of revenue preferably quite separate to the vagaries of annual consolidated revenue budgets.

Reef Regions recommends that this issue be considered in depth as the *Long Term Sustainability Plan – 2050* move to the implementation phase. Opportunities for revenue generation need to be explored.

4.3 Performance Review and Investment Planning

The Reef and indeed the Australian community is vitally interested in the condition and trends of the Reef. Therefore the more a consistent and competent message can be provided, the better.

The GBRMPA Outlook Reporting process is mandated and therefore has a high level of legitimacy and yet resources to compile the Outlook Report every 5 years are severely constrained. Part of the solution for resourcing and definitely for getting the message across to the Australian community might be for all to data collection, analysis and interpretation activity, across Australian and Queensland Government and community, to all work to the common goal of a single Outlook Report across all Reef issues every 5 years. This will take some organizing and rigor but the benefits are substantial. Certainly this would focus efforts, ensure a more cooperative information sharing approach and most importantly foster the level of integration we need if we are to accurately depict the Reef as a linked system and understand the trends and causes of the trends in condition.

The companion and parallel activity must be investment planning. That is, together with the Outlook 5-yearly report, again collated and prepared collaboratively, should preferably be, as a companion document, the Business Plan for the next 5 years investment. A strong financial discipline is required in the Business Plan. The Business Plan should reflect on progress and investment to date, evaluate progress, clearly set out the likely return on proposed further investment, the focus and the processes for activity in the following 5 year period.

Preference should be given to basing the return on investment analysis upon those aspects of the Reef and its community that can be accurately valued in \$ terms. The related more intangible benefits and costs should preferably be simply listed as unpriced benefits / costs. This would certainly aid community understanding and reduce the likelihood of debate over externalities.

4.4 Land Use Planning – Catchment and Coastal

As with reporting, there is a plethora of planning activities resulting in inefficiencies, sometimes duplication, often inconsistencies, a lack of a systems approach to Reef matters and much community confusion. Fostering a more Reef wide approach to planning is certainly inferred by several of the targets in the Governance theme.

Work to bring much of the planning together into a consistent hierarchy under the *Long Term Sustainability Plan – 2050* would be useful and would assist in delivery to several of the Governance Theme targets. Preferably the final suite of agreed plans should have some form of statutory basis.

This would include the Natural Resources Management groups' Water Quality Improvement Plans, which are essentially a subset of each group's Natural Resources Management Plans.

The next version of Natural Resources Management Plans should preferably have some form of statutory recognition and be implemented alongside the Local Government Plans, thereby filling much of the gap in coastal planning and sustainable development of Reef catchments.

4.5 Change - Smart systems for Land Use Change and Landscape Repair

There is a recognition among the Natural Resources Management groups and the community generally that there will have to be some changes in land use, some repair of key assets such as wetlands, rivers and estuaries and their connectivity, flows and fluxes to the Reef lagoon if we are going to ensure a resilient and healthy Reef system. This will need to include acquisitions as part of repairing the Reef ecological system.

Similar challenges are being faced elsewhere, with in southern Australia substantial investment now underway to recreate shellfish reefs and acquire and repair wetland ecosystems. Perhaps some of the best-promoted examples of system repair are occurring across the USA [e.g. Restore America's Estuaries 2012; 2013; (Creighton 2013a; 2013b)] sets out for Australia the context for repair, the type of repair works possible and suggests a suite of objectives, targets and outcomes. This work is complimented by the GBRMPA studies mapping past and present extent of ecologically valuable wetland, floodplain and estuary complexes.

This landscape repair work, the negotiations involved in changing land use, in acquiring and repairing key assets and seeking to optimise benefits across all land uses including urban, agriculture and Reef resilience is challenging and will need substantial discussion with landowners, industry and all three levels of government. Nevertheless there are many land use allocation and infrastructure decisions made in times past that in hindsight do not provide the optimum possible benefits to the Reef community, Queensland's economy and to Reef ecology.

In advocating an increased focus on this very challenging aspect of Reef resilience the alternate case needs to be put – the dilemma of doing nothing. With no focused investment system repair, the prognosis for the Reef and its multiple community benefits are:

- ◆ further, possibly unreasonable pressure on agricultural industries on good quality agricultural land to find even more improvements to practice, probably beyond the dual objectives of profitability and sustainability;
- ◆ a less than resilient Reef system, possibly unable to accommodate future shocks, be they from acidification, hypoxia, sea surface temperature or extreme events;
- ◆ continued decline in the recreational amenity, ecology and biodiversity of these otherwise most productive of our ecosystems, thereby making any repair in the longer term even more expensive;
- ◆ continued decline in fishery stocks with continued flow-on loss of jobs in regional communities and reduced seafood production;
- ◆ reduced availability of 'family seafood', whether purchased or caught recreationally, increasing reliance on seafood imports with implications for terms of trade, food security and food quality; and
- ◆ continued costs whether it be cleaning up fish kills, loss of amenity, loss of tourism experiences, poor water quality or algal blooms.

Any land use change will need extensive engagement, be undertaken carefully and with a suite of criteria focusing on the best way achieve both system repair and economic viability. These criteria could include documentation of the key assets and their role e.g targets EHT5 and EHT3; understanding the economic benefits of repair e.g. EBT2; and prioritised investment to the resources available e.g. GT4.

4.6 Governance and an improved statutory framework

As alluded to in Governance Objectives GO1 and GO3, improvements to governance arrangements are recommended. Following are several areas of opportunity not covered in the *Long Term Sustainability Plan – 2050* targets and actions:

- ◆ **Review of GBRMPA's mandate** – at this time the statutory remit for GBRMPA ends at most at high water mark, yet the major threats to Reef resilience and health originate from the catchments. Review of arrangements might lead to a stronger role for GBRMPA in at least all aquatic environments – creeks, rivers, wetlands and estuaries.
- ◆ **Reform processes in fishing industry management take account of declining productivity** – current reform processes essentially pit commercial fishers against recreational fishers and both fishing groups against conservationists. The conflict is over resource sharing when the issue should be about resource decline. All key interest groups have in common the desire to see a continued productive resource. Flow on benefits of maintaining a productive resource to the Qld economy and indeed as part of overall Reef health is substantial. While it is difficult to disentangle the causes of decline in productivity, the best available evidence over time from 1960's onwards suggests that much of the decline is NOT due to fishing effort, closures, changing gear, demand and so on, but due to habitat loss. The key prawn species [Banana and Tiger - *Penaeus merguensis* and *Penaeus esculentus*] provide possibly the best example. Prawns are annual stock and are highly fecund. As long as the habitat and food is available, catch will have minimal impact on the next year's productivity. Yet with major losses in seagrasses, salt marshes and poor water quality productivity of the resource continues to decline.
- ◆ **Enhancing the Water Act from a community benefit perspective** – right across Qld there are issues of river bank erosion, loss of productive land and massive bed loads from stream bank erosion. The end results include filling previous deep holes in rivers and reducing their fish productivity; increasing turbidity and likelihood of algal blooms in upper reaches of rivers; costs in irrigation water pump maintenance and Council water treatment plants; muds replacing sand spits in estuaries; smothering of freshwater mussel reefs in rivers and oyster reefs in estuaries and embayments such as Moreton Bay, loss in seagrass productivity; and of course impacts further offshore, whether it be the Reef or Harvey or Moreton Bay. Within the Water Act there are a particular class of rivers and creeks – “named watercourses”. A regulation within the Water Act that underpinned the protection and repair of named watercourses, especially ensuring managed access and the retention or repair of riparian vegetation would be of substantial community and economic benefit.
- ◆ **Implementing through Regulation the Qld Fisheries Act sections on wetlands** – the wetland and aquatic ecosystems components of the Act have yet to be implemented via regulation. To do so would provide a statutory underpinning for parts of the systems repair work proposed for the Reef and be of community and economic benefit across Qld.
- ◆ **Review of representational roles on Reef management** – the Great Barrier Reef Report Card 2012 and 2013 concentrates on the outcomes achieved through the Reef Alliance. Yet the Alliance is not represented on the support structures to the Reef Ministerial Council. Perhaps the Alliance and other groups should gain a more formal role in Reef policy development

4.7 Climate Change and Marine Environments

Management of marine resources for multiple outcomes including conservation, tourism and sustainable harvest is regarded globally as more challenging than ever. A range of anthropogenic activities has triggered environmental changes that greatly exceed the natural background fluctuations (Rockstrom et al.

2009; Steffen et al. 2011). Most pervasive is a changing climate resulting in altered physical conditions in many marine regions around the world (Doney et al. 2012; Hobday and Pecl 2014).

Concomitant changes in distribution, abundance, physiology and phenology are already evident for many marine species (Doney et al. 2012, Poloczanska et al. 2013). Nowhere is this change more evident than on the coasts where the documented and predicted increases in temperature, acidity, UV radiation, nutrient concentrations, fishing pressure, coastal constructions, frequency and duration of hypoxic events are thoroughly documented (e.g. Hoegh-Guldberg et al. 2007, IPCC 2013). Our Reef system and all the pressures on it provide an excellent example of the multiple stresses acting on coastal to nearshore environments.

The speed of change in average environmental conditions and the increased frequency of extreme events (heat waves, hypoxia) may exceed the potential of marine organisms for tolerance or adaptation (IPCC 2014, Koehn et al. 2011). Moreover, global change is multifactorial and the compound action of several stressors often is synergistic (Brown et al. 2013). Change will also lead to altered responses, economic opportunities and conservation priorities, all of which will require revised policy frameworks and management approaches operating at faster time scales than these institutions tend to operate.

Systems thinking demonstrates that climate and its impacts are but one of many issues that need to collectively be the input to policy and to management decisions for the Reef or for any other Australian marine region. Indeed marine management by virtue of being multi-objective and needing to meet diverse and sometimes competing user needs is best served by a multi-component approach that incorporates climate as one of many issues to be accommodated. Responses to address the challenges of climate change will range from those that are minor or incremental through to those that involve more radical shifts in resource management and utilisation (Stafford-Smith et al. 2011; Park et al. 2012; Wise et al. 2014).

To acknowledge this, it is suggested that there are three interlinked phases of the adaptation process under activities can be categorized. Historically, management of marine biodiversity and resources has not necessarily or typically taken a systems view. Thus, there is a need to ensure that policy; management and institutional structures are better aligned so that there is a solid platform on which to develop adaptation responses (Wise et al. 2014; Frusher et al. 2014). This first necessary phase is best termed '**preconditioning**'.

Preconditioning

Key component elements with this phase include:

- ◆ Policy and management need to respond to changing social-ecological conditions, so interventions must be as dynamic as the systems they seek to influence – *part of the Long Term Sustainability plan – 2050 address this issue;*
- ◆ Action for climate adaptation must be a part of larger social and economic adaptations to changing circumstances – *not yet in place for Australia or Reef.*
- ◆ Climate policy should be implemented as part of integrative, multi-objective policy and management - *not yet in place for Australia or Reef.*
- ◆ In responding through fisheries management interventions to changing interactions, it is essential to include climate influences - *not yet in place for Australia or Reef.*

The Great Barrier Reef and all marine management in Australia are still well within this first phase from a policy formulation and management perspective. However, most of the actions in the next phase are now at least initiated and progressing, well ahead of the policy and management structures.

This '**future proofing**' of systems can include the knowledge assimilation and building of conceptual understanding required to begin operational processes and direct actions on the ground. Elements under this category highlight the need for integrated systems thinking and approaches, based on an interdisciplinary and socio-ecological systems view.

Future Proofing

Key component elements with this phase include:

- ◆ Fostering resilient healthy ecosystems is an imperative for policy and management – *initiated for Reef and parts of Australia's marine estate.*
- ◆ Policy and management must address spatial and temporal scales that match the values and issues of concern – *initiated for Reef.*
- ◆ Catchment management is essential for positive marine outcomes – *well underway for Reef, well ahead of the rest of Australia.*
- ◆ In responding to threatening processes, it is essential to ensure ecosystem integrity – *initiated for Reef and Australia marine areas.*
- ◆ In protecting key species, site- and species-specific strategies are essential. *Initiated for Reef and parts of Australia.*

It is suggested that by 2050 the Reef and its management should be already comprehensively responding to all of these elements. Delivery of the Long Term Sustainability Plan will achieve much of this, albeit still without the policy framework in place.

Lastly, to facilitate the sustainable use and conservation of living marine resources into a vastly different future, both '**transformation and opportunity**' need to be considered.

Transformation and Opportunity

The types of issues to be dealt with here include:

- ◆ Changes brought about by a changing climate must be assessed for beneficial opportunities – *yet to be examined;*
- ◆ In responding to increased climate variability and change, a transition towards flexible total stock management systems is essential – *yet to be examined ;*
- ◆ Policy and management must take advantage of the key role marine ecosystems can have in carbon sequestration – *yet to be examined;*
- ◆ Carbon sequestration in marine systems is best done as part of a multi-objective approach – *yet to be examined.*

The Reef Alliance perceives these issues may come to the fore sometime towards the end of the period of the Long Term Sustainability Plan. Now is the time to ensure the pre-conditioning is in place and that by about say 2020 or at the latest 2030, *future proofing* activities are well progressed.

5. Concluding Comments – a work in progress

This draft Plan is still very much draft. It represents a first order review of the targets and directions proposed in the draft *Long Term Sustainability Plan – 2050*. This review and suite of suggestions has been undertaken by the Reef’s Natural Resources Management groups. It captures many of the experiences and track record of delivery that has characterised Reef Rescue I and part of Reef Rescue II. This draft is provided at this time as an input to ongoing deliberations on and continuous improvement of the draft *Long Term Sustainability Plan – 2050*.

5.1 Next Steps

Following are the next steps as the Reef Alliance works to provide a competent well specified set of suggestions for implementation of the *Long Term Sustainability Plan – 2050*:

Mid January to late January 2015	<ul style="list-style-type: none"> detailed discussions across all Reef Alliance members especially the peak agricultural and conservation groups to gain their insights into opportunities for keeping the Reef great and to finalise the broad intent and directions of our proposals;
Late January to mid February	<ul style="list-style-type: none"> discussions and interactions with other key members of the Reef community, including Qld Seafood Industry Association, SunFish, Qld Tourist Operators, Local Governments, key Indigenous groups, GBRMPA and all groups within the Reef Guardian initiative and Local Marine Advisory Committees and both the Australian and Qld Governments;
Late January to late February	<ul style="list-style-type: none"> further project development and where possible specification of project outputs and resources towards the delivery of the <i>Long Term Sustainability Plan – 2050</i>.

5.2 Acknowledgements

This report has been compiled by Colin Creighton [colinmwnrm@bigpond.com; 0749 584775 and mobile +61 418225894] with an ad hoc working group comprising Mike Berwick, Paul Birch, Rob Cocco, Scott Crawford, Penny Hall, Carole Sweatman and Jane Waterhouse with input from many others.

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