Tropical Water Quality Hub

National Environmental Science Programme

Final Report

Assessing the human dimensions of the Great Barrier Reef: A Mackay-Whitsunday Region focus

Margaret Gooch, Allan Dale, Nadine Marshall and Karen Vella

JAMES COOK UNIVERSITY AUSTRALIA

CSIRO

QUT

Assessing the human dimensions of the Great Barrier Reef:

A Mackay-Whitsunday Region focus

Margaret Gooch[1], Allan Dale[1], Nadine Marshall[2] and Karen Vella[3]

[1] The Cairns Institute, James Cook University, Cairns Campus
[2] CSIRO, Townsville
[3] Queensland University of Technology, Brisbane

Supported by the Australian Government's
National Environmental Science Program
Project 3.2.2: The IMS 2050 Human Dimensions Project: Cost-effective Indicators and Metrics for key GBRWHA human dimensions linked to Reef 2050 Plan objectives and targets.

National Library of Australia Cataloguing-in-Publication entry:
978-1-925514-14-8

This report should be cited as:
Gooch, M., Dale, A., Marshall, N., & Vella, K. (2018). *Assessing the human dimensions of the Great Barrier Reef: A Mackay-Whitsunday Region focus.* Report to the National Environmental Science Programme. Reef and Rainforest Research Centre Limited, Cairns (52pp.).

Published by the Reef and Rainforest Research Centre on behalf of the Australian Government's National Environmental Science Programme (NESP) Tropical Water Quality (TWQ) Hub.

The Tropical Water Quality Hub is part of the Australian Government's National Environmental Science Programme and is administered by the Reef and Rainforest Research Centre Limited (RRRC). The NESP TWQ Hub addresses water quality and coastal management in the World Heritage listed Great Barrier Reef, its catchments and other tropical waters, through the generation and transfer of world-class research and shared knowledge.

Cover photographs: Front Cover: *Town of Proserpine* Back Cover: *Racing yacht spinnakers*
Back - © freeaussiestock.com - licensed under a Creative Commons Attribution 3.0 Unported License.

This report is available for download from the NESP Tropical Water Quality Hub website:
http://www.nesptropical.edu.au

CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS

ABARES..... Australian Bureau of Agricultural and Resource Economics and Sciences
ABC ..... Australian Broadcasting Corporation
ABS ..... Australian Bureau of Statistics
ADF…… Australian Defence Force
AMSA ..... Australian Maritime Safety Authority
AWPR…… Adult Workforce Participation Rate
BHP BMI ……BHP Billiton Mitsubishi Alliance
BITRE ..... Bureau of Infrastructure, Transport and Regional Economics
BMP..... Best Management Practice
BRC……Bundaberg Regional Council
BTRE ..... Bureau of Transport and Regional Economics
CAFNEC…….Cairns and Far North Queensland Environmental Centre
CAMBA……...China Australia Migratory Bird Agreement
CC……Climate Change
CCIQ……Chamber of Commerce & Industry Queensland
CEO ..... Chief Executive Officer
CFRC…… . City Futures Research Caentre
COC..... Codes of Conduct
COTS ..... Crown-of-Thorns-Starfish
CSG……Coal Seam Gas
DAE……. Deloitte Access Economics
DBCT……...Dalrymple Bay Coal Terminal (DBCT)
DEHP ..... Department of Environment and Heritage Protection
DIDO ..... Drive-in/drive-out
DIN…….. Dissolved Inorganic Nitrogen
EBIT..... Earnings Before Interest and Taxation
ECTF……East Coast Trawl Fishery
EMS ..... Environment Management System
EotR..... Eye on the Reef (program)
ERA……. Environmentally Relevant Activity
ERP..... Estimated Resident Population
ES…….Environmental Standard
FIFO..... Fly-in/fly-out
FMP……Field Management Program
GBR..... Great Barrier Reef
GBRMPA ..... Great Barrier Reef Marine Park Authority
GFC ..... Global Financial Crisis
GRP ..... Gross Regional Product
GSP ..... Gross State Product
GVP ..... Gross Value of Production
GWA……Greater Whitsunday Alliance
HESB.....High Efficiency Sediment Basins
HPCT……...Hay Point Coal Terminal
HR2RTWG…..Healthy Rivers to Reef Technical Working Group
IMO ..... International Maritime Organization

ICHD……Indigenous Cultural Heritage Database
IPA..... Indigenous Protected Area
IPBES ..... Intergovernmental Panel on Biodiversity and Ecosystem Services
ISO..... International Organization for Standardization
JAMBA…….Japan Australia Migratory Bird Agreement
JCU..... James Cook University
LGA ..... Local Government Area
LMAC..... Local Marine Advisory Committee
LNG……..Liquefied Natural Gas
LOTE……Language Other Than English
LPG..... Liquid Petroleum Gas
MOU..... Memorandum of Understanding
MRC…….Mackay Regional Council
M-W……..Mackay-Whitsunday
MIW……..Mackay-Isaac-Whitsunday (LGAs)
MRRS…… Mackay Region Recreational Strategy 2017-2022
MWHR2RP…..Mackay Whitsundays Healthy Rivers to Reef Partnership
MWTORG……Mackay Whitsundays Traditional Owner Reference Group
NESMG..... North-East Shipping Management Group
NESMP……North-East Shipping Management Plan
NESP ..... National Environmental Science Programme
NDRAA ..... Natural Disaster Relief and Recovery Arrangement
NFZ……..Net Free Zones
NIEIR ..... National Institute of Economic and Industry Research
NQ ..... North Queensland
NRM..... Natural Resource Management
NQBP……..North Queensland Bulk Ports
OGBR ..... Office of the Great Barrier Reef
OUV……Outstanding Universal Value
PMP ..... Property Management Plan
PSSA ..... Particularly Sensitive Sea Area
QDAF..... Queensland Department of Agriculture and Fisheries
QDEHP ..... Queensland Department of Environment and Heritage Protection
QDNRM…….Queensland Department of Natural Resources and Mines
QGSO……..Queensland Government Statistician's Office
QoL……..Quality of Life
QPWS..... Queensland Parks and Wildlife Service
QRC ……Queensland Resources Council
QSIO..... Queensland Spatial Information Office
RAC ..... Reef Advisory Committee
RIMReP ..... Reef 2050 Integrated Monitoring and Reporting Program
RO……Run-off
RRRC..... Reef and Rainforest Research Centre
SEQ ..... South East Queensland
SM ..... Spanish Mackerel
SPP..... State Planning Policy
STP…… Sewage Treatment Plants
SVA..... Social Ventures Australia

TAFE..... Technical and Further Education
TEK..... Traditional Ecological Knowledge
TIQ…….. Trade and Investment Queensland
TO..... Traditional Owner
TQ..... Tourism Queensland
TRA..... Tourism Research Australia
TSS……..Total Suspended Solids
TUMRA..... Traditional Use of Marine Resources Agreement
TWQ..... Tropical Water Quality
UCG……Underground Coal Gasification
WH..... World Heritage
WHA ..... World Heritage Area
WPoM……..Whitsundays Plan of Management
WQ…….. Water Quality
WQIP ..... Water Quality Improvement Plan
WRC…… Whitsunday Regional Council
WWF..... World Wildlife Fund

ACKNOWLEDGEMENTS

Funding was provided by the Australian Government's National Environmental Science Programme Tropical Water Quality Hub. Many thanks also for the contribution of Katrina Keith, Jennifer McHugh and our participating actors/experts from the community, industry and government sectors.

EXECUTIVE SUMMARY

This report focuses on the trial of a regionally-specific framework to assess and monitor the human dimensions of the Great Barrier Reef (GBR) as they relate to the Mackay-Whitsunday Region and the adjacent GBR. To ensure GBR policy makers and managers better consider the needs of Reef-dependent and Reef-associated communities and industries, the aim of this project is to develop a participatory approach to the assessment, monitoring and bench-marking of human dimensions of relevance to the region and to the GBR. In considering the Mackay-Whitsunday Region's human dimensions, the project team has gathered evidence from peer-reviewed literature, the grey literature and other forms of knowledge such as Indigenous and local knowledge. The process involves synthesising evidence from diverse sources, presenting the evidence as a series of tables, and allocating draft scores to attributes of each key human dimension theme or cluster. The tables and proposed scores are then discussed in regional expert panel meetings using a consistent set of decision rules for supporting the scoring based on available evidence. Key findings from the evidence gathered so far for the Mackay-Whitsunday Region are summarised here.

Aspirations, capacities and stewardship:
Regional education levels are sound and compare favourably with rest of Queensland. There are high levels of natural resource management (NRM) awareness and environmentally responsible behaviours; however anecdotal evidence suggests that recreation fishing requires increased compliance and stewardship effort, and urban stewardship could be improved in some areas. Further, there is a growing gap between community aspirations and resource allocations to deliver and showcase improved environmental sustainability across the region. There are high levels of agreement among national residents and catchment residents that it is the responsibility of all Australians to care for the GBR, indicating that cohesive stewardship efforts at local, regional and national scales would remain a sound investment.

Community vitality:
The regional population base is generally stable demographically, although fluctuations occur in response to economic conditions. Community vitality has recently been affected by STC Debbie which caused widespread damage and increased community feelings of isolation, loss and anxiety. In general however, Mackay-Whitsunday residents are very satisfied with region's enviable lifestyle including recreational opportunities and proximity to the GBR. Traditional Owners in this region deeply value the GBR as a place of social enjoyment, gatherings and ceremonies during times of mourning. Regional residents also value the favourable climate, productive agricultural land, the people, the sense of community, small town sizes, and access to reasonably good services (health, school, infrastructure). An ageing population poses challenges to Mackay's healthcare facilities and services. The region enjoys excellent transport infrastructure and accessibility to local and regional markets, via a combination of road, rail (passenger and freight), port connectivity and air links to key markets.

Culture and Heritage (Contemporary culture and natural, Indigenous & historic heritage):
The region's natural heritage is internationally significant. Specifically the GBR World Heritage listing states that "The Whitsunday Islands provide a magnificent vista of green vegetated islands and white sandy beaches spread over azure waters". Marine debris detracts from these

values, as do visual and noise impacts from coastal development, dredging and transient shipping. There is a lack of knowledge about the location of maritime historic heritage sites and the condition of historic shipwrecks is poorly understood. Across the region Indigenous heritage values are unique, dynamic, diverse and living. This includes language and place names, songlines, storylines, intimate traditional ecological knowledge, social enjoyment, historic travel and trade routes, access and use of coastal fishing places, fish traps, middens, quarries, hunting grounds and traditional estates. Traditional Owners have long expressed an interest in taking a more prominent NRM role in managing regional land and sea country.

Economic values:
The region supports a diverse agricultural sector (grazing; sugarcane, sorghum, horticulture); substantive commercial fishing; high quality nature-based tourism; and services the mining sector. It contributes bet $16B-$17B p.a. to national economy. In the Whitsundays, tourism is the largest sector, with an emphasis on lifestyle and high quality food production. There are two ports in the region: Hay Point which had a throughput of 1,133 bulk carriers in 2015-16, up from 1087 in 2014-15; and Mackay Port which had 164 ships in 2015-16 – down from 173 in 2014-15. Mackay will likely continue to grow, but several smaller regional towns are experiencing population declines, leading to decreased demand for services and facilities, and resulting in a smaller workforce in these areas. STC Debbie caused substantial damage to the cane industry ($250M) and to horticulture ($100M); severely disrupted tourism operations; caused widespread property damage; and disrupted power and telecommunications to small businesses, affecting economic confidence in the region in the short-term. Despite these set-backs, the region has shown economic resilience as it transitions from the mining boom and recovers from STC Debbie.

Governance:
Basic GBR-wide and bilateral strategic planning framework is in place via the Reef 2050 Plan and possible implementation strategies and institutional arrangements exist at all required scales for delivery. A strong framework for ongoing and adaptive monitoring, evaluation and review is emerging via RIMReP. There is, however, a significant ongoing likelihood of decline in GBR health as a result of poor connectivity among key governance subdomains affecting GBR outcomes (e.g. greenhouse gas abatement) and the risk of implementation failure related to the catchment-based delivery of regional actions envisaged under the Reef 2050 Plan. All required institutional actors play an important role in GBR governance, but capacities and available resources are often limited across government, industry, community and Indigenous sectors. Science capacities are generally well suited to resolve significant environmental problems facing the GBR but not social, cultural and economic considerations. Biophysical knowledges (including models and decision support tools) are generally strong across the marine and catchment space, though social, cultural and economic sciences are not developed enough to deliver truly integrated knowledge to make sound decisions.

1.0 INTRODUCTION

The GBR, one of the seven natural wonders of the world, is facing an unforgiving deadline due to climate change and other threats to its very existence (De'ath, et al 2012; GBRMPA, 2014a; DAE, 2017; Hughes et al 2016; 2017). People across the world and in its catchment love the GBR and value it to the tune of $56 Billion dollars (DAE, 2017). Its annual contribution to Australia's national economy is more than $6 Billion per annum (DAE, 2017). People such as Traditional Owners, recreational users, commercial fishers and tourism operators who use and depend on the GBR; and everyone else who values it for its social, cultural and economic benefits, are suffering in the wake of declining GBR health. Policy makers, managers and partners have long recognised that maintaining the health of the GBR both now and in the future will rely on mobilising the energy, motivation and aspirations of those who value and love the Great Barrier Reef (Great Barrier Reef Marine Park Authority, 2014).

There is growing recognition that local communities and their actions have a much more dynamic relationship with marine and coastal resources than merely causing negative impacts (Kittinger et al 2014; Cinner, David 2011; Christie et al 2003; Edgar, Russ, Babcock, 2007; Pollnac et al 2010; Ban et al 2017). In focussing solely on the human impacts on the GBR, managers may miss valuable opportunities to empower people to work in partnership with management, harnessing powerful sources of custodianship, and deepening social, cultural and economic ties to the GBR. Providing opportunities for strengthening socially-enabling factors such as equity, trust, participation and compliance can be the way forward for GBR managers to achieve their goals, and at the same time, provide tangible benefits to local, national and international communities (Christie et al 2003). In particular, to improve GBR health, policy makers and managers need to understand and monitor (a) people's relationship with the GBR including how many people directly use/visit the GBR, where they go, how they get there, what they do, and why; (b) psychological forces driving behaviours that affect the GBR (positively or negatively); (c) the role of GBR decision-makers including users, managers, partners, communities and industry in affecting change; (d) equity and inclusion of multiple perspectives; and (e) the adaptive capacity of industries and communities who depend on a healthy GBR for the economic, social, or cultural values that it provides.

This report is the fourth in a series of six regional reports produced as part of a 12 month National Environmental Science Program (NESP) project (*NESP Project 3.2.2: Cost-effective indicators and metrics for key GBRWHA human dimensions*). The project is trialling a regionally-specific and robust framework to assess and monitor the human dimensions of the GBR and its catchment. The GBR catchment lies within six Natural Resource Management (NRM) regions and a report is being produced for each part of the GBR and catchment that falls within each region – i.e. the Wet Tropics; Eastern Cape York (part of the Cape York region); Burdekin; Mackay-Whitsunday; Fitzroy; and Burnett- Mary. These six areas are administrative regions based on sub-catchments within the larger GBR catchment. The NRM regions were established over ten years ago by the Commonwealth and Queensland governments to help deliver environment and sustainable agriculture programs (ABS 2016). They extend beyond the coastline to include part of the GBR Marine Park and are shown in Figure 1.

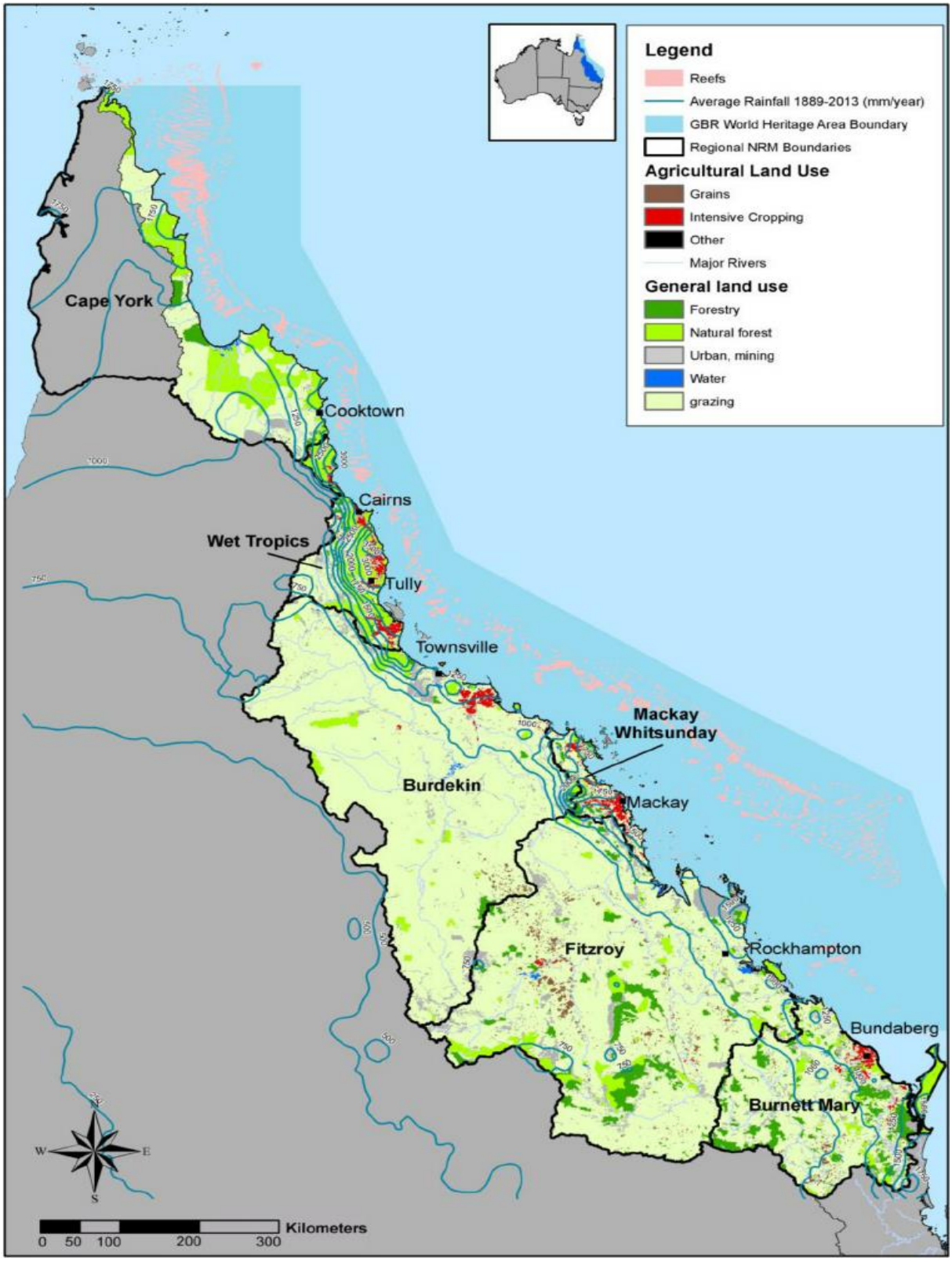

Figure 1: NRM Regions in the Great Barrier Reef catchment

(SOURCE: Thorburn, Wilkinson, and Silburn, 2013, p. 5).

The human dimensions of the GBR are the social, cultural, institutional and economic factors that shape people's relationship with the GBR. Managers realise that these relationships are

diverse and wide-ranging and include collective actions by industries, communities and governments, each influencing GBR resilience[1]. In turn, the resilience of the GBR influences the resilience of these communities. To be effective, GBR managers need to know more about these relationships. At the most basic level, managers are interested in how many people directly use or visit the GBR; who these people are, where they go, what they do and why. Marshall et al (in review) identified eight cultural benefits derived from the GBR, and these are used throughout this document to illustrate the richness of people's relationship with it.

Table 1: Eight cultural benefits associated with the GBR – Marshall et al (In review)

Cultural benefits	Description
Identity	The feeling of belonging to a place or social group with its own distinct culture and common social values and beliefs.
Pride in resource status	Refers to a satisfied sense of attachment towards a place or its status such as World Heritage Area status. It can be linked to a signal of high social status.
Place importance/ Attachment to place	The emotional and physical bond between person and place which is influenced by experiences, emotions, memories and interpretations. It often provides a reason for people to live where they live.
Aesthetic appreciation	Describes the aesthetic value that an individual attributes to aspects of an ecosystem. Aesthetic responses are linked to both the characteristics of an environment and culturally or personally derived preferences.
Appreciation of biodiversity	Describes how people are emotionally inspired by biodiversity and other measures of ecosystem integrity at a particular place.
Lifestyle	The expression of 'visible' culture that has evolved around a natural resource or ecosystem; describes the extent to which people lead their lives around a natural resource and how people interact with it for recreation
Scientific value	The value that people associate with learning opportunities in the past, present and future. The legacy and appreciation of ecosystems and natural resources that have been inherited from the past and their sense of continuity across time
Wellbeing maintenance	The extent to which individuals are concerned for their own wellbeing if the health of the natural resource were to decline

Reviewed literature reveals that people's relationship with the GBR is also influenced by attitudes towards, and perceptions of the GBR and its management. These have changed considerably over time, and will no doubt change again in future. It confirmed that attitudes and perceptions are shaped by culture, societal norms, context and circumstances, including personal experiences, word-of-mouth, and print media. Indigenous Traditional Owners have had the longest association with the GBR, and their attitudes and perceptions have been relatively constant over millennia as custodians and sustainable exploiters of the GBR and its resources. By contrast, non-Indigenous attitudes and perceptions are varied and can change

[1] This description of the human dimensions of the Great Barrier Reef and catchment was developed through discussions with managers and researchers, and will be developed further to inform the up-dated Great Barrier Reef Water Quality synthesis statement.

relatively quickly, especially for those new to the GBR and its catchment. The literature has already highlighted factors likely to affect attitudes/perceptions relating to the GBR including:

- Familiarity with the GBR and its management;
- Occupation;
- Proximity to the GBR;
- Access to the GBR and its resources;
- Identity with and/or affinity for the GBR;
- Dependency on the GBR's resources for income or other benefits;
- Where people go and what they do in the GBR;
- What people value about the GBR;
- Motivations for visiting the GBR;
- Sense of optimism about the future of the GBR;
- Understanding of factors that threaten GBR health;
- Knowledge of the current condition of the GBR;
- Levels of satisfaction with GBR-based experiences; and
- Levels of confidence and trust in GBR management (Gooch, 2016).

The GBR's human dimensions include residents in GBR catchment towns and cities (including Traditional Owners) as well as national and international people who either have an interest in the GBR or who influence (directly or indirectly) the condition of the GBR. This also includes those in government agencies (e.g. local, State and Commonwealth governments). They also include people in the following GBR maritime and catchment industries:

- Cane
- Grazing
- Dairy
- Horticulture
- Grains
- Aquaculture
- Research
- Mining/extractive industries
- Urban development and construction
- Ports and shipping
- Forestry
- Marine and coastal recreation
- Commercial fishers
- Marine and coastal tourism

People are also involved in a vast range of non-commercial activities related to the GBR including Traditional Owner use of marine and coastal resources; non-commercial recreational activities such as boating, diving, snorkelling; defence activities in designated areas; fishing – recreational as well as illegal fishing (i.e. intentional targeting of protected zones).

The Great Barrier Reef Marine Park Authority (GBRMPA) works with a specific set of human dimension values used for assessment, monitoring and management of activities within its jurisdiction. These are:

- Access to GBR resources;

- GBR aesthetics;
- Appreciation, understanding and enjoyment of the GBR;
- Human health associated with the GBR;
- Personal connection to the GBR;
- Intra and inter-generational equity associated with the GBR;
- Empowerment derived from the GBR; and
- Employment and income derived from GBR-dependent industries (GBRMPA, 2017a). *See Attachment A for detailed descriptions of each value.*

Traditional Owners in particular still maintain connection to, and responsibility for caring for their particular country, through membership in a descent group or clan. There are more than 70 Traditional Owner groups along the GBR (GBRMPA 2016a). Traditional Owner heritage values include all customs, lore and places that are part of Aboriginal and Torres Strait Islander peoples' spiritual links to land or sea country and which tell the story of Indigenous peoples from time immemorial to the present. Traditional Owner values comprise tangible and non-tangible attributes which often overlap – including sacred sites, sites of particular significance and places important for cultural tradition; Indigenous structures, technology, tools and archaeology; stories, songlines, totems and languages; and cultural practices, observances, customs and lore. Traditional Owner heritage values are connected to and inter-related with other GBR values and should be considered holistically (DAE, 2017; GBRMPA 2005; 2016a). Non-Indigenous cultural heritage includes buildings, monuments, gardens, industrial sites, landscapes, cultural landscapes, archaeological sites, groups of buildings and precincts, or places which embody a specific cultural or historic value. Historic heritage relates to the occupation and use of an area since the arrival of European and other migrants and describes the way in which the many cultures of Australian people have modified, shaped and created the cultural environment. GBRMPA recognises four historic maritime heritage values of the GBR Marine Park - World War II features and sites; historic voyages and shipwrecks; lighthouses; and other places of historic significance (GBRMPA 2005; 2017b; 2017c).

The Approach

A human dimensions indicator framework was constructed based on five themes or clusters describing different aspects of human dimensions. Each cluster is further described by a set of attributes as listed in Table 2. The clusters were modified from the work by Vella et al (2012) who defined four main groupings of indicators derived from Social Impact Assessment literature (e.g. Vanclay 1999); social-ecological resilience literature (e.g. Berkes & Folke 1998); and the Millennium Ecosystem Assessment (MEA 2005), to describe the human dimensions of communities in north Queensland. These four groupings formed the basis of a framework for evaluating social resilience in the Wet Tropics Region of the GBR catchment (Dale et al 2016a, 2016c). To construct the framework we also reviewed the work of the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES), which recognises that healthy human systems depend (either directly or indirectly) on a healthy ecosystem (Diaz et al., 2015). We then aligned the IPBES and Dale et al (2016c) frameworks with values articulated in the Great Barrier Reef Strategic Assessment (GBRMPA 2014a), the Great Barrier Reef Outlook Report (GMRMPA 2014b) and published regional report cards for the GBR (Healthy Rivers to Reef Partnership: Mackay Whitsundays, 2016; Fitzroy Partnership for River Health, 2015; and the Gladstone Healthy Harbour Partnership, 2016). We added a fifth

cluster, culture and heritage, based on the cultural significance of the GBR, and its world heritage status Table 2.

Table 2: The five GBR human dimension clusters and their alignment with Reef 2050 Plan themes

Reef 2050 Plan Theme	The five human dimensions cluster and their attributes
All seven themes – i.e., economic benefits, community benefits, heritage, governance, water quality, biodiversity and ecosystem health.	**Aspirations, capacity and stewardship** Cohesive vision and aspirations for the future of the GBR together with awareness, skills, knowledge and capacities to turn aspirations into action. Personal and collective (including industry) efforts to: (a) minimise impacts on the GBR and catchment; (b) restore degraded marine, coastal and catchment ecosystems; (c) apply Ecologically Sustainable Development (ESD) principles; and (d) be actively involved in GBR and catchment management. ACS1 Levels of community awareness & education about the GBR ACS2 Community capacity for stewardship ACS3 Adoption of responsible/ best practice – GBR recreational users ACS4 Adoption of responsible/ best practice – Agricultural & land sector. ACS5 Adoption of responsible/ best practice – Industry & urban sector. ACS6 Adoption of responsible/ best practice – Marine industries.
Community benefits An informed community that plays a role in protecting the Reef for the benefits a healthy Reef provides for current and future generations	**Community Vitality** is characterised by demographic stability, security, happiness and well-being. Community vitality associated with the GBR includes how & why people access, use and value the GBR; services and infrastructure supporting the interface between the community and GBR; and the social health derived from the GBR, e.g., nature appreciation, relaxation, recreation, physical health benefits, and other lifestyle benefits derived from the GBR. A healthy GBR community derives high levels of appreciation and enjoyment from the GBR and is highly satisfied with the GBR and its management. CV1 Demographic stability across the catchment CV2 Security in the catchment including housing, safety & risk management. CV3 Wellbeing/ happiness within the general community. CV4 Community health/ wellbeing/ satisfaction associated with the GBR. CV5 Regional services & service infrastructure supporting the interface between the community & GBR.
Heritage Indigenous and non-Indigenous heritage values are identified, protected, conserved and managed such that the heritage values maintain their significance for current and future generations	**Culture and Heritage** Status of integrated and diverse culture and heritage associated with the GBR catchment. Cultural and heritage connections promote a sense of place associated with GBR coastal communities, and there is strong place attachment and identity associated with the community, because of its association with the GBR. This cluster also includes values of significance in accordance with Traditional Owner practices, observances, customs, traditions, beliefs or history. Historic heritage is specifically concerned with the occupation and use of an area since the arrival of European and other migrants. Contemporary culture is how the GBR is experienced by people today. CH1 World Heritage – underpinned by ecosystem health, biodiversity & water quality CH2 Indigenous (Traditional Owner) heritage CH3 Contemporary culture CH4 Historic maritime heritage (since European settlement).
Economic Benefits Economic activities within the Great Barrier Reef World	**Economic values** This includes the monetary advantages that people derive directly or indirectly from a healthy and well-managed GBR. Fundamental is the premise that economic activities within the Great Barrier Reef World Heritage Area (GBRWHA) and its catchments are ecologically

Heritage Area and its catchments sustain the GBR's Outstanding Universal Value (OUV)	sustainable. GBR-dependent industries rely on a healthy GBR and include GBR-based commercial fishing, tourism, recreation, research and TO use. GBR-associated industries include industries that may impact on the GBR, but are not economically dependent on GBR health, e.g., shipping, catchment industries such as agriculture, urban development, port development. EV1 Size and diversity of regional economic growth EV2 Economic viability of GBR-associated industries EV3 Economic viability of GBR-dependent industries EV4 Inclusiveness & economic fairness/ equity EV5 Workforce participation & employment EV6 Economic confidence within the region.
Governance The OUV of the Reef is maintained & enhanced each successive decade through effective governance arrangements & coordinated management activities**.**	**Governance** refers to the health of GBR-based decision-making systems (from local to international scales), including levels of connectivity between different parts of the governance system, effective use of diverse knowledge sets and system capacity for effective action. Also includes viability of institutional arrangements; community participation in GBR management; and use of ESD principles in planning and management. G1 Strategic focus of governance system G2 Connectivity within & between key decision making institutions & sectors G3 Adaptive governance capacity of key decision making institutions & sectors G4 Adaptive use & management of integrated knowledge sets.

In constructing the tables for each region, the project team gathered evidence from peer-reviewed literature, grey literature and other forms of knowledge such as Indigenous and local knowledge. We drew on qualitative and quantitative data. Quantitative data sets used in the analysis include the following:

- **ABS** (Australian Bureau of Statistics) *Data by Region* http://stat.abs.gov.au/itt/r.jsp?databyregion
- **ABS** (Australian Bureau of Statistics). (2015). *Information paper: An experimental ecosystem account for the Great Barrier Reef Region, 2015* (cat. no. 4680.0.55.001). Canberra: ABS. Retrieved from http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/4680.0.55.001Main%20Features202015?opendocument&tabname=Summary&prodno=4680.0.55.001&issue=2015&num=&view=
- **ABS** (Australian Bureau of Statistics). *ABS Census Data*. Retrieved: http://www.abs.gov.au/websitedbs/D3310114.nsf/Home/Census?opendocument&ref=topBar
- **ABS** (Australian Bureau of Statistics). 4609.0.55.003 - *Land Account: Queensland, Experimental Estimates, 2011 – 2016*. *Land Account: Queensland, Experimental Estimates, 2011-2016*,
- **ABS** (Australian Bureau of Statistics) – Community profiles http://www.abs.gov.au/websitedbs/censushome.nsf/home/communityprofiles
- **ABARES** (Australian Bureau of Agricultural and Resource Economics and Sciences) *Catchment Scale Land Use of Australia* http://www.agriculture.gov.au/abares/display?url=http://143.188.17.20/anrdl/DAFFService/display.php%3Ffid%3Dpb_luausg9abll20160616_11a.xml
- **ABARES** (Australian Bureau of Agricultural and Resource Economics and Sciences) *Data sets*. http://www.agriculture.gov.au/abares/data
- **GBR Report Card 2016 Reef Water Quality Protection Plan**. http://www.reefplan.qld.gov.au/measuring-success/report-cards/2016/assets/report-card-2016-detailed-results.pdf

- **GBRMPA** (Great Barrier Reef Marine Park Authority). *Vessel registration levels for the Great Barrier Reef catchment area.* http://www.gbrmpa.gov.au/VesselRegistrations/
- **Infofish**. https://crystal-bowl.com.au/
- **North Queensland home insurance**. http://nqhomeinsurance.gov.au/
- **QGSO** (Queensland Government Statistician's Office). *Queensland regional profiles* http://statistics.qgso.qld.gov.au/
- **Progress in Australian Regions Yearbook 2017.** https://bitre.gov.au/publications/2017/files/00_REGIONS_YEARBOOK.pdf
- **Rental Vulnerability Index** https://cityfutures.be.unsw.edu.au/cityviz/rental-vulnerability-index/
- **SELTMP** *The Social and Economic Long Term Monitoring Program for the Great Barrier Reef* http://seltmp.eatlas.org.au/seltmp
- **TRA** (Tourism Research Australia) https://www.tra.gov.au/
- **University of Canberra** (2017) *2016 Regional Wellbeing Survey: Results by RDA and LGA*. http://www.regionalwellbeing.org.au/

The process involves synthesising evidence from diverse sources, presenting the evidence as a series of tables, and allocating draft scores to attributes of each human dimension cluster. We then invited people to review the tables through a series of expert panel meetings held in each region. Meeting participants were selected on the basis of: (a) their experience and knowledge of the Great Barrier Reef from a regional, community, industry (GBR-dependent and GBR-associated industries), or governance perspective; and/or (b) their involvement in social, economic and/or environmental initiatives which contribute to regional community wellbeing. If an invited person was unable to attend, but could offer a proxy who can represent them, then the proxy is accepted. Panel members comprised chairs of GBRMPA's Local Marine Advisory Committees; Chairs and/or CEOs of NRM bodies; local government; Regional Development Australia; tourism organisations; commercial fishers; regional healthy waterways partnership members; Traditional Owners; and researchers on the project team. There were usually around 10 people on each panel. Specifically, panel members were invited to appraise evidence about the GBR's human dimensions presented in the tables; add additional knowledge to fill data gaps; and record data gaps and limitations. During the meeting discussions, the multiple lines of evidence were weighed up using a set of decision rules (Table 3) then used to score attributes within each of the five human dimension clusters. The scores are used to make critical judgements on the state or condition of regional community resilience as a way of representing the human dimensions of that part of the GBR. The process helps all involved in the meetings and their interested parties to plan for the future, and to alert GBR managers, partners and stakeholders to emerging issues and risks. Reference to the *regional community* includes all levels of government, industry, Traditional Owners and local residents viewed through the regional geographic lens. A thriving, resilient community can anticipate risks and limit impacts while still retaining the same function, structure, purpose, and identity. Sometimes a regional community may get trapped in an undesirable state, unable to change over time. Being able to understand which attributes of a community need attention is an important first step to overcome stagnation or decline (CARR 2013; Walker and Salt). The *broader community* includes national and international people who either have an interest in the GBR or who influence (directly or indirectly) the condition of the GBR including industry sectors, Traditional Owners and government agencies.

Table 3: Decision rules for assessing resilience of regional communities that will influence social, economic and environmental outcomes of relevance to the GBR

Index Rating	Decision Rule
5	The regional community will easily manage the GBR sustainably, maintaining or improving their economic and social wellbeing and the health of the GBR over time.
4	The regional community will make reasonable progress on managing the GBR sustainably, at least maintaining but also improving their economic and social wellbeing and the health of the GBR over time.
3	The regional community will suffer some shocks associated with managing the GBR sustainably, taking considerable time and investment to secure their economic and social wellbeing and the health of the GBR over time.
2	The regional community will struggle to manage the GBR sustainably, resulting in declining social and economic wellbeing and ongoing decline in the health of the GBR over time.
1	The regional community will be unable to manage the Reef sustainably, and their social and economic wellbeing and the health of the GBR will be unlikely to recover over time.

2.0 THE MACKAY-WHITSUNDAY REGION

Although the Mackay-Whitsunday Region is the smallest in the GBR catchment, it is one of the most biodiverse - known for iconic sites such as Eungella National Park, Whitsunday Islands National Park, Cape Palmerston National Park, Goorganga Plains, Sand Bay, St Helens Bay, and Sarina Inlet wetlands. The region encompasses 900 km of coastline and 204 GBR islands. Beginning just south of Bowen, it extends west to the Clarke Conners Range and ends just south of Clairview. Major population centres are Mackay (123,540 persons); Proserpine (8,293 persons); Sarina (5,522 persons) and Cannonvale-Airlie Beach (6, 924 persons) (ABS 2017). The region's agricultural land comprises sugar cane, cattle grazing and horticulture. The Central Queensland coalfields influence the region through provision of vital infrastructure to support the mining industry, including one of the world's largest coal terminals at Hay Point. The region attracts visitors from all parts of the globe (Reef Catchments NRM 2014).

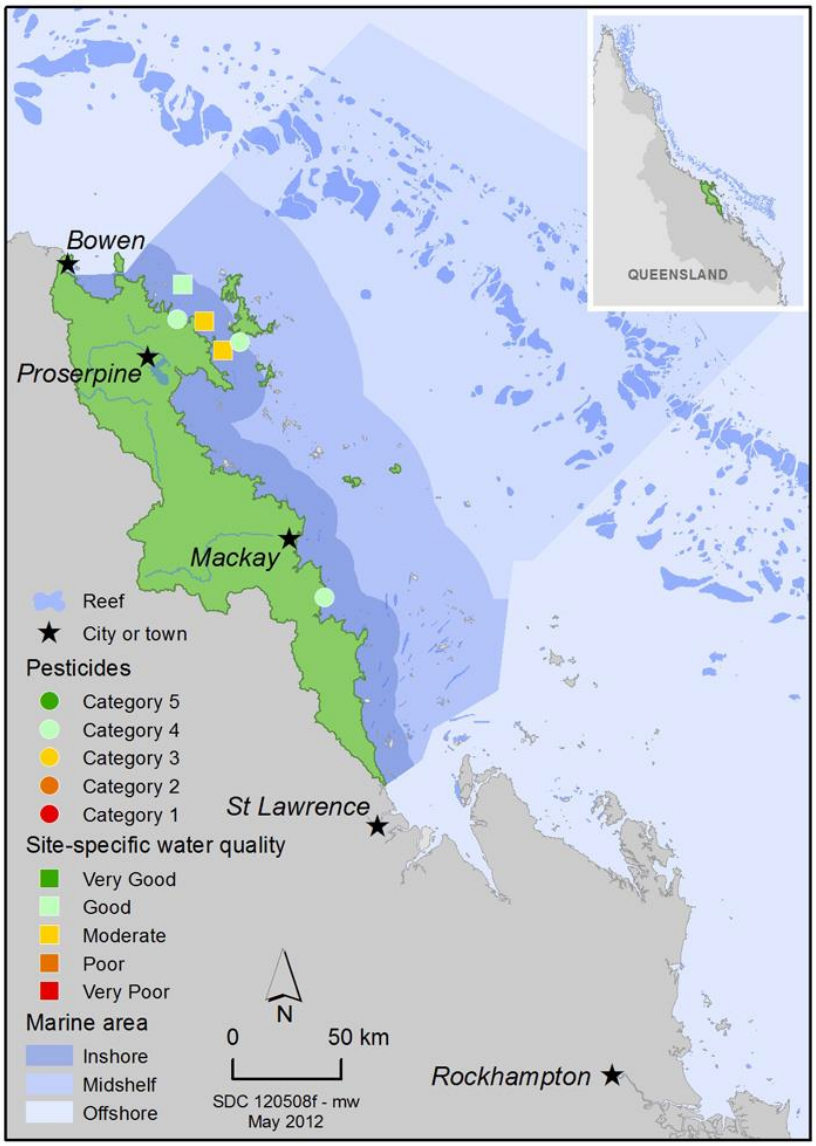

Figure 2: The Mackay-Whitsunday Region and adjacent GBR

(SOURCE: http://www.reefplan.qld.gov.au/measuring-success/report-cards/2011-report-card/assets/mw-water-quality-and-pesticide-scores-map.jpg)

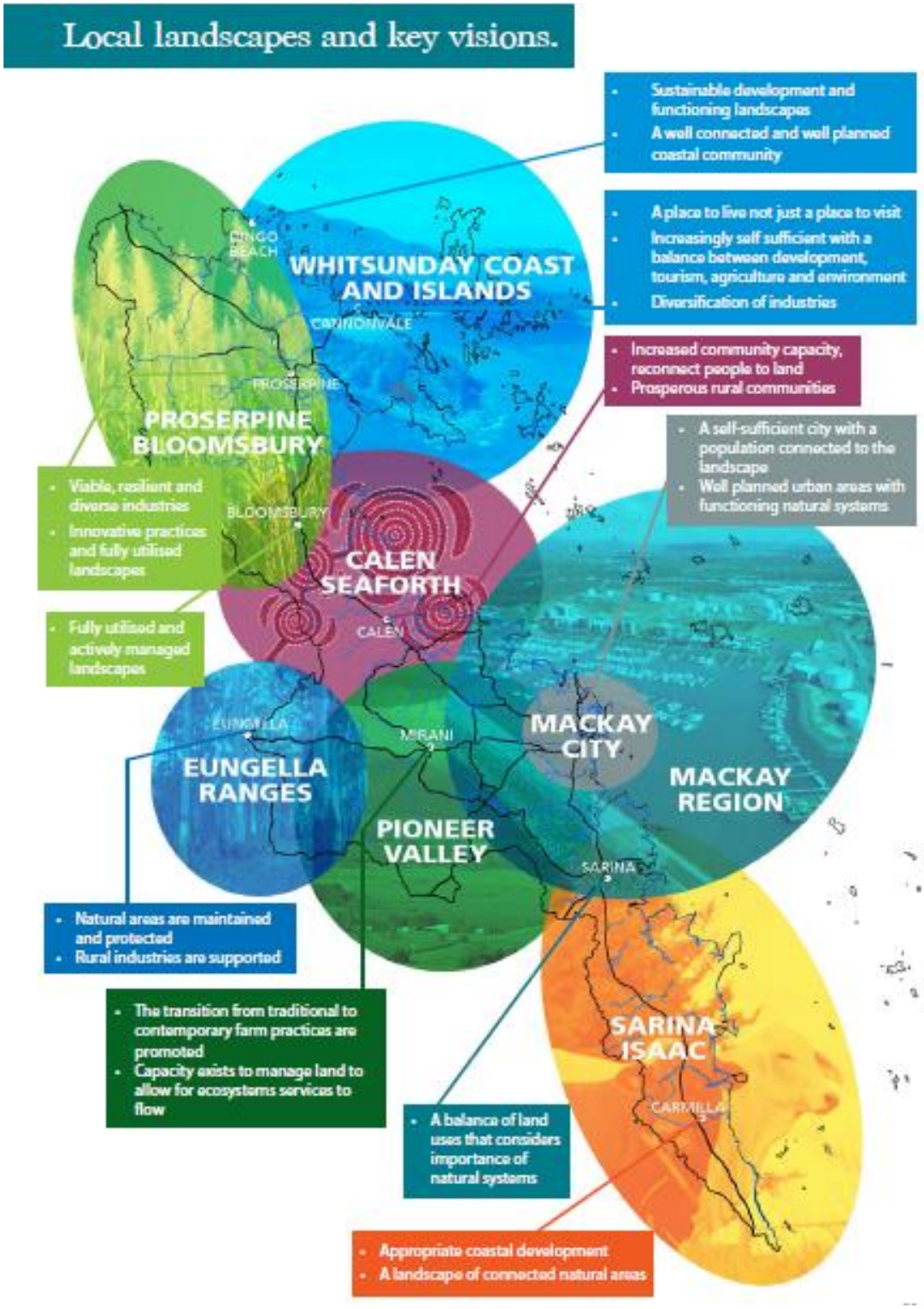

Figure 3: The Mackay-Whitsunday Region – local landscapes and visions

(SOURCE: Reef Catchments 2014)

Cluster One: Aspirations, capacities and stewardship

Cohesive vision and aspirations for the future of the GBR together with awareness, skills, knowledge and capacities to turn aspirations into action. Personal and collective (including industry) efforts to (a) minimise impacts on the GBR and catchment; (b) restore degraded marine, coastal and catchment ecosystems; (c) apply ESD principles; and (d) be actively involved in GBR and catchment management.

Table 4: Aspirations, capacities and stewardship

Attribute Component	Possible Indicators	Evidence	Conclusions	Proposed Value and Logic
ACS1 Levels of community awareness, education	• Regional education/ skills levels • Awareness of NRM issues • Awareness of GBR & waterway condition & threats • GBR learning opportunities	**Regional education/ skills levels** • In 2011, 52.3% had non-school quals. (54.2% for Qld). 26.4% studied Engineering & Related Technologies; cw 16.8% for Qld (QGSO 2017a). **Awareness of NRM issues** • Perception that *water quality* is a big problem: 32.3% MIW residents c.w. 41.4% for rural & regional Aust & 43.7% rural & regional Qld; Perception that *soil erosion* is a big problem: 24.9% MIW residents c.w. 41% for rural & regional Aust & 39.4% % rural & regional Qld; Perception that *environmental degradation in general* is a big problem: 13.9% MIW residents c.w. 40.4% for rural & regional Aust & 40.7% % rural & regional Qld (Uni of Canberra 2017). **Awareness of GBR and waterway condition & threats** • 45% M-W residents agree that coral reefs in the region are in good condition; 64% agree that mangroves are in good health; 63% agree that estuarine & marine fish are in good condition; 65% are worried about the status of freshwater fish in the region; 60% DISAGREE that freshwater rivers & creeks in the region ARE NOT in good condition; 75% DISAGREE that they ARE NOT worried about climate change impacts on the GBR (Marshall & Pert 2017). • 41% M-W regional residents say the greatest threat to the GBR is pollution; 30% cite climate change & 20% say poor water quality is the greatest threat (Marshall & Pert 2017). *GBR catchment residents* • In 2013, 52% GBR coastal residents believed climate change is an immediate threat to the GBR. In 2017, this increased to about 65% (SELTMP, 2013a; 2017). *National/International perspectives*	• Regional education levels are sound & compare favourably with rest of Qld. • High levels of NRM awareness & environmentally responsible behaviour, but a growing gap between community aspirations & resource allocations to deliver improved environmental sustainability (Reef Catchments 2016). • GBRMPA's Reef Guardian School's Program has a large influence on community capacity for stewardship • Within the whole GBR catchment, there is a broad societal awareness of the impacts of climate change & catchment-based activities on the GBR.	**3.5** Among the general regional community, perceptions of threats to local ecosystems & the GBR are variable. More broadly, there is a high level of national & international awareness & concern about the GBR that does not always translate into cohesive policy

		• Australians consider pollution, climate change & people to be the biggest threats to the GBR c.w. shipping, & agricultural runoff mentioned by catchment respondents. Tourists listed the most serious threats as tourism (41%), climate change (40%), & commercial fishing (22%). Commercial fishers list agricultural run-off (34%) new ports & port expansions (31%), shipping (31%). Only 18% of fishers see climate change as a major GBR threat. 81% Australians agree that all Australians should be responsible for the GBR c.w.94% GBR coastal residents. 54% Australians are optimistic about the GBR's future (Marshall et al., 2013a). • 2/3 Australian & international respondents of a recent survey were prepared to pay to protect the GBR. Of these 61% alluded to its importance to the planet; 59% felt future generations should be able to visit it; 59% cited its importance to biodiversity; 52% felt it was morally & ethically right to pay for its protection (DAE, 2017). **GBR learning opportunities** • 78% M-W regional residents are interested in learning more about GBR condition; 53% say they have knowledge & skills to reduce their GBR impacts; 90% value the GBR because it provides opportunities for learning through science; 69% value the GBR because it provides a place where people can continue to pass down wisdom, traditions & a way of life (Marshall & Pert 2017). *GBR-wide Reef-education programs* • GBR-wide Reef Guardians Program - 276 schools, 120,000 students, 7,400 teachers; 16 Councils covering 300,000 km2; 17 commercial fishers (line, trawl, net, collection); 24 sugarcane, banana, horticulture & broad-acre farmers & 5 beef graziers (GBRMPA, 2016a).	• There are high levels of agreement among national residents & catchment residents that it is the responsibility of all Australians to care for the GBR, indicating that cohesive stewardship efforts at local, regional & national scales would be a sound investment.	action related to key threats.
ACS2 Community capacity for stewardship	• Sense of responsibility towards the environment • Sense of responsibility towards the GBR & coastal waterways • Regional Reef-based stewardship activities • Numbers & types of TO involvement in on-ground WQ improvement & monitoring	**Sense of responsibility towards the environment** • 84% M-W residents agree they make every effort to use energy efficiently at home & at work; 74% DISAGREE that they RARELY CONSIDER l impacts of production processes for goods & services that they purchase; 82% DISAGREE that they DON'T USUALLY make extra effort to reduce waste; 70% re-use or recycle most goods & waste; 17% are part of an environmental community-based group (Marshall & Pert 2017). **Sense of responsibility towards the GBR & coastal waterways** • 88% M-W residents agreed they would like to do more to help protect the GBR; 89% agreed they could do more to improve water quality in local waterways (including rivers, creeks); 72% DISAGREE that they CANNOT make a difference in improving GBR health; 86% DISAGREE that it is NOT their responsibility to protect the GBR; 68% agree that they feel a	• Responses to a SELTMP survey suggest that M-W Region residents they have relatively high aspirations & levels of capacity & stewardship around the GBR. • Many local stewardship groups & active volunteers i National and International	**3.5** Sound levels of capacity for stewardship at local, national & international levels

		social expectation to reduce impacts they may have on the GBR; 76% DISAGREE that they DO NOT HAVE time or opportunity to reduce their impacts on the GBR (Marshall & Pert 2017). • GBR coastal residents strongly agreed they would like to do more to help protect the GBR (7.3/10 in 2013 & 7.75/10 & agreed they have a personal responsibility to protect the GBR (6.8/10 in 2017 (Marshall & Pert 2017). **Regional Reef-based stewardship activities** • Several active M-W landcare/coastcare groups: 1,400 volunteers did > 6,000 hrs conservation works & removed 4.2T marine debris from 150ha coastline including 17 islands (Reef Catchments 2016). • $700,000 Reef Trust project engaged > 4000 people in marine debris removal across the whole GBR (GBRMPA, 2016a). • 2/3 Australian & international survey respondents are prepared to pay to protect the GBR. Of these 61% alluded to its importance to the planet; 59% felt future generations should be able to visit it; 59% cited its importance to biodiversity; 52% felt it was morally & ethically right to pay for its protection (DAE, 2017). **Numbers & types of TO involvement in on-ground WQ improvement & monitoring** • Not enough evidence to assess	communities are willing to pay to help protect the GBR .	
ACS3 Adoption of responsible/ best practice – GBR recreational/ artisanal users	• Extent & type of stewardship practices • How many people visit this section of the GBR? • Where do they go? • What do they do? • How do they get there?	**Extent & type of stewardship practices** • MRRS focuses on the Mackay Region's beaches, stocked impoundments, estuary & reef fishing sites. It identifies & prioritises projects & actions to support sustainable rec fishing industry (MRC 2017) • Data shows DAF's NFZ introduced in 2015 is working – boat ramp surveys show total catch by rec. fishers > 48.3% bet. 2016 - 2017; total fish caught > 563 to 939. Time taken to catch a legal fish fell < 7.62 hrs/fish in Nov 2015 to 4.55 hrs/fish in 2016 to 2.48 hs/fish in 2017 (Infofish 2017). **Number of GBR visitors** • 94% M-W residents visited the GBR for recreation at least once in the past 12 months (Marshall & Pert 2017). • In 2015-16 MW region had 1M day trippers, 3M domestic overnight visitors & 2M international visitors. Of these around 50% (i.e. 3M) visited the GBR (DAE, 2017). • The Whitsundays area had 472 000 domestic overnight visitors 2016-2017 (decline of 2.1% over the past 3 years); 252000 holiday visitors (decline of 9%) & interstate visitation was down by 7.4% to 169 000. Business visitation surged by 39.8% to 129 000 in the same period – figures are likely due to the impact of STC Debbie in March 2017. Overall visitor	• New Rec Fishing Strategy for Mackay prioritises stewardship actions • Evidence supports the introduction of NFZs for increasing fish stocks. • Basic regulatory compliance and education/awareness systems in place.	**3** Hard to get regionally specific data on use patterns & stewardship efforts of recreational/ artisanal users, but rec. fishing efforts for stewardship are sound.

		nights grew by 3.1% to 2.3 M, due to visitors staying longer. However they spent less - decline of 6.1% in overnight expenditure to $456.4M (TEQ 2017). • International visitors to the Whitsundays grew by 8.2% pa over the past 3 years to 247000 in 2017, but they stayed fewer nights and spent less money. Overall visitor nights declined by 14.6% & expenditure declined by 6.3% to 197.1M (TEQ 2017). • Recreation boating & fishing in Whitsundays > 20% of vessels registered for whole GBR (Reef Catchments, 2014). • No. of recreational vessels registered in M-W rose steadily from 19,184 in 2008 to 21,774 in 2014; decreased to 21,474 in 2016 (GBRMPA, 2017e). **Where recreational visitors go** • Not enough evidence to assess **Why do they visit? What do they do?** • 12% M-W residents belong to a GBR-based club or community group (Marshall & Pert 2017). • 30% M-W pop'n fish at least once each year, significantly higher than the state average of 17% (QDAFF 2015). Most fishing effort is in marine waters. M-W is popular for fishers across Australia (QDAFF 2015) • Top three activities contributing to M-W residents' use and enjoyment of the GBR (ranked using mean ratings on 1-10 scale) were: Sightseeing/exploration = 8.14; Wildlife watching = 7.66; Viewing coral and reef habitats = 7.61 (Marshall & Pert 2017).		
ACS4 Adoption of best practice systems – Agricultural & land sector. (including Aquaculture)	• Extent & type of stewardship practices of agricultural industries.	• Aquaculture rated as very effective for 2015-16 FY (MWHR2RP, 2016). Regulation requires nil net discharge of nutrients - regional compliance rate of 100% (Eco Logical Aust & Adaptive Strategies, 2016). **Regional Landcare** 2015-2016: • 55 attendees *Healthy Soils Symposium*; 6 sustainable management events for 200 land managers; 98 community leaders supported partnerships for sustainable ag.; *Innovative Grazing Forum* -118 attendees; *Innovative Grazing Network* - 25 graziers (Reef Catchments 2016). **Regional Reef Programme:** 2013 – 2016: • $2,606,181 for cane farmers via water quality grant investment plus $3,710,296 contribution from cane farmers • 348 cane farmers completed farm planning on 625 farms covering an area of 68,766 ha; 13,151ha chem. management projects; 20,424ha nutrient management projects; 14,818ha soil management projects; 13,300ha Irrigation management projects; 8 constructed wetlands capturing 1125ML	• Strong progress over last decade concerning improvement in grazing and agricultural practices. • Social and environmental conflicts remain over proposed regulatory arrangements. • Graziers could adopt practices that benefit the GBR, however, many lack financial capacity. • While substantive improvements in	3 While substantive improvements in practice uptake, considerable progress still required to meet Reef 2050 Plan targets.

		stormwater & 8 detention/ sediment basins capturing 241ML (Reef Catchments 2016). • Smartcane BMP program engaged with 479 growers; 18 achieved BMP accreditation process (CoA & QG 2016). • 22 M-W graziers improved grazing land management practices on 2112ha & 8k streambanks through Reef Catchments NRM & Aust. Gov.'s Reef Programme which also helped repair 30 gully sites & 57 streambank sites protecting 35km streambank (CoA & QG 2016). • DAF's beef extension team provided BMP follow-up services, info. on grazing land management, sediment loss & impacts on GBR water quality; & helped 3 beef businesses across 8263ha with BMP (CoA & QG 2016). • *Project Catalyst* supports grower led innovation across GBR to reduce nutrients, chemicals & sediments entering the GBR (Reef Catchments 2016). **Reef Plan Report Card** for M-W industry *Grazing Target: 90% grazing lands managed using BMP by 2018* • 416 graziers farm 304,000ha land & 2300km streambanks. • In 2016 40% grazing land was under BMP relating to pasture (hillslope) erosion; 21% for streambank erosion & 38% for gully erosion. Overall BMP for B-M graziers is D (CoA & QG 2016). *Sugar Target: 90% grazing lands managed using BMP by 2018* • 1380 growers farm 136,000 ha sugarcane. • In 2016, 42% sugarcane land was under BMP for pesticides, 23% for nutrients & 43% for soil. Overall BMP for B-M cane farmers is D.	practice uptake, considerable progress still required to meet Reef 2050 Plan targets.	
ACS5 Adoption of best practice systems – Industry & urban sector.	• Extent & type of stewardship practices of urban councils & industries.	• MRC has invested in staff and resources to implement stewardship actions through the Reef Guardian Action Plan 2015-2016 (MRC 2014). • Urban & other intensive uses account for 10% total regional particulate nutrient load & 4% regional DIN. Point sources (e.g. sewage treatment plants) may be significant to local management areas (Folkers et al. 2014). • MWHR2P Report Card assessed Urban stewardship as partially effective due to poor implementation of environmental management plans & low compliance (67%) with environmental legislation & approval conditions (HR2RTWG, 2016; Eco Logical Australia & Adaptive Strategies, 2016). • SPP (DILGP, 2017) states that all exposed soil areas > 2500 m^2 must have sediment controls implemented & maintained to achieve 80% hydrologic effectiveness (50mg/L TSS or less & pH bet. 6.5–8.5). One method for achieving compliance is to implement HESBs (Turbid Water Solutions, 2017). To date NO LGAs in the GBR catchment have HESBs	• Sound urban stewardship is implemented through the MRC's Reef Guardian program, but could be improved through higher compliance rates among some urban industries. • Across the whole GBR catchment, traditional sediment basins are often not designed to	**3.5** Strong regulatory framework for point source pollution, but low compliance rates

		on working construction sites within their jurisdictions (S. Choudhury pers. comm.) • Upgrades to sewage pump stations at 40 sites across the Mackay region will boost network resilience & reliability, improve services & access during emergencies, & reduce sewerage overflows (QDSD, 2017). • RC Urban project (completed 2016) multi-agency collaboration to restore wetlands, construct bio-retention systems & install gross pollutant traps. Resulted in reduced net sediment & urban pollutant loss & improved WQ. Biodiverse native plantings & strategic weed management built resilience, improved connectivity & ecosystem condition under pressure from coastal urban development. Founded on strong working relationships developed with state government agencies, councils, industry groups, community groups and others (Reef Catchments, 2016). • MWHR2RP Report assessed stewardship of Heavy Industry as 'Effective', as they complied with all environmental regulations (Eco Logical Australia & Adaptive Strategies, 2016).	minimum standards & thus ineffective. Local councils want support from other governments for an independent, dedicated compliance team that would travel the State. (S. Choudhury pers.comm.)	
ACS6 Adoption of best practice systems – Marine sector	• Extent & type of stewardship practices of GBR-associated industries (Ports & shipping) • Arrangements to ensure GBR shipping is safe. • No. shipping accidents • Extent & type of stewardship practices of GBR-dependent industries (Fishing & Tourism)	**Ports & shipping** • Large coal spillage with coal & fine black dust washed up at East Point beach & Louisa Creek Beach in Feb 2017 (Wilacy, 2017) • MWHR2RP Report assessed stewardship of Ports as 'Effective', as they each complied with all environmental regulations (Eco Logical Australia & Adaptive Strategies, 2016). • CAFNEC consider the NESMP vague about impacts of GBR shipping. WWF & AMSA recognise that the plan provides important priority actions, but urgent changes are needed (e.g. compulsory pilotage for the entire GBR; use of high-standard ships in GBR waters, & improved marine biosecurity arrangements (Comm. of Aust. 2014) **GBR Fishing & Fisheries** • 8% comm. fishers have fuel efficient vessels; 81% participate in industry best practice; 13% use emissions calculator (Marshall et al., 2013a). • Introduction of NFZ from St Helens to Cape Hillsborough in 2015 has increased total catch rates for recreational fishers (Infofish 2017). • Compliance of commercial fishers increased or was stable across most regions between 2012 & 2013, & inspections increased across all regions from 2012 to 2013. Several MOUs & Codes of Conduct (COCs) for commercial fishers, but formal information is lacking. Commercial fishers do not feel constrained in taking action to reduce their impacts on the GBR. Of all constraints, expense appears to be the biggest issue (Tobin et al., 2014).	**Ports & Shipping** • Generally comply with legal requirements, but could improve in some areas. **GBR Fishing & Fisheries** • Could improve uptake of environmentally friendly practices • Most commercial fisheries are reasonably well regulated. • Introduction of NFZ has helped to increase stocks of some species of table fishes. **GBR tourism** • Good progress towards uptake of environmentally friendly	**3.5** Significant progress has been made on tourism, port management & the management of shipping in the GBR.

		• *Queensland Sustainable Fisheries Strategy 2017–2027* should improve management practices in the commercial fishing sector (QDAF 2017a) **Skills Levels in GBR Industries** • GBR tourism operators & commercial fishers with comparatively smaller businesses, have higher levels of adaptive capacity than their peers (Marshall et al., 2013a). • Need to provide assistance to develop business plans to help commercial fishing industry cope with change & be resilient (Sutton, Lédée, Tobin, & De Freitas, 2010). **Regional tourism** • MWHR2RP Report assessed stewardship of Tourism as 'Effective', as they each complied with all environmental regulations (EcoLog. Aust. & Adaptive Strategies 2016). **GBR-Wide Tourism** • 67 GBR tourism operators have ECO Certification & carry 69% GBR tourists (GBRMPA, 2016a). 52% tourists prefer those with 'green' credentials; 63% ops. "regularly get involved in research &/or management"; 98% "try to encourage other people to reduce GBR impacts"; 90% provide interpretation for tourists that promotes GBR conservation or sustainable use; 88% use fuel efficient engines; 84% separate waste for recycling; 83% participate in industry best practices; 45% participate in Eye on the Reef; 43% use green energy; 28% use emissions calculator; 19% use carbon offsets; 8% use alternative fuels (Marshall et al., 2013a).	practices & eco-certification.	
Rating				**20**
Maximum for this Attribute				**30**

Cluster Two: Community vitality

Community vitality is characterised by demographic stability, security, happiness and well-being. Community vitality associated with the GBR includes how & why people access, use and value the GBR; services and infrastructure supporting the interface between the community and GBR; and the social health derived from the GBR - e.g. nature appreciation, relaxation, recreation, physical health benefits, and other lifestyle benefits derived from the GBR. A healthy GBR community derives high levels of appreciation and enjoyment from the GBR and is highly satisfied with the GBR and its management

Table 5: Community vitality

Attribute Component	Possible Pressure, State & Trend Indicators	Evidence	Conclusions	Proposed Value & Logic
CV1 Demographic stability across the Region	• Basic demographic characteristics (e.g. population, age structure, migration & growth rates). • Migration intentions over the next 12 months	**Basic demographic characteristics** • 2016 ERP of 136,704 (ABS, 2017) c.w. 991,978 for GBR catchment, & 4,778,854 for Qld. Av growth rate 1.2% p.a. over 5 ys & 1.7% p.a. over 10 yrs. Within the region, Mackay had the largest population with 123,540 persons (QGSO 2017a; 2017b). • In 2016, 12.2% were born overseas, c.w. 21.6% across Qld; 4.9% were Indigenous c.w. 4% for Qld. 5.7% regional residents speak language other than English at home, c.w.12% across Qld (QGSO 2017a). **Migration intentions in the next 12 months** • 22.3% MIW residents were likely to move in the next 12 months c.w. 10.8% for rural & regional Aust & 12.6% rural & regional Qld (Uni of Canberra 2017).	• Regional population is concentrated in Mackay • Many inland centres are very small & service large, scattered pastoral properties or mines, with pop'n declining & aging. • Maintaining human resources in rural areas & ensuring passing down of knowledge is a significant challenge. • Population changes occur in response to economic conditions.	**3.5** Demographic transience characterises the region - affected by rural decline and uncertainty in the resources sector.
CV2 Security in the catchment including housing, safety & risk management.	• Financial distress: (i) delay or cancel non-essential purchases; (ii) could not pay bills on time; (iii) went without meals, or unable to heat or cool home; (iv) asked for financial help from friends or family	**% residents with high financial distress (2, 3 or 4 factors)** • 27.7% MIW residents c.w. 20.9% rural & reg. Aust & 22.3% rural & reg. Qld (Uni of Canberra 2017). **Regional Crime Rates & domestic safety** • Regional crime rate 10,450 per 100,000 c.w. Qld Av of 9,856/100,000 persons; offences against a person 633/100,000 c.w. 634/100,000 for Qld (QGSO 2017a). **Perceptions of safety**	• MIW residents have higher financial distress than other residents in rural & reg. Aust. • Level of economic resources impacts affordability of healthy food & access health care (NQPHN, 2016). • Rental vulnerability (RV) in Airlie Beach is quite low. It was low in Mackay in 2011,	**3** Security in the catchment varies according to extreme weather events

	• Crime rates • Perceptions of safety • Housing including availability & affordability	• 65.8% MIW residents agreed with the statement: *This is a safe place to live* c.w. rural & reg. Aust (80.7%) & 83.3% rural & reg. Qld residents (Uni of Canberra 2017). *Impacts of STC Debbie on Whitsundays* • 4,357 premises directed to evacuate due to storm surge threat. 33% of all urban premises damaged; 208 properties severely damaged or destroyed; 800 residents displaced; 6,450 applications for assistance for hardship or loss of possessions; Asbestos threat from aged building damage; all schools & daycare centres suffered external, internal damage & materials loss; increased community feelings of isolation, loss, anxiety & fear (WRC, 2017a). *General extreme weather consequences* • Buildings more expensive because they have to be cyclone rated & goods need to be transported further from major production hubs (BITRE, 2011). • Postcodes 4740 (Mackay), 4800 (Proserpine) & 4802 (Airlie Beach) have relatively high risk of flood & cyclones (based on Finity Consulting's natural peril assessment), but this is highly variable within the area, thus insurance rates vary widely (AG 2016). **Housing availability & affordability** • When low-income households have to spend more than 30% income on housing, they start to go without other things – e.g. meals, health care & outings. For this reason, low-income households in unaffordable housing are said to be in "housing stress" or "rental stress" (Troy & Martin 2017). *Rental Vulnerability Index (RVI)* – extremely high = 1; extremely low = 0 • Mackay (postcode 4740) RVI 2011 = 0.322; RVI 2016 = 0.512; • Proserpine (postcode 4800) RVI 2011 = 0.709; RVI 2016 = 0.787; • Airlie Beach (postcode 4802) RVI 2011 = 0.237; RVI 2016 = 0.312 (CFRC 2017). *Homelessness* • Homelessness in Mackay dropped from 77.1 per 10 000 persons in 2006 to 53.5/10 000 in 2011; a decline of 23. 6 % (Comm. of Aust. 2017).	but has almost doubled in 2016. RV in Proserpine is very high, slightly increasing bet. 2011 & 2016. • Homelessness in Mackay declined bet. 2006 & 2011 by 23% • MIW residents do not feel as safe as other rural & regional Australian residents, & this was exacerbated by STC Debbie. • Modern building standards will help minimise cyclone damage to property in the future.	and economic fluctuations.

CV3 Wellbeing/ happiness within the general community.	• **Community Wellbeing** (1-7) (i) great place to live, (ii) Coping with challenges, (iii) Pride, (iv) Optimism, (v) Community spirit. • **Community liveability** (i) liveability (ii) friendliness (iii) local economy (iv) local landscape • **Personal Wellbeing** (0-100). Satisfaction with (i) standard of living, (ii) health, (iii) achievements, (iv) relationships, (v) safety (vi) Feeling part of community, (vii) future security. • **Health** • **Mental illness**	**Community wellbeing** • MIW residents rate community wellbeing as 5.1/7 c.w. 5.5 rural & regional Aust; 5.5 rural & regional Qld (Uni of Canberra 2017). • M-W Regional communities value the favourable climate, productive agricultural land, the people, sense of community & small town sizes, access to good services (health, school, infrastructure); access to good quality water, clean air & healthy, fertile soil. M-W residents are very satisfied with region's enviable lifestyle including recreational opportunities & proximity to the GBR (Reef Catchments 2014). **Perceptions of decreasing community liveability** • 37.9% MIW residents perceive decreasing community liveability c.w. 20.2% rural & reg. Aust. residents; & 25.5% rural & reg. Qld residents (Uni of Canberra 2017). **Perceptions of personal wellbeing** • MIW residents rated their personal wellbeing as 68.9/100 c.w. 73.7 rural & regional Aust; 73 rural & regional Qld (Uni of Canberra 2017). **Health** • 5.3% MIW residents report poor health c.w. 5.2% rural & reg. Aust; 5.1% rural & reg. Qld (Uni of Canberra 2017). • Mackay has the highest rate of obesity in Qld – 83.4% population are overweight obese c.w. the state av. of 63.3%. The rate has increased steadily from 71.6% in 2012, to 76.8% in 2011, then to 83.4% in 2015 (Comm. of Aust. 2017). **Mental illness** • 8.3% MIW residents are likely to suffer from a serious mental illness c.w. 9.6% rural & reg. Aust; 10.8% rural & reg. Qld (Uni of Canberra 2017).	• Generally high levels of happiness/wellbeing within the region, though levels of health & personal wellbeing could be improved – e.g. obesity rates are the highest in the State. • Community wellbeing compromised by extreme weather events – e.g. STC Debbie	**3** Community wellbeing is enhanced by favourable climate, productive agricultural land, the people, sense of community & small town sizes, but devalued by personal health and wellbeing associated with lifestyle choices, & compromised by extreme weather events.
CV4 Community health/ wellbeing/ satisfaction associated with the GBR.	• Stress associated with decline in GBR health • **GBR contributions to quality of life & wellbeing** GBR contribution to (i) QoL; (ii) desirable way of life & ecosystem services e.g. fresh seafood (iii) optimism about the future; (iv) satisfaction with GBR experiences;	**Stress associated with decline in GBR health** • 80% M-W residents DISAGREE that they would NOT be personally affected if GBR health declined; % admitted that thinking about coral bleaching makes them feel depressed (Marshall & Pert 2017). • 54% of Australians would be personally affected if GBR health declined c.w. 81% GBR coastal residents (Marshall et al., 2013a). **GBR contributions to quality of life & wellbeing** • 86% M-W residents agree that the GBR contributes to their quality of life & wellbeing; 89% value the GBR because it supports a desirable & active way of life; 68% value the GBR because it inspires artistic or thoughtful ways; 75% value the GBR for the fresh seafood it provides; only 56% feel optimistic about the future of the GBR; 80%	• The GBR plays an important role in the health & wellbeing of coastal residents & visitors & most are very satisfied with GBR experiences. • Recreational fishers' experiences have been enhanced through the introduction of Net Free Zones in November, 2015.	**3.5** High levels of wellbeing related to the GBR are reported in both regional & Australian populations.

	(v) GBR experiences (negative & positive); (vi) physical &/or mental health • **Indigenous health associated with the GBR** • **Commercial fishers' wellbeing** • **Tourism Operators' wellbeing**	value the GBR because it makes them feel better physically and/or mentally (Marshall & Pert 2017). • M-W GBR health has significant influence on community wellbeing. TOs value the area as a place of social commune & economic significance, including social enjoyment, gatherings & ceremonies during times of mourning (GBRMPA 2017f). *Net Free Zones (NFZ)* • Surveys in 2015 & 2016 examined whether rec. fishers' satisfaction & expectations of fishing in NFZs changed following the introduction of NFZs around Mackay, Cairns & Rockhampton in 2015. In 2016, rec fishers in the NFZs were more satisfied with the following activities compared to 2015: o experiencing exciting fights with fish o number of big fish caught o number of fish caught o size of the fish caught o overall fishing in the area. • Keen recreational fishers had the biggest increase in satisfaction—mean satisfaction increased more than 25% from 2015 to 2016 (QDAF, 2017). **Indigenous wellbeing** • Indigenous health & wellbeing is affected by a significant collection of chronic health conditions which can & are being minimized by access to & use of GBR resources (Hill & Lyons, 2014). **Coastal residents' wellbeing** • 1545 surveyed GBR catchment residents found absence of visible rubbish; healthy reef fish, coral cover & mangroves; & iconic marine species, are more important to residents' QoL than benefits from commercial activities in GBR & catchment such as jobs & incomes related to mining, agriculture & commercial fishing sectors (Larson et al 2015). • In 2013, 75% GBR coastal residents were very satisfied with GBR experiences (i.e. rating > 8/10). Greatest +ive influences were visual quality, weather, hospitality/company, habitat quality, & fish number. Greatest -ive influences were number of fish, habitat quality & weather. 80% GBR tourists were very satisfied with GBR experiences (8/10) Highest scores for sightseeing & photography (8.6), GBR seafood (8.5), wildlife watching (8.5), scuba diving (8.4), camping & hiking (8.3) snorkelling (8.2).		

		Tourists' wellbeing • Greatest positive influence on tourists' GBR experience were aesthetics, weather, GBR health, hospitality & wildlife; absence of crowding. Greatest negatives were bad weather & issues associated with tourism operators (e.g. service, cleanliness, cost). In 2013, 74% intern'l & 57% domestic tourists came to the catchment because of the GBR, & rated overall satisfaction with GBR experiences as 8.4/10. (Marshall et al., 2013a). **Commercial fishers' wellbeing** • In 2013, the GBR contributed to quality of life & wellbeing of 87% M-W fishers (Tobin et al., 2014). **Tourism Operators' wellbeing** • In 2013, 76% GBR tourism operators lived in the catchment because of the GBR (Marshall et al., 2013a).		
CV5 Regional services & service infrastructure supporting the interface between the community & GBR	• Energy/water security • Quality of infrastructure • Impacts on infrastructure • Perceptions of access to health, education, aged care & child care • Perceptions of access to roads & public transport	**Energy security** • Av. electricity bill for Qld residents will rise by 3.3% pa; & 4.1% for Qld small businesses (QCA 2017). **Quality of Infrastructure** • Excellent transport infrastructure & accessibility to local & regional markets, via a combination of road, rail (passenger & freight), port connectivity & air links to key markets. Ageing population poses challenges to Mackay's healthcare facilities & services (MRC, 2015). • State Govt has committed $1.2B to bridge & road works in & around Port of Mackay to enhance port's supply chain competitiveness & benefit local communities (NQBP 2016). • Mackay Ring Road - key priority for all levels of govt. & part of Bruce Hwy Upgrade Program, including 11.3 kilometre of two-lane rural highway bypass & 14 new bridges. Jointly funded by Qld & Fed govts. Stage 1 due to commence in 2017; significant planning work underway to improve flood prone routes (QDT& MR 2017). **Impacts on infrastructure** • Bruce Highway north & south & Shute Harbour Road cut for 3 days, isolating major communities from supply, hospital & airport; Lack of highway access exacerbated all other impacts; Whitsunday Coast Airport closed for 6 days; 3 bridges damaged or destroyed; Sea ports closed for 3 days; Shute Harbour destroyed; Substantial road damaged; Iconic community assets damaged - Showground Pavilion; Airlie Foreshore; Airlie Lagoon & Bicentennial Walkaway; Council Library & Chamber buildings; PCYC; Entertainment Centre; Potable	• Solid service infrastructure arrangements in the region enhance links bet. region & tourist population & the GBR, increasing regional resilience. • Major damage & disruption due to STC Debbie. Stakeholder workshops conducted by Dept Transport & Main Roads after STC Debbie revealed a need for resilient roads which can remain open during weather events, & if they cannot, that they can re-open quickly & safety on the region's roads must be a priority(QDT&MR 2017). • All physical & social infrastructure can be severely damaged in extreme weather, leading to adverse impacts on	**3** All infrastructure could be damaged more often by increases in size, extent & duration of extreme weather. Coastal infrastructure has added risk of damage from sea level rise & storm surges.

		water unavailable to Airlie Beach, Cannonvale & Jubilee Pocket (four days x 10,000 residents); Power disrupted to 65,000 premises –95% restored within 16 days (WRC, 2017a). • After 2011 floods infrastructure damage impacted commercial fishers' ability to get fish to market, & tourism operators were affected by damaged infrastructure – e.g. jetties, roads, rail & airports (Gooch et al 2013). **Perceptions of access to health, education, aged care & child care** • 64.6% MIW residents perceive that they have good access c.w. 75%residents in both rural & regional Aust & rural & regional Qld (Uni of Canberra 2017). **Perceptions of access to roads & public transport** • 39.4% MIW residents perceive that they have good access c.w. 50.3% for rural & regional Aust & 53.9% rural & regional Qld (Uni of Canberra 2017).	GBR-dependent communities & industries	
Rating				**16.5**
Maximum for this Cluster				**25**

Cluster Three: Culture and heritage

Status of integrated and diverse culture and heritage associated with the GBR catchment. Cultural and heritage connections promote a sense of place associated with GBR coastal communities, and there is a strong sense of place attachment and identity associated with the community, because of its association with the GBR. This cluster also includes values of significance in accordance with Traditional Owner practices, observances, customs, traditions, beliefs or history. Historic heritage is specifically concerned with the occupation and use of an area since the arrival of European and other migrants. There are 4 major attributes associated with this cluster: natural heritage; Indigenous heritage; Contemporary culture; Historic cultural heritage.

Table 6: Culture and heritage

Attribute Component	Possible Pressure, State & Trend Indicators	Evidence	Conclusions	Proposed Value & Logic
CH1 World Heritage – underpinned by ecosystem health, biodiversity & water quality	• Regional natural assets • Perceptions of the GBR's natural beauty & other world heritage attributes • Impacts on GBR-Wide World Heritage values	**Regional natural assets** • GBRWHA aesthetic values contribute to its OUV & listing as a WH Site under criterion (vii) "contain superlative natural phenomena or areas of exceptional natural beauty & aesthetic importance". Specifically the World Heritage listing states that "The Whitsunday Islands provide a magnificent vista of green vegetated islands and white sandy beaches spread over azure waters" (GBRMPA, 2017f). • WPoM area is a significant presentation area for GBR WH values. Dugong, marine turtles & their habitats as well as corals, seagrasses & mangroves are of significant cultural, spiritual & social importance, especially to TOs. The area is an important calving ground for humpback whales; several species of dolphins inhabit the area, including the protected Australian snubfin dolphin & the Australian humpback dolphin. The area is recognised internationally under JAMBA & CAMBA as an important stopover for migratory seabirds & shorebirds (GBRMPA, 2017f). **Perceptions of natural beauty & other World Heritage attributes** • 92% M-W residents value the GBR because it attracts people from all over the world & 88% value the GBR simply because it exists, even if they don't use or benefit from it (Marshall & Pert 2017). • 94% M-W regional residents agree that the GBR's aesthetic beauty is outstanding & 95% value the GBR because it supports a variety of life, such as fish and corals; 73% M-W residents like	• Assessment & monitoring of OUV & aesthetics is a new field, & methods are being trialled now for application in the future. Majority M-W regional residents agree that the GBR's aesthetic beauty is outstanding & like the colour/clarity of local waterways, but many also feel that local beaches have too much rubbish on them which detracts from their natural beauty. • Climate change is predicted to increase the intensity of extreme weather events, which are significant in driving	**3.5** Exceptionally high based on OUV however the natural heritage is adversely affected by marine debris, industrial development, recent cyclones & other extreme weather events.

		the colour/clarity of water along the beaches in their region, however 83% feel there is too much rubbish on these beaches (Marshall & Pert 2017). **Impacts on GBR-Wide World Heritage values** • > 50 known hot spots for marine debris in WPoM Area; visual & noise impacts from activities such as coastal development, dredging & transient shipping,& large numbers of tourists, all diminish natural scenic values both visually & audibly (GBRMPA 2017f). • STC Debbie caused major damage to Whitsunday Islands & inshore ecosystems & damage to inshore coral reefs. Full impacts not yet known, but Reef health surveys revealed extensive damage to inshore reef systems directly exposed to cyclonic winds, including Manta Ray Bay off Hook Island, Blue Pearl Bay off Hayman Island & reefs off Double Cone Island (HR2RP 2017).	impacts to coastal and marine ecosystems (Waterhouse et al, 2017). • Assessment & monitoring of OUV & aesthetics is a new field, and methods are being trialled now for application in the future. • Increasing human uses may lead to cumulative adverse impacts on the scenic amenity in the WPoM Area.	
CH2 Indigenous (Traditional Owner) heritage	• ID, state & trend of Indigenous heritage values. • TO management of GBR resources including number & strength of (i) TO connections with GBR resources incl. identification, protection & management of Indigenous cultural heritage in sea country; (ii) Partnerships, institutional arrangements & agreements between TOs & all GBR stakeholders; (iii) TO-driven frameworks & participatory monitoring methods	**ID, state & trend of Indigenous heritage values** • Traditional Owners identified cultural & spiritual values of the land & seascape as important in providing them with their sense of Aboriginality (Reef Catchments 2014). • Water has long been a natural resource of significance to M-W TOs, their spirituality & their physical health. From prehistoric to contemporary times saltwater areas & freshwater sites are regarded for their diversity in use & value. This includes language & place names, songlines, storylines, intimate traditional ecological knowledge, social enjoyment, historic travel & trade routes, access & use of coastal fishing places, fish traps, hunting grounds & traditional estates (GBRMPA 2017f). • Areas adjacent to the WPoM Area include evidence of the history of TO occupation & use of islands & surrounding waters including a quarry of international significance, a nationally significant rock art site at Nara Inlet on Hook Island, other rock art sites, middens & stone fish traps (GBRMPA 2017f). • 46% M-W residents agree that the GBR is important for Traditional or Cultural practices; 58% value the GBR because of its rich Traditional Owner heritage (Marshall & Pert 2017).	• There is an increasing capacity of Indigenous land & sea institutions, but much work needs to be done to progress rights & to substantively progress country based planning, strategy development & implementation. • Better supporting Indigenous peoples to document & share TEK is a first step to the bigger challenge of engaging with Indigenous processes of knowing about environmental	**2.5** Strong Traditional Owner use of land & sea country resources remains across the region & formal agreements for managing use have improved dramatically over the past decade but continue to have capacity concerns.

	• Levels of Traditional Owner satisfaction with: (i) Identification, documentation & storage of cultural information; (ii) Traditional Owner led methodologies; (iii) participation in GBR management; (iv) extent to which TEK is identified, maintained & transferred. Levels of TO use & dependency on the GBR	• Traditional Owners have observed impacts on Indigenous cultural integrity & heritage values from rising sea levels (e.g. fish traps in Girringun country are being affected (GBRMPA, 2014a). • GBRMPA is developing an Indigenous Heritage Strategy to improve understanding & protection of GBR Indigenous heritage values (GBRMPA, 2016a). • GBRMPA's FMP manages cultural & Indig. heritage on island national parks & Comm. Islands, including developing heritage management plans to protect significant sites & active maintenance & restoration at some locations (GBRMPA & QG, 2016). **TO management of GBR resources** *(i) TO connections* • TO aspirations for securing rights & managing GBR cultural value have been well defined over the past 20 years since Sea Forum (Dale et al., 2016b). *(ii) Partnerships, arrangements & agreements* • MWTORG has members from Yuwibara, Koinmerburra, Barada Barna, Wiri, Ngaro, Gia & Juru. MWTORG meets regularly with stakeholders & community to improve knowledge of cultural heritage values & NRM issues (Reef Catchments, 2016) • About 8 TUMRAs cover 24.6% of the GBR – i.e. 45,200 km2 - & involve 16 Traditional Owner groups to address issues such as the sustainable take of culturally significant species, & supporting cultural practice in GBR conservation & management. The agreements incorporate traditional & contemporary scientific knowledge for GBR management (GBRMPA, 2016a). • GBRMPA is developing cultural protocols to guide management of Indigenous heritage & is partnering with Traditional Owners to determine how to store, handle & manage Indigenous knowledge appropriately (GBRMPA, 2016a). • GBRMPA has prepared draft guidelines for Traditional Owner heritage impact assessment in the permission system (GBRMPA, 2016a). *(iii) TO-driven frameworks & participatory monitoring methods* • With the MWHR2RP, MWTORG facilitated development of Indigenous cultural heritage for inclusion into the 2015 Report Card. 21 sites were assessed & included shell middens, rock	change (Hill & Lyons, 2014). • Across WPoM area cultural heritage values are unique, dynamic, diverse & living as they are valued by Traditional Owners. The values are inherited from past generations and by maintaining those cultural heritage values today, the ancient responsibility to manage land and sea areas for future generations continues. • Cultural heritage is broad and is expressed through spiritual and cultural affiliations with a site or area and through activities undertaken in accordance with customs and traditions (GBRMPA 2017f).	

		shelters, fish traps, quarries & paintings. (Reef Catchments, 2016). **Traditional Owner satisfaction with GBR management** • Insufficient data currently exists. **TO use & dependency on the GBR** • Insufficient data currently exists.		
CH3 Contemporary culture associated with the GBR	• Place attachment, identity, • GBR as culture – levels of pride, inspiration & personal connection to the GBR • National connections to the GBR	**General regional place attachment** • M-W residents aspire to celebrate diversity & help people understand the value of our cultural influences, & educate people about the special places 'beyond the reef', including nearby agricultural landscapes (Reef Catchments, 2014) *% **disagreement** with: 'I like the environment & surrounds I live in':* • 12.2% MIW residents disagree c.w. 4.2% for rural & regional Aust & 5.3% rural & regional Qld (Uni of Canberra 2017). **GBR as 'culture'** • 60% M-W residents see the GBR as an important part of their culture; 97% love living beside the GBR; 96% are proud the GBR is a World Heritage Area; 74% agree that the GBR is part of their identity; & 53% value the GBR because it is spiritually important to them (Marshall & Pert 2017). • On average, GBR catchment residents had lived in the catchment for 20.7 years. 66% indicated there are "not many other places better than the GBR for recreation activities they enjoy". 94% "feel proud that the GBR is a WHA". 64% believe "the GBR is part of my identity". 41% live in the catchment because of the GBR. Strongest GBR values for residents were: aesthetic beauty (9.1/10); biodiversity 9.1; WH status, 9.0; economic values 8.9; scientific & education 8.5; & lifestyle 8.5 (Marshall et al., 2013a). **National Connections to the GBR** • In 2013, 93% Australians described the GBR as inspiring, 46% believed it is the most inspiring natural icon in Australia; 82% had positive associations with the GBR; 84% were proud the GBR is a WHA; 64% saw the GBR as part of their identity (Marshall et al., 2013a).	• People in this region overwhelmingly love living beside the GBR & are extremely proud that the GBR is a WHA. • National residents resoundingly agree that the GBR is inspiring	**4** There is a high level of contemporary cultural integrity in relation to the GBR.
CH4 Historic maritime heritage (since European settlement)	Identification, protection & management of historic heritage in GBR environments	**Whitsunday Plan of Management (WPoM)** • At least 20 shipwrecks in the WPoM area are >75 years old & protected by the Historic Shipwrecks Act 1976. *SS Valetta* is the only one with a known location (GBRMPA, 2017f). • Dent Island Lightstation is a part of the Area's scenic appeal & recognised on the Comm. Heritage List, providing evidence of	• Key historical heritage assets tend to be considered & managed by a disparate range of institutions & agencies (e.g. historical	**3** While there is a strong historical heritage asset across the GBR coast, & sites within the catchment are well managed, the *maritime* components

	• Cultural significance of historic heritage values for the GBR.	the historical development of maritime navigation aids in Australia. It requires ongoing maintenance (GBRMPA, 2017f). • WW II plane wrecks are likely to have significant archaeological information about wartime activities (& may include human remains) (GBRMPA, 2017f). • Places of historic significance in the WPoM Area are fragile & irreplaceable; there is a lack of knowledge about the location of heritage sites; condition of known historic shipwrecks is poorly understood (GBRMPA, 2017f). • Historic shipwrecks &World War II sites in the WPoM Area are vulnerable to dredging, pipe & cable laying & marina development; *GBR-wide historic maritime history* • Across the GBR > 800 historic shipwrecks, but only ~ 40 located & ~ 20 positively identified; conservation management plans exist for 6 under the Historic Shipwreck Act 1976 (GBRMPA, 2017c; P. Illidge, pers. comm). • Historic sites are under pressure from natural threats (cyclones, sediment erosion), vessel anchoring, & pilfering (GBRMPA, 2017f; P. Illidge, pers. comm). • Obligations under Reef 2050 Plan e.g. Action HA 11 not being met (P. Illidge, pers. comm). • GBRMPA is developing a Heritage Strategy to better understand & protect GBR Indigenous & historic heritage values (GBRMPA, 2016a). • GBRMPA has prepared draft guidelines for Historic heritage impact assessment in the permission system (GBRMPA, 2017d, 2017e) • When sea level was much lower, Indigenous people walked across the land (now the GBR) leaving evidence of their passing. Many archaeological sites exist, both under sea & on islands, but knowledge is scattered & not well documented (P. Illidge, pers. com.)	societies, QPWS, Indigenous Land & Sea Institutions, etc).	remain poorly defined, planned & managed. This value is higher than other GBR catchment regions due to WPoM.
Rating				**13**
Maximum for this Attribute				**20**

Cluster Four: Economic values

This includes the monetary advantages that people derive directly or indirectly from a healthy and well-managed Great Barrier Reef. Fundamental to this cluster is the premise that economic activities within the Great Barrier Reef World Heritage Area and its catchments are ecologically sustainable. GBR-dependent industries rely on a healthy GBR and include GBR-based commercial fishing, tourism, recreation, research and Traditional Owner use. These industries generate income and employment for thousands of people in coastal communities near the Great Barrier Reef, and beyond. The GBR tourism industry generates and collects the Environmental Management Charge which directly benefits GBR Marine Park management, which has flow on benefits to the broader community and society. GBR-associated industries include industries that may impact on the GBR, but are not economically dependent on GBR health e.g. shipping, catchment industries such as agriculture, urban development and port development.

Table 7: Economic values

Attribute Component	Possible Pressure, State & Trend Indicators	Evidence	Conclusions	Proposed Value and Logic
EV1 Size & diversity of regional economic growth	• Regional Product (GRP) • Core industries	**Gross Regional Product** • M-W region contributes bet $16B-$17B p.a. to national economy (GWA 2017; WRC 2017b). • ECTF is the largest fishery in the region targeting mostly prawns, & also bugs, squid & scallops. Other commercial species harvested are shark, crab, mackerel, mullet & barramundi (ABARES 2017). • Mackay region has a diverse ag. sector. In 2014-15 the most important commodities based on GRP were cattle & calves ($485 million); sugarcane ($354 million) & sorghum ($64 million). In 2014–15 Mackay region accounted for 53% Qld's capsicum production (ABARES 2017). • M-W has experienced population & economic fluctuations fuelled mainly by global demand for mining resources beyond the region. In the Whitsundays, tourism is the largest sector, with an emphasis on lifestyle & high quality food production (QDT&MR 2017).	• Workshops with stakeholders held by Qld Dept of Transport & Main Roads revealed the need to diversify the economy to reduce exposure to cyclical nature of the resources sector (QDT&MR 2017). Mackay is heavily dependent on servicing the mining & agriculture industries; both experience cyclical trends in line with global commodity markets (MRC 2015).	**3.5** Economic uncertainty in the region remains high due to high dependence on resources sector and agriculture.
EV2 Economic viability of *Reef-*	• Ports & shipping • Agriculture	**Ports & shipping** • Hay Point: 1,133 bulk carriers in 2015-16, up from 1087 in 2014-15; Mackay Port had 164 ships in 2015-16 c.w. 173 in 2014-15 (NQBP, 2016). • BHP BMA completed its Hay Point HPX-3 expansion project in 2015 to increase coal export capacity. Overall, total coal	• Port expansion needs to be done in ways that do not diminish the GBR's values. • Primary industries are vulnerable to expected decreases in rainfall, increased evaporation rates &	**3** Potential exists to refocus economic

associated industries [2]		exports for 2015-16 totalled 142.8 million tonnes – only 0.6% below last year (NQBP 2016). • At Port of Mackay, sugar exports were up from last year by 6% and fuel up 0.9%. NQBP is committed to grow the Port of Mackay (NQBP 2016). **Regional Agriculture** • Due to STC Debbie, Whitsunday's cane industry sustained $250M damage; other horticultural loss of $100M; lost plantings equating to delay in production & employment (WRC, 2017a). • 740 businesses reported as unable to operate (power, water, supply chain) for at least six & up to 15 days due to outages. • Subsequent need to reduce staff numbers, impacting employment nos. (WRC, 2017a). • Sugarcane farming is the dominant intensive agricultural land use (18% of land area) & produces 32% regional particulate nitrogen load, 65% DIN load, 40% filterable reactive P load, & 26% suspended sediment load. Cane farming produces most filterable reactive phosphorus, ametryn, atrazine, diuron, & hexazinone. Grazing & forestry account for 54% of land area & produce about 27% total regional particulate nitrogen & DIN loads, 41% part. phosphorus & filterable reactive phosphorus loads, & 53% regional sediment load (Folkers et al. 2014).	increases in extreme weather events (State of Qld 2011). • While agricultural production continues to grow, water availability & seasonal & storage proposals are expensive & may have viability limits. • There are strong regional dependencies on the boom and bust nature of commodity cycles affecting the region.	diversity through new industries that link to GBR-related lifestyle values Continued growth & diversification in agriculture are possible but needs to be neutral or positive with respect to GBR outcomes. While agricultural production continues to grow, water availability & seasonal & storage proposals are expensive & may have limits.
EV3 Economic viability of *Reef-dependent industries*[3]	• Vulnerability of GBR-dependent industries • Adaptive capacity of GBR-dependent industries • Economic viability of GBR-tourism • Economic viability of GBR-commercial fishing	**Vulnerability & adaptive capacity of GBR dependent industries** • 96% MW residents feel the GBR is a valuable asset for the regional economy (Marshall & Pert 2017).however, GBR tourism, recreation & fishing industries remain specifically vulnerable to the impacts of the Global Financial Crisis (GFC) & repeated large weather events (Marshall et al., 2013a; 2013b). In particular, fishers & tourism operators are sensitive to changes in GBR condition (Marshall et al., 2013a; 2013b). • Extreme events may generate severe & long-lasting reductions in visitation. Further, media portrayal of extreme	• Although most residents (96%) agree that the GBR is a valuable asset for the regional economy, it's health is highly vulnerable to extreme weather events, and they ways in which they are reported in the media, resulting in uncertainty in GBR tourism & fisheries management.	**3** Repeated extreme weather events & coral bleaching means many corals do not have time to recover & even pristine reefs are not immune.

[2] *Reef-associated industries* are those which do not depend on the health of the GBR but which may have an impact on GBR health (e.g. urban industries in catchment cities & towns; agricultural industries in GBR catchments; ports & shipping).
[3] *Reef-dependent industries/activities* are those which depend on healthy GBR ecosystems for their prosperity– e.g commercial fishing, marine tourism, recreation, GBR-related research Traditional Owner use of GBR resources.

		weather events will negatively influence visitor perceptions & may exacerbate the negative economic consequences on the tourism industry (Stoeckl et al., 2014). • STC Debbie caused major damage to Whitsunday Islands & inshore ecosystems; damage to infrastructure, including island resorts, vessels & boat ramps, & damage to inshore coral reefs visited by tourist operators. Full impacts not yet known, but Reef health surveys revealed extensive damage to inshore reef systems directly exposed to cyclonic winds, including Manta Ray Bay off Hook Island, Blue Pearl Bay off Hayman Island & reefs off Double Cone Island (HR2RP 2017). • GBR tourism operators & commercial fishers with comparatively smaller businesses, higher levels of occupational identity, place attachment, formal networks, & strategic approaches have higher levels of adaptive capacity (i.e. sensitivity to change may be offset by adaptive capacity & improved skills levels) (Marshall et al., 2013a). • Need to re-skill & provide assistance to develop business plans to help the commercial fishing industry cope with change & be resilient (Sutton, Lédée, Tobin, & De Freitas, 2010) **Economic viability** *Tourism* • M-W tourism contributed $633M to national economy in 2015–2016; cw $5.6B for the whole GBR (DAE 2017). • STC Debbie Tourism disruption- av. 3 week's trade lost; 2 of 3 iconic island resorts inoperable for 12 months; Regional brand damage; market uncertainty; substantial damage to tourism infrastructure & national parks (WRC, 2017a). *Fishing* • GBR Commercial fishers from M-W added $10M to GVP in 2011-12 - 5% of the total GBR com fishing GVP (DAE, 2017) • M-W has 104/1060 GBR commercial fishing licences – 60 are active; 83% are owner-operators & 38% travel > 100km from port. Among M-W commercial fishers' household financial dependency on fishing is high. It is an aging industry. Most are owner-operators rather than 'investors', & operate in one fishery type (Tobin, 2014). • Between 2001 & 2016 fishing decreased in value across the whole GBR by 46% (i.e. from $190M to $104M). Physical production dropped 46% (15,341 tonnes to 8,259 tonnes). Licence numbers & fishing effort also decreased, by 52% & 45% respectively (ABS, 2017).	• Value of commercial fishing has increased in recent years, against the trend for other GBR sections.	

EV4 Inclusive-ness & economic fairness/ equity	• Income – personal & household • Opportunities for GBR Traditional Owners • Equity between industries/activities	**Regional Income** • 12.9% of M-W Region residents are in the most disadvantaged quintile (QGSO 2017a). • In 2016, median personal income of M-W residents was $36,134 pa, ($34,320 state-wide). Within the region, Isaac had the highest median total personal income - $53,560pa. In 2016, 26.4% < $20,800 p.a. (28% for Qld); 8.5%> $104,000 p.a. (7.1% Qld) (QGSO 2017a). **Opportunities for GBR Traditional Owners** • Aboriginal participation in GBR tourism is very low, as measured by ads in local tourism trade literature (DAE, 2017). **Equity between industries/activities** *Harvest labour* • 3 types harvest workers – ○ itinerant Australians – repeat workers; award rates ○ backpackers – rarely repeat workers; race against time to record 88 days' work in one year to gain visa renewal; most need multiple jobs to reach 88 day target. More vulnerable than Australians - lack of labour market knowledge exposes them to greater exploitation – below award conditions; ○ undocumented workers – more like bonded servitude – most vulnerable - liability to deportation, depend on a single contractor, poor language skills, exclusion from unions & regulatory protection, & social isolation. (Underhill & Rimmer 2016; laQuinto 2017). • Backpackers - 25% Australia's ag. workforce & up to 85% for some seasonal harvests - few career paths for permanent residents; sudden decrease in backpackers could adversely affect ag prod'n in GBR catchment & elsewhere *(*laQuinto 2017). *Reef-dependent industries/activities* • Only 41% commercial fishers in M-W believe they have fair access to GBR resources (Tobin et al, 2014). Commercial fishers are under increased pressure for GBR access from recreational fishers, conservation based closures, & onshore activities (e.g. coastal development) that impact where vessels may operate (Pascoe et al., 2016). • QDAF's 2014 harvest strategy allows coral trout stock recovery, but reduces ann. commercial catch. Catch taken by recreational fishers may hinder stock recovery (Tobin et al., 2016).	• Significant economic disparities remain for younger & Indigenous peoples. • Regional brain drain of high-skilled high-income professionals continues to drive reduced disposable income/ expertise. • Increased insurance premiums may exacerbate financial strain & inequity on industry & residents & increase economic vulnerability & inequity.	**3** Ongoing resource decline & regional-capital city inequities could drive declining equity. GBR-dependent industries generally have comparable equity with other industries; although compensation for extreme weather events between terrestrial & marine industries (e.g. fishing & agriculture) is not equitable.

EV5 Workforce participation & employment	• Regional employment participation rates & trends • GBR- related employment	• In 2011, 10.3% people in M-W were employed in construction; 10.3% in mining. • Regional unemployment in March 2017 was 6.4% c.w. 6.2% across Qld (QGSO 2017a) • Youth & indigenous sectors are strongly marginalised in employment arrangements **GBR- Related Employment.** • In M-W in 2015-16 there were 46 people directly employed in GBR commercial fishing & 7052 employed in tourism (DAE, 2017).	• Transient 'backpacker' populations skew workforce participation figures & creates problems in building a diversified & stable workforce in GBR related industries. • Employment in resources, construction, ag, GBR-based fishing & tourism is vulnerable to impacts of global economic shifts & climatic events. • Cyclical unemployment rate & some degree of redeployment of workforce in response to major events over time.	**3** The regional economy has a very strong workforce exposure to volatility in the resources industry & a very high dependence on backpackers. The region also remains strongly influenced by tourism volatility.
EV6 Economic confidence in the Region	• Regional economic confidence • Confidence in GBR industries •	**Regional Economic Confidence** • Mackay median house price: $350000 in 2009; up to $400000 in 2014 & big drop to $258000 in 2017 (REA Group Ltd 2017a). • Airlie Beach median house price: $685000 in 2012; down to $630000 in 2016; & up to $648000 in 2017 (REA Group Ltd 2017b). • Proserpine median house price: $315000 in 2009; $360000 in 2010; $323000 in 2013 & down to $285000 in 2017 (REA Group Ltd 2017c). • Common held perceptions about very high regional housing prices, supply issues & high costs of doing business, which arose during the resource sector peak. This is an outdated perception as these factors have all returned to normal levels (MRC, 2015). • Mackay will likely continue to grow, but several smaller regional towns are experiencing population declines, leading to decreased demand for services & facilities, & resulting in a smaller workforce in these areas (MRC 2015). • STC Debbie destroyed agricultural production, severely disrupted tourism operations, caused widespread property damage, & disrupted power & telecommunications to small	• Workshops with stakeholders held by Qld Dept of Transport & Main Roads revealed that population reduction due to contraction in the resources sector is affecting small businesses in the region (QDT&MR 2017). • Region has shown resilience as it transitions from mining boom & recovers from STC Debbie (Qld Govt 2017b). • Attracting skilled workers to Mackay is needed to help support expansion of key businesses & industries (MRC 2015). • Reef-dependent industries are optimistic about the future of the GBR, but this does not always extend to confidence in the viability of their own businesses.	**3.5** Future economic confidence currently rides on uncertainty in the resources sector and recovery from STC Debbie. Emerging strategies are looking to stabilise and grow the economy.

		businesses, affecting economic confidence in the region in the short-term (Qld Govt 2017a). **Confidence in GBR-Tourism** • 26% GBR tourism operators think "the GBR areas that my operation uses are not in great condition". 24% are not optimistic about their business; 43% are "confident things will turn out well for them, regardless of future events; 39% are "uncertain how to plan for changes in the GBR" but 59% have planned for their financial security (Marshall et al. 2013a). **Confidence in GBR-Fisheries** • 88% M-W Region GBR comm. fishers (c.w 71% whole GBR) are optimistic about GBR's future, but only 52% are optimistic about the future of their business (Tobin, 2014). 5.4/10 believe things will turn out well for them in future; 6.2/10 are uncertain of how to plan for change. Many plan for their financial security (6.7) & are keen to learn how to better prepare for change (6.7) (Marshall et al., 2013a).		
Rating				**19**
Maximum for this Cluster				**30**

Cluster Five: Governance

Table 8: Governance

Attribute Component	Possible Pressure, State & Trend Indicators	Evidence	Conclusions	Proposed Value & Logic
G1 Strategic focus of governance system.	• No./ type of opportunities for improved Reef 2050 Plan Governance • No./ severity of system-wide problems for delivery of key Reef 2050 Plan targets.	**No./ type of opportunities for improved Reef 2050 Plan** • The Reef 2050 Plan represents the one fully integrated, bilaterally agreed strategy concerning the future health of the GBR. The Reef 2050 Plan exists in a first phase development form with clear (but not yet highly robust) targets but also with more limited strategy development (Commonwealth of Australia, 2015). • This Plan includes ongoing management of the GBR World Heritage Values & the strategic improvement of water quality flowing into the Reef lagoon. **No./ severity of system-wide problems for delivery of key Reef 2050 Plan targets** • Basic core delivery mechanisms, particularly at catchment scale are operational & in place across most GBR catchments (e.g. Regional NRM, WQIPs, Land Use Plans, PMPs/BMPs etc). (Dale et al, 2016c) • Strong foundations exist (via the RIMReP framework) & are developing for monitoring GBR health & water quality. Human dimension monitoring arrangements are just emerging. Outlook reporting presents a five year formalised opportunity for review (Gooch et al 2017; Dale et al, 2016c).	• Clear strategic planning & coordination frameworks for planning & action in relation to management of the Marine Park & water quality improvement are emerging at GBR, regional level, catchment & property scales. • Frameworks for monitoring, evaluation & review are emerging in the RIMReP & outlook context. These arrangements are increasingly looking towards inclusion of the human dimensions of the GBR asset. There is a lack, however, of a clear future strategic land use framework (& associated focus on management actions.	**3.5** Basic GBR-wide & bilateral strategic planning framework is in place via the *Reef 2050 Plan* & possible implementation strategies & institutional arrangements exist at all required scales for delivery.
G2 Connectivity within & between key decision making institutions & sectors.	• No./ type governance subdomains (or policy areas) that counteract Reef 2050 Plan targets/action • Status of partnerships, inter-governmental arrangements • Levels of transparency, ownership, accountability, responsiveness	**No./ type governance subdomains (or policy areas) that counteract Reef 2050 Plan targets/actions** • At least 5 non-GBR governance subdomains have been identified as negatively impacting of GBR health (in broader social, economic & environmental terms) (Dale et al, 2016c) **Status of partnerships, inter-governmental arrangements** - Refer back to CH2 • MRC is a Reef Guardian Council and invests money & resources into environmental actions to benefit the GBR • The commissioning of new coal mines such as that planned for the Galilee Basin, & the pursuit of polluting & expensive “clean coal” projects & new gas plants, is completely at odds with protecting the GBR & other reefs globally (Hughes et al., 2017). • Commercial fishers are under increased pressure for GBR access from recreational fishers, conservation based closures, & onshore	• There is a significant ongoing likelihood of decline in GBR health as a result of poor connectivity among key governance subdomains affecting GBR outcomes (e.g. greenhouse gas abatement). • Effective partnerships such as those forged through the Reef Guardians need to be strengthened & extended to involve more local residents & Traditional Owners. • Governance of fishing is improving.	**2.5**

	• Sectoral/community contributions to decision-making • Inter-generational equity in Reef-related decision-making • Intra-generational equity in Reef-related decision-making	activities (e.g. coastal development) that impact where vessels may operate (Pascoe et al., 2016). **Levels of transparency, ownership, accountability, responsiveness** • Connectivity between the Reef 2050 Plan governance subdomain & other key subdomains negatively influencing GBR outcomes is poor (most notably the climate change & greenhouse gas abatement subdomain (Dale et al., 2016c). **Mackay-Whitsunday Specific Context** • Focus groups of M-W residents revealed dissatisfaction due to weak governance arrangements leading to poor land management, increased erosion & invasive species. Traditional Owners identified lack of consultation as a key issue, with their views not represented adequately at all levels of decision making (Reef Catchments 2014). • Since NFZ from St Helens to Cape Hilsborough in Nov. 2015, catch rates for rec. fishers > 6.4% from survey 1-2 & 48.3 from survey 2-3. Kept catch rate > 112.2% from survey 1-2 & 32.6% from survey 2-3. Time taken to catch a legal fish fell from 7.62 hours/fish in survey 1 to 4.55 hours/ fish in survey 2, to 2.48 hours/fish in survey 3. **Inter-generational equity in Reef-related decision-making** • Only 37% M-W residents feel that future generations have been adequately considered in GBR management (Marshall & Pert 2017) **Intra-generational equity in Reef-related decision-making** • 78% M-W regional residents agree that they have fair access to the GBR compared to other user groups (Marshall & Pert 2017); while only 41% commercial fishers believe they have fair access to GBR resources (Tobin et al., 2014).		
G3 Adaptive governance capacity of key decision making institutions & sectors.	• Levels of integrated strategy development & delivery design • Support for management • Confidence in management • Sectoral/community contributions to decision-making •	**Levels of integrated strategy development & delivery design** • Within the context of the Reef 2050 Plan, capacity in integrated strategy development & delivery design in both federal & state policy building institutions is currently limited. • Required catchment scale institutions to improve water quality & reef protection & management action exist but face unstable statutory recognition with respect to these role & lack stable resourcing (Dale et al 2016c) **Support for management** • 69% M-W regional residents support current rules and regulations that affect GBR access & use; 69% support rules & regulations that affect access & use of local freshwater areas (Marshall & Pert 2017). **Confidence in management** • Only 26% M-W residents think enough is being done to effectively manage the GBR & 45% are confident that the GBR is well managed; 46% are confident that local freshwater areas are well managed (Marshall & Pert 2017).	• Policy making capacities limited in regard to designing effective delivery systems, risking implementation failure. • There is little confidence in GBR management by local residents, who generally feel that not enough is being done to protect the GBR.	**2.5** All required institutional actors play an important role in GBR governance, but capacities are limited across government, industry, community & Indigenous sectors.

		Sectoral/community contributions to decision-making • Traditional Owners are routinely marginalised in development of policy & delivery systems (Dale et al, 2016a). • 56% M-W regional residents feel like they can contribute to GBR management (Marshall & Pert 2017).		
G4 Adaptive use & management of integrated knowledge sets.	• Availability of integrated knowledge sets • Use of integrated knowledge sets in decision-making • Management of integrated knowledge sets.	• Despite some progress, recognition of Traditional Knowledge, as opposed to working within a western scientific framework needs to be embedded in GBR management agencies (Grant, 2012). • Core biophysical knowledges concerning marine & catchment science are strong. • Across the GBR, traditional & historical knowledge sets remain strong but in decline. • Decision support models & prioritisation tools are relatively advanced in the GBR. • Funding through Reef & Rainforest Research Centre (RRRC) has returned to regional design & implementation but remains poorly linked to state-based scientific investment & effort (Dale et al, 2016c). **Mackay-Whitsunday Specific Context** • Immediate actions taken in partnership with tourism operators, community, GBRMPA & QPWS following tropical cyclone Debbie included approval for tourism industry to assist QPWS with flipping corals & returning large displaced bommies back to the water; mapping/ consolidating information sources to understand extent of damage & identify surviving coral areas; training volunteers to complete rapid monitoring surveys with in-kind assistance of industry; activation of the Marine Tourism Contingency Plan to allow tourism operators to temporarily relocate activities; participation in local Tourism Recovery Working Group to ensure the industry's views about priority actions are heard (GBRMPA, 2017g).	• Strong biophysical science capacity & decision support tools exist in both the marine & catchment space. • Limited social & economic knowledge is levered within GBR decision making systems. • Declining health in historical & traditional knowledge sets, in part because of resource limitations facing Traditional Owner land & sea institutions. • Multi-sectoral response plans activated in the wake of STC Debbie using local and scientific knowledge.	**3.5** Biophysical knowledges are generally strong across the marine & catchment space, though social & economic sciences are not developed enough to deliver truly integrated knowledge to make sound decisions.
Rating				**12**
Maximum for this Attribute				**20**

REFERENCES

ABARES (Australian Bureau of Agricultural and Resource Economics and Sciences) (2017). *About my region: Mackay Region.* Retrieved from: http://www.agriculture.gov.au/abares/research-topics/aboutmyregion/qld-mackay

ABC (Australian Broadcasting Commission) (2017). *Coral bleaching: Extreme heat pushes parts of the Great Barrier Reef beyond recovery*. Retrieved from http://www.abc.net.au/news/science/2017-03-16/coral-graveyards-grow-as-bleaching-becomes-the-new-normal/8353030

ABS (Australian Bureau of Statistics) (2015). *Information paper: An experimental ecosystem account for the Great Barrier Reef Region, 2015* (cat. no. 4680.0.55.001). Canberra: ABS. Retrieved from http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/4680.0.55.001Main%20Features202015?opendocument&tabname=Summary&prodno=4680.0.55.001&issue=2015&num=&view=.

ABS (Australian Bureau of Statistics) (2016) Australian Bureau of Statistics 2016. *Australian Statistical Geography Standard (ASGS): Volume 3 - Non ABS Structures, July 2016.* Retrieved http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/1270.0.55.003~July%202016~Main%20Features~Natural%20Resource%20Management%20Regions%20 (NRMR)~11

ABS (Australian Bureau of Statistics). (2017). *ABS Census Data.* Retrieved: http://www.abs.gov.au/websitedbs/D3310114.nsf/Home/Census?opendocument&ref=topBar

Australian Government (2016) *North Queensland home insurance*. Retrieved from: http://nqhomeinsurance.gov.au/

Ban, N., T. Davies, S. Aguilera, C. Brooks, M. Cox, G. Epsteine, L. Evans, S. Maxwell, M. Nenadovich. 2017. Social and ecological effectiveness of large marine protected areas *Global Environmental Change*. 43: 82–91.

Beard, J., Tomaska, N., Earnest, A., Summerhayes, R., & Morgan, G. (2009). Influence of socioeconomic and cultural factors on rural health. *Australian Journal of Rural Health, 17*(1), 10-15. doi:10.1111/j.1440-1584.2008.01030.x

Berkes F. & C. Folke, eds. 1998. *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience*. Cambridge, UK: Cambridge Univ. Press.

Binney, J. (2015) Reviewing prioritisation frameworks in Great Barrier Reef catchments. Phase 1: Draft Report for the Queensland Department of Environment and Heritage Protection. MainStream Economics and Policy, Brisbane.

Bishop, R. 2014. *Reef Facts TNS Research Report*. Brisbane: Department of Environment and Heritage Protection.

Brodie, J. and J. Waterhouse. 2012. A critical review of environmental management of the 'not so Great' Barrier Reef. *Estuarine, Coastal and Shelf Science* 104-105: 1-22.

BITRE (Bureau of Infrastructure, Transport and Regional Economics) (2011) *Northern Australia statistical compendium 2011 update* Canberra ACT.

BTRE (Bureau of Transport and Regional Economics) (2005). Focus on Regions No. 4 Social Capital. Canberra: Bureau of Transport and Regional Economics

Christie, P., McCay, B. J., Miller, M. L., Lowe, C., White, A. T., Stoffle, R., et al. 2003. Toward developing a complete understanding: a social science research agenda for marine protected areas. Fisheries 28, 22–26.

Cinner, J. and D. Gilbert 2011. The Human Dimensions of Coastal and Marine Ecosystems in the Western Indian Ocean, Coastal Management, 39:4, 351-357

City Futures Research Centre (CFRC) (2017) *Rental Vulnerability Index* Retrieved from: https://cityfutures.be.unsw.edu.au/cityviz/rental-vulnerability-index/

Commonwealth of Australia. (2014). *Management of the Great Barrier Reef. Report to The Senate Environment and Communications References Committee*. Canberra: Senate Printing Unit, Parliament House. Retrieved from http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Environment_and_Communications/Great_Barrier_Reef/Report

Commonwealth of Australia. (2015). *Reef 2050 long-term sustainability plan*. Canberra: Department of the Environment and Great Barrier Reef Marine Park Authority. Retrieved from http://www.environment.gov.au/marine/gbr/publications/reef-2050-long-term-sustainability-plan

Commonwealth of Australia. (2016). *Reef 2050 Plan—Update on Progress, Commonwealth of Australia 2016.*

Commonwealth of Australia & Queensland Government (CoA & QG) (2016) *GBR Report Card 2016 Reef Water Quality Protection Plan*. Retrieved from: http://www.reefplan.qld.gov.au/measuring-success/report-cards/2016/assets/report-card-2016-detailed-results.pdf

Commonwealth of Australia (2017). *Progress in Australian Regions Yearbook 2017.* Department of Infrastructure and Development, Bureau of Transport, Infrastructure and Regional Economics. Retrieved from: https://bitre.gov.au/publications/2017/files/00_REGIONS_YEARBOOK.pdf

Community and Regional Resilience Institute (CARRI) 2013. Definitions of community resilience: an analysis. Retrieved from http://www.resilientus.org/wp-content/uploads/2013/08/definitions-of-community-resilience.pdf

Context (2013) *Defining the aesthetic values of the Great Barrier Reef.* Retrieved from: http://www.environment.gov.au/resource/defining-aesthetic-values-great-barrier-reef-world-heritage-area-february-2013

Dale, A. P., George, M., Hill, R., & Fraser, D. (2016a). *Traditional Owners and Sea Country in the southern Great Barrier Reef - Which way forward?* Cairns: Reef and Rainforest Research Centre Ltd. Retrieved from http://nesptropical.edu.au/wp-content/uploads/2016/05/NESP-TWQ-3.9-FINAL-REPORT.pdf

Dale, A. P., Vella, K., Potts, R., Voyce, B., Stevenson, B., Cottrell, A., . . . Pert, P. (2016c). Applying social resilience concepts and indicators to support climate adaptation in tropical North Queensland, Australia. In J. Knieling (Ed.), *Climate adaptation governance in cities and regions: Theoretical fundamentals and practical evidence* (pp. 21-44). Chichester, UK: Wiley.

Dale, A. P., Vella, K., Pressey, R. L., Brodie, J., Gooch, M., Potts, R., & Eberhard, R. (2016b). Risk analysis of the governance system affecting outcomes in the Great Barrier Reef. *Journal of Environmental Management, 183*, 712-721. doi:10.1016/j.jenvman.2016.09.013

De'ath, G., K.Fabricius, H. Sweatman and M. Puotinen. 2012. The 27–year decline of coral cover on the Great Barrier Reef and its causes. *Proc Natl Acad Sci* 109(44): 17995–17999. Published online 2012 Oct 1. doi: 10.1073/pnas.1208909109

Deloitte Access Economics (DAE) (2017).*Valuing the Great Barrier Reef.* Draft report prepared for the Great Barrier Reef Foundation.

Deloitte Access Economics.(DAE) (2013). *Economic contribution of the Great Barrier Reef*. Retrieved from http://www.gbrmpa.gov.au/__data/assets/pdf_file/0006/66417/Economic-contribution-of-the-Great-Barrier-Reef-2013.pdf

Díaz, S., Demissew, S., Carabias, J., Joly, C., Lonsdale, M., Ash, N., . . . Zlatanova, D. (2015). The IPBES conceptual framework — connecting nature and people. *Current Opinion in Environmental Sustainability, 14*, 1-16. doi:10.1016/j.cosust.2014.11.00

Eco Logical Australia and Adaptive Strategies 2016. *Mackay-Whitsunday Stewardship Assessment – 2015-16.* Prepared for the Mackay-Whitsunday Healthy Rivers to Reef Partnership.'

Edgar G.J., G. Russ and R. Babcock. 2007. Chapter 19: Marine protected areas. pp 534-565 In *Marine Ecology* Eds S.D. Connell and B.M. Gillanders. Oxford University Press. ISBN: 0195553020.

Fitzroy Partnership for River Health. (2015). *Fitzroy Basin report card 2014-2015*. Retrieved from http://riverhealth.org.au/report_card/ehi/

Folkers, A., Rohde K., Delaney, K. and Flett, I. (2014). *Mackay Whitsunday Water Quality Improvement Plan 2014-2021.* Retrieved from: http://reefcatchments.com.au/files/2015/06/WATER-QUALITY-IMPROVEMENT-PLAN-MACKAY-WHITSUNDAY-ISAAC-2014-2021_DRAFT.pdf

Gladstone Healthy Harbour Partnership. (2016). *Gladstone Harbour report card 2016*. Retrieved from http://ghhp.org.au/report-cards/2016

Gooch, M. (2016). *Key Literature Reviewed for Repositioning Project*. Unpublished literature review prepared for the Great Barrier Reef Marine Park Authority.

Grant, C. (2012). Indigenous people and World Heritage: The benefits, opportunities and challenges. In P. Figgis, A. Leverington, R. Mackay, A. Maclean, & P. Valentine (Eds.), *Keeping the outstanding exceptional: The future of World Heritage in Australia* (pp. 20-29). Sydney: Australian Committee for IUCN. Retrieved from http://aciucn.org.au/wp-content/uploads/2015/09/06_Grant.pdf

Great Barrier Reef Marine Park Authority (GBRMPA). (2005). Heritage Strategy for the Great Barrier Reef Marine Park. Retrieved from: http://www.gbrmpa.gov.au/__data/assets/pdf_file/0010/3403/GBRMPA_HeritageStrategy.pdf

Great Barrier Reef Marine Park Authority (GBRMPA). (2011). *Extreme weather and the Great Barrier Reef*. Townsville: GBRMPA. Retrieved from http://www.gbrmpa.gov.au/__data/assets/pdf_file/0016/14371/GBRMPA-Extreme-weather-report-Final-R3b-LowRes.pdf

Great Barrier Reef Marine Park Authority (GBRMPA). (2014a). *Great Barrier Reef region strategic assessment: Strategic assessment report*. Townsville: GBRMPA. Retrieved from http://elibrary.gbrmpa.gov.au/jspui/handle/11017/2861

Great Barrier Reef Marine Park Authority (GBRMPA). (2014b). *Great Barrier Reef outlook report 2014*. Townsville: Great Barrier Reef Marine Park Authority. Retrieved from http://www.gbrmpa.gov.au/managing-the-reef/great-barrier-reef-outlook-report

Great Barrier Reef Marine Park Authority GBRMPA (2016a) *Guidelines:Traditional Owner heritage impact assessment in the permission system* Unpublished draft

Great Barrier Reef Marine Park Authority (GBRMPA). (2016b). *Great Barrier Reef Marine Park Authority annual Report 2015–16.* Townsville: GBRMPA. Retrieved from http://elibrary.gbrmpa.gov.au/jspui/handle/11017/3059

Great Barrier Reef Marine Park Authority (GBRMPA). (2016c). *Cairns Local Marine Advisory Committee communique November 2016*. Retrieved from http://www.gbrmpa.gov.au/about-us/local-marine-advisory-committees/cairns/cairns-communique

Great Barrier Reef Marine Park Authority (GBRMPA). (2016d). *Reef Guardian Councils milestone report: Summaries 2014–15*. Retrieved from http://elibrary.gbrmpa.gov.au/jspui/bitstream/11017/3026/1/Reef-Guardian-Council-Milestone-Report-Summaries-2014-15.pdf

Great Barrier Reef Marine Park Authority GBRMPA (2017a) *Guidelines: social impact assessment in the permission system.* Unpublished draft

Great Barrier Reef Marine Park Authority (GBRMPA). (2017b). *Guidelines: Historic heritage - assessment in the permission system.* Unpublished draft

Great Barrier Reef Marine Park Authority (GBRMPA). (2017c). *Guidelines: Historic heritage (lighthouses)- assessment in the permission system.* Unpublished draft

Great Barrier Reef Marine Park Authority (GBRMPA). (2017d), *Managing for a resilient Great Barrier Reef Marine Park supporting information paper and workbook,* GBRMPA, Townsville.

Great Barrier Reef Marine Park Authority (GBRMPA). (2017e). *Vessel registration levels for the Great Barrier Reef catchment area*. Retrieved from http://www.gbrmpa.gov.au/VesselRegistrations/

Great Barrier Reef Marine Park Authority (GBRMPA). (2017f). *Great Barrier Reef Marine Park Amendment (Whitsundays Plan of Management) Instrument 2017: Exposure Draft*. Retrieved from: http://www.gbrmpa.gov.au/zoning-permits-and-plans/plans-of-management/whitsunday-plan-of-management/have-your-say

Great Barrier Reef Marine Park Authority (GBRMPA). (2017g). *Whitsundays Plan of Management Update*. Retrieved from: http://www.gbrmpa.gov.au/__data/assets/pdf_file/0007/253699/Factsheet-Update-WPOM.pdf

Greater Whitsunday Alliance (GWA). 2017. *About our region* Retrieved from: http://www.greaterwhitsundayalliance.com.au/about-the-region

Hayes, A. (2011). *Submission: The National Disaster Insurance Review*. Retrieved from http://www.ndir.gov.au/content/submissions/issues_paper_submissions/Hayes.pdf

Harwood, J., Smith, D., & Henderson, D. (2016). Building community cyclone resilience through academic and insurance industry partnership. *Australian Journal of Emergency Management, 31*(4), 24-30.

Healthy Rivers to Reef Partnership: Mackay-Whitsunday (HR2RP) (2016). *Mackay Whitsunday 2015 report card*. Retrieved from http://healthyriverstoreef.org.au/report-card/report-card-results/

Healthy Rivers to Reef Partnership: Mackay-Whitsunday (2017). Spotlight on Cyclone Debbie. Retrieved from: http://healthyriverstoreef.org.au/wp-content/uploads/2016/07/HR2R_Cyclone-Debbie-feature_Proof-2_6OCT2017.pdf

Healthy Rivers to Reef Technical Working Group (HR2RTWG) (2016). *Development of Methods for the Mackay-Whitsunday Report Card 2015: Stewardship and Cultural Heritage Reporting, Final Report November 2016* Retrieved http://healthyriverstoreef.org.au/wp-content/uploads/2016/12/Development-of-Methods-for-the-Mackay_Stewardship-and-cultural-2015.pdf

Hogan, A., Berry, H., NG, S., & Bode, A. (2011). Decisions Made by Farmers That Relate to Climate Change. *Agricultural Science, 23*(1), 36-39. Hughes, L., Steffen, W., Alexander, D., & Rice, M. (2017). *Climate change: A deadly threat to coral reefs*. Potts Point, NSW: Climate Council of Australia Ltd. Retrieved from http://www.climatecouncil.org.au/climate-change-threat-to-reef.

Hughes, T., J. Kerry, M. Álvarez-Noriega, J. Álvarez-Romero, K. Anderson, A. Baird, R. Babcock, M. Beger, D. Bellwood, R. Berkelmans, T. Bridge, I. Butler, M. Byrne, N. Cantin, S. Comeau, S. Connolly, G. Cumming, S. Dalton, G. Diaz-Pulido, C. M.Eakin, W. Figueira, J. Gilmour, H. Harrison, S. Heron, A. Hoey, J. Hobbs, M. Hoogenboom, E. Kennedy, C. Kuo, J. Lough, R. Lowe, G. Liu, M. McCulloch, H. Malcolm, M. McWilliam, J. Pandolfi, R. Pears, M. Pratchett, V. Schoepf, T. Simpson, W. Skirving, B. Sommer, G. Torda, D. Wachenfeld, B. Willis , S. Wilson 2017. Global warming and recurrent mass bleaching of corals *Nature* 543: 373–377 (16 March 2017). Available from: https://www.nature.com/nature/journal/v543/n7645/full/nature21707.html Retrieved 1 June, 2017.

Hughes, T., Schaffelke, B. & Kerry, J. (2016) How much coral has died in the Great Barrier Reef's worst bleaching event? *The Conversation.* Retrieved from http://theconversation.com/how-much-coral-has-died-in-the-great-barrier-reefs-worst-bleaching-event-69494

Infofish Australia (2017) *Assessing Fishing Trends - St Helens To Cape Hillsborough Net Free Zone.* Report prepared for the Mackay Recreational Fishers Alliance Inc.

Kittinger, J. N., Koehn, J. Z., Le Cornu, E., Ban, N. C., Gopnik, M., Armisby, M., et al. (2014). A practical approach for putting people in ecosystem-based ocean planning. *Front. Ecol.* 12, 448–456. doi: 10.1890/130267

Kreger, A., & Hunter, E. (2005). *Unfenced Road Ahead: A Review of Rural and Remote Mental Health Service Delivery and Policy. A Report for the Mental Health Unit, Queensland Health*. Brisbane: University of Queensland and Queensland Health Retrieved fromhttp://crrmhq.com.au/pdfs/UnfencedRoad.pdf

laQuinto, B. L. (2017) Working holiday makers in Australia: food security, climate change, and the backpacker tax. Geographical Research, doi: 10.1111/1745-5871.12261.

Mackay Regional Council (MRC) (2014). Reef Guardian Council Action Plan 2015- 2016. Retrieved from: http://www.mackay.qld.gov.au/__data/assets/pdf_file/0005/191255/draft_new_format_action_plan_2015_16_final_version.pdf

Mackay Regional Council (MRC) (2015) Economic Development Strategy: 2015-2020. Report prepared by the MAckay Regional Council in conjunction with AEC Pty Ltd. Retrieved from: http://www.mackay.qld.gov.au/__data/assets/pdf_file/0011/193781/EDS_2015-2020_DIGITAL_FINAL.pdf

Mackay Regional Council (MRC) (2017) *Mackay Region Recreational Fishing Strategy 2017-2022: Final Report.* Retrieved from: http://www.mackay.qld.gov.au/__data/assets/pdf_file/0004/215419/Mackay_Fishing_Strategy_-_Final_219.7v3.pdf

Marshall, N., Birtles, A., Brown, K., Cinner, J., Curnock, M., Eakin, H., Goldberg, J., Gooch, M., Kittinger, J., Marshall, P., Manuel-Navarrete, D., Pelling, M., Pert, P., Smit, B. & Tobin, R. (in review) Culture Matters in the Great Barrier Reef. *Frontiers in Ecology and the Environment.*

Marshall, N., Bohensky, E., Curnock, M., Goldberg, J., Gooch, M., Nicotra, B., . . . Tobin, R. (2014a). *Measuring the human dimension of the Great Barrier Reef: Social and economic long-term monitoring program*. Townsville: CSIRO Publishing. Retrieved from http://seltmp.eatlas.org.au/node/1285

Marshall, N., Bohensky, E., Curnock, M., Goldberg, J., Gooch, M., Pert, P., . . . Tobin, R. (2013a). *The Social and Economic Long Term Monitoring Program for the Great Barrier Reef: Key Findings, SELTMP 2013*. Cairns: Reef and Rainforest Research Centre. Retrieved from http://www.nerptropical.edu.au/sites/default/files/publications/files/NERP-TE-PROJ-10.1-SELTMP-2013-KEY-FINDINGS-TECHNICAL-REPORT-COMPLETED.pdf

Marshall, N., Bohnet, I., Crowley, G., Curnock, M., Dale, A., & Gooch, M. (2014b). Social impacts in the primary industries of the Wet Tropics cluster. In D. W. Hilbert, R. Hill, C. Moran, S. M. Turton, I. Bohnet, N. A. Marshall, P. P. L., N. Stoeckl, H. T. Murphy, A. E. Reside, S. G. W. Laurance, M. Alamgir, R. Coles, G. Crowley, M. Curnock, A. Dale, N. C. Duke, M. Esparon, M. Farr, S. Gillet, M. Gooch, M. Fuentes, M. Hamman, C. S. James, F. J. Kroon, S. Larson, P. Lyons, H. Marsh, D. Meyer Steiger, M. Sheaves, & D. A. Westcott (Eds.), Climate change issues and impacts in the Wet Tropics NRM cluster region (pp. 128-138). Cairns: James Cook University. Retrieved from https://publications.csiro.au/rpr/download?pid=csiro:EP14913&dsid=DS3

Marshall, N. A., Park, S. E., Adger, W. N., Brown, K., & Howden, S. M. (2012). Transformational capacity and the influence of place and identity. *Environmental Research Letters, 7*(3), Art. 034022. doi:10.1088/1748-9326/7/3/034022

Marshall, N. A., & Smajgl, A. (2013). Understanding variability in adaptive capacity on rangelands. *Rangeland Ecology & Management, 66*(1), 88-94. doi:10.2111/REM-D-11-00176.1

Marshall, N. A., & Stokes, C. J. (2014). Influencing adaptation processes on the Australian rangelands for social and ecological resilience. *Ecology and Society, 19*(2), Art. 14. doi:10.5751/ES-06440-190214

Marshall, N. A., Tobin, R. C., Marshall, P. A., Gooch, M., & Hobday, A. J. (2013). Social vulnerability of marine resource users to extreme weather events. *Ecosystems, 16*(5), 797-809. doi:10.1007/s10021-013-9651-6

Marshall NA, Stokes CJ, Webb NP, Marshall PA, Lankester AJ (2014) Social vulnerability to climate change in primary producers: A typology approach. Agriculture, Ecosystems & Environment 186: 86-93.

Marshall, N. & Pert, P. (2017) *The Social and Economic Long Term Monitoring Program for the Great Barrier Reef.* Draft Report prepared for the Great Barrier Reef Marine Park Authority. Townsville, Queensland Australia.

Millennium Ecosystem Assessment (MEA) (2005). *Ecosystems and Human Well-being: Synthesis.* Island Press, Washington, DC.

North Queensland Bulk Ports Corporation (NQBP) (2009). *Port of Hay Point Environmental Management Plan.* Retrieved from: http://nqbp.com.au/hay-point/

North Queensland Bulk Ports Corporation (NQBP) (2016). *North Queensland Bulk Ports Annual Report 2015-16.* http://nqbp.com.au/wp-content/uploads/2017/04/NQBP-Annual-Report-2015-2016-High-Res.pdf

Office of the Great Barrier Reef, Queensland Department of Environment & Heritage Protection (OGBR). (2016). *Queensland Government annual investment report 2015-2016 Reef water quality protection plan*. Retrieved from http://www.reefplan.qld.gov.au/implementation/assets/reef-water-quality-protection-plan-investment-report-2015-16.pdf

Osipova, E., L. Wilson, R. Blaney, Y. Shi, M. Fancourt, M. Strubel, T. Salvaterra, C. Brown, and B. Verschuuren. 2014. *The benefits of natural World Heritage: Identifying and assessing ecosystem services and benefits provided by the world's most iconic natural places.* Gland, Switzerland: IUCN. vi + 58 pp.

Pascoe, S., Innes, J., Tobin, R., Stoeckl, N., Paredes, S., & Dauth, K. (2016). *Beyond GVP: The value of inshore commercial fisheries to fishers and consumers in regional communities on Queensland's east coast, FRDC Project No 2013-301*. Canberra: FRDC. Retrieved from https://publications.csiro.au/rpr/pub?pid=csiro:EP164852

Piggott-McKellar, A., & McNamara, K. (2016). Survey: Two-thirds of Great Barrier Reef tourists want to 'see it before it's gone'. *The Conversation,* (15 August). Retrieved from https://theconversation.com/survey-two-thirds-of-great-barrier-reef-tourists-want-to-see-it-before-its-gone-62103

Pollnac, R., P. Christie, J. Cinner, T. Dalton, T. Daw, G. Forrester, N. Graham, and T. McClanahan. 2010. Marine reserves as linked social–ecological systems *PNAS*, 107 (43):18262–18265.

Queensland Department of Agriculture Fisheries and Forestry (QDAFF) (2015). *Statewide Recreational Fishing Survey, Preliminary estimates.*

Queensland Department of Transport and Main Roads (QDT& MR) (2017) *Mackay Isaac Whitsunday Draft Regional Transport Plan: developed in collaboration with Mackay, Isaac and Whitsunday local governments*

Queensland Department of State Development (QDSD) (2017) *Mackay Regional Sewage Pump Station Resilience Upgrades*. Retrieved from: https://www.statedevelopment.qld.gov.au/index.php/regional-development/regional-economic-development/building-our-regions/regional-capitals-fund/regional-capitals-fund/1200-mackay-regional-sewage-pump-station-resilience-upgrades

Queensland Government (2017a). *Media Statement: Category C funding now available for Whitsunday small businesses.* Retrieved from: http://statements.qld.gov.au/Statement/2017/4/14/category-c-funding-now-available-for-whitsunday-small-businesses

Queensland Government (2017b). *Queensland Budget 2017-18: Mackay Regional Action Plan* Retrieved from: https://s3.budget.qld.gov.au/budget/rap/Mackay-RAP-2017-18.pdf

Queensland Government Statistician's Office (QGSO) (2017a). Queensland Regional Profiles: Resident Profile for Mackay-Whitsunday Region Queensland Government Statistician's Office, Queensland Treasury. Retrieved from http://statistics.qgso.qld.gov.au/

Queensland Government Statistician's Office (QGSO) (2017b). *Queensland regional profiles: Resident profile for SEQ*. Brisbane: Queensland Government Statistician's Office, Queensland Treasury. Retrieved from http://statistics.qgso.qld.gov.au/

REA Group (2017a) *Mackay Investment property data for all houses*. Retrieved from: https://www.realestate.com.au/invest/house-in-mackay,+qld+4740

REA Group (2017b) *Airlie Beach Investment property data for all houses*. Retrieved from: https://www.realestate.com.au/invest/house-in-airlie+beach,+qld+4802

REA Group (2017c) *Proserpine Investment property data for all houses*. Retrieved from: https://www.realestate.com.au/invest/house-in-proserpine,+qld+4800

Reef Catchments NRM. (2014). *Natural Resource Management Plan 2014-2024: Mackay, Whitsunday, Isaac.* Retrieved from: http://reefcatchments.com.au/natural-resource-management-plan-2014-2024/

Reef Catchments NRM (2016) *2015-16 Reef Catchments (Mackay Whitsunday Isaac) Limited Annual Report*. Retrieved from: www.reefcatchments.com.au

State of Queensland. (2014) *Department of Agriculture, Fisheries and Forestry Annual Report: 2013-2014.* Compiled by Planning and Performance, Business Corporate Partnerships, in the Department of Agriculture, Fisheries and Forestry. Available from: https://publications.qld.gov.au/storage/f/2014-10-03T02%3A21%3A09.503Z/3495-daff-annual-report-2013-14-web.pdf. Accessed on 7 April, 2017.

State of Queensland (Department of Agriculture & Fisheries) (QDAF) (2017a) *Queensland Sustainable Fisheries Strategy 2017–2027*. Retrieved from: https://publications.qld.gov.au/dataset/155ccffb-3a30-48c1-8144-7892e8a57339/resource/319c7e02-f07b-4b2e-8fd5-a435d2c2f3c9/download/qld-sustainable-fisheries-strategy.pdf

State of Queensland (Department of Agriculture and Fisheries) (QDAF) (2017b) *Recreational fishers' satisfaction and expectations of Queensland's net-free zones June 2017*. Report compiled by Fishery Monitoring of Fisheries Queensland, Department of Agriculture and Fisheries. Retrieved from: https://publications.qld.gov.au/dataset/ea45c6ff-a18a-4d4c-8827-e7bd57677c5a/resource/2a46b1be-d8de-4099-b9e4-d3eaf38315a6/download/qld-net-free-zones-satisfaction-expectations.pdf

Sutton, S. G., Lédée, E. J., Tobin, R. C., & De Freitas, D. M. (2010). *Impacts of the 2004 rezoning of the Great Barrier Reef Marine Park on commercial line, charter and trawl fishers. Report to the Marine and Tropical Sciences Research Facility*. Cairns: Reef and Rainforest Research Centre Limited. Retrieved from https://data.gov.au/dataset/impacts-of-the-2004-rezoning-of-the-great-barrier-reef-marine-park-on-commercial-line-trawl-and

Thorburn, P., Wilkinson, S., & Silburn, D. (2013). Water quality in agricultural lands draining to the Great Barrier Reef: A review of causes, management and priorities. *Agriculture, Ecosystems and Environment,* 180, 4–20, doi:10.1016/j.agee.2013.07.006

Tobin, R., Bohensky, E., Curnock, M., Goldberg, J., Gooch, M., Marshall, N., . . . Stone-Jovicich, S. (2014). *The social and economic long term monitoring program (SELTMP) 2013: Commercial fishing in the Great Barrier Reef. Interim report*. Cairns: Reef and Rainforest Research Centre Limited. Retrieved from http://www.nerptropical.edu.au/sites/default/files/publications/files/NERP-TE-PROJ-10.1-SELTMP-2013-COMMERCIAL-FISHING_reviewed.pdf

Tobin, A., Lewis, R., & Tobin, R. (2016). *Defining a resource allocation option in a multi-sectoral fishery: Using the Queensland Coral Reef Fin Fish Fishery as a test case. FRDC Project No 2013-230 DLD*. Canberra: FRDC. Retrieved from http://frdc.com.au/research/Final_Reports/2013-230-DLD.pdf

Tourism Queensland and Events Queensland (TEQ) (2017) *Whitsundays Regional Snapshot.* Retrieved from www.teq.queenlsnad.com

Troy, L. & Martin, C. (2017) *Queensland Rental Vulnerability Index: Final report.* City Futures Research Centre, Faculty of Built Environment, University of NSW Australia 2017. Retrieved from https://cityfutures.be.unsw.edu.au/cityviz/rental-vulnerability-index/

Underhill, E. & Rimmer, M (2016). Layered vulnerability:Temporary migrants in Australian horticulture. *Journal of Industrial Relations* Vol. 58(5) 608–626.

University of Canberra (2017). *Queensland – Regional Wellbeing Surveys, 2016: Mackay-Isaac-Whitsunday, Townsville & North West Queensland.* Retrieved from: http://www.canberra.edu.au/research/faculty-research-centres/ceraph/regional-wellbeing/survey-results/2016-survey-results/2016-results-by-rda-and-lga

Vanclay, F. (1999) Social impact assessment **in** J. Petts (ed.) *Handbook of Environmental Impact Assessment* (Vol 1), Oxford: Blackwell Science, pp. 301–26.

Vella, K., Dale, A., Cottrell, A., & Gooch, M. (2012, July). *Assessing community resilience to climate change*. Paper presented at the 12th International Coral Reef Symposium, Cairns, QLD, Australia. Retrieved from https://researchonline.jcu.edu.au/22405/

Walker, B. & Salt, D. 2006. *Resilience Thinking: Sustaining Ecosystems and People in a Changing World;* Island Press: Washington, DC, USA, pp. 1–151.

Whitsunday Regional Council (WRC) (2017a) *Whitsunday Regional Council Local Recovery Plan*. Retrieved from: https://www.whitsunday.qld.gov.au/DocumentCenter/View/3070

Whitsunday Regional Council (WRC) (2017b). *Economic Profile*. Retrieved http://www.economyprofile.com.au/whitsunday/industries/gross-regional-product

Wilacy, M (2017). *Great Barrier Reef: Coal spillage discovered from ship loader at mining port, Government says*. Retrieved from: http://www.abc.net.au/news/2017-02-08/great-barrier-reef-coal-spillage-discovered-in-waters/8248546

ATTACHMENT A

Access refers to people's ability to enter and use the Marine Park and its resources. Millions of people visit the Marine Park each year. It provides a wide range of recreational opportunities such as boating, snorkelling, diving, fishing and nature appreciation. There are also opportunities for commercial fishing, marine tourism and education. In some key locations, management arrangements such as Plans of Management separate or limit certain use to avoid conflicts. Access also refers to the potential for people to visit and use the Marine Park in the future.[1,2,3]

Aesthetic values are associated with healthy intact ecosystems. They are connected to both environmental attributes (such as bays, beaches, continental islands, coral cays, mangroves, marine animals, water, as well as seagrass meadows) and experiential attributes (presented by beauty, discovery, naturalness, remoteness, sense of inspiration, as well as tranquillity and solitude).[3] The aesthetics values of the Great Barrier Reef are experienced and described from a variety of perspectives:

- panoramic – above in the air or high lookout points. This perspective displays patterns of waters, reefs, cays and islands, and as a vast landscape.
- at water or land level – the Great Barrier Reef at eye level, as sky, water, and land emerging from water and with a sense of world beneath the water.
- below the water – the Great Barrier Reef is an underwater landscape. The three-dimensional qualities of the underwater landscape.[3]

Aesthetics refers to people's perceptions of the beauty of a site or object. While aesthetics are strongly influenced by visual appearance, all the senses play a role – sight, sound, smell, touch and taste. Aesthetics influence the way in which people value and enjoy the Great Barrier Reef. Aesthetics is highly personal – one person may seek solitude and quiet, while another seeks social interactions. The same person often values different elements at different times. Places that are easy to access are less likely to provide opportunities for enjoying solitude or tranquillity, but may enhance opportunities for socialising and personal comfort. Perceptions of the beauty and desirability of natural areas are influenced by people's personal experiences and cultural backgrounds. Psychological, social or cultural dimensions of aesthetics include a sense of history, a sense of place, inspiration, spiritual connections; and opportunities for learning, relaxation, recreation and escapism.[3] Indigenous perspective on aesthetic values may include cultural expressions such as storytelling, mythology, spirituality, literature, music/art, symbols of power, wealth.[3] Aesthetics are recognised under criterion (vii) of the World Heritage Convention: for attributes which 'contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance.' Aesthetics are closely linked to the condition of natural, cultural and historic heritage values within the Marine Park. The natural beauty of most of the Marine Park remains intact, especially for offshore coral reefs and aerial vistas, as well as for neighbouring islands (many of which are Queensland national parks). Significant loss of coral cover has reduced underwater aesthetic value at many inshore reefs, particularly since the year 2000 due to severe weather, crown-of-thorns starfish and increased sea surface temperature increases. temperatures. Aesthetics is linked to wellbeing are also closely linked to social values such as access, understanding, appreciation and personal connection.

Understanding, appreciation and enjoyment

Understanding refers to people's knowledge of the Marine Park, its values and the interconnected systems that support life on the Great Barrier Reef.

Understanding comes from learning, either in-person or remotely. The levels of understanding held by coastal residents and GBR visitors is an important factor in how they may respond to potential impacts on GBR health. Personal experiences, together with scientific knowledge and cultural knowledge gained from stories passed from one generation to the next (including intergenerational aspects of learning for wise decision-making)[1], provide a context for understanding the Marine Park and its values. Understanding allows reflection on what the Great Barrier Reef may have been like in the past; how it contributed to human wellbeing; and how it has responded to human activities. Appreciation refers to realising and feeling grateful for the uniqueness of the Great Barrier Reef. Appreciation often grows with understanding. Enjoyment refers to the positive emotions people experience when they visit or see the Marine Park. Most people in the world will never visit the Marine Park in person, but many still enjoy the Marine Park through photographs, videos or stories. The Marine Park's biophysical and heritage values are the primary reasons why people visit the Reef either as part of a commercial tourist program or in a recreational capacity. There are many opportunities for coastal residents and visitors to learn about and help protect the Great Barrier Reef. A key component of many tourism programs is presenting and interpreting the Marine Park to their guests. Close to 70% of visitors to the Marine Park travel with certified high standard tourism operators. These operators are committed to a high standard of presentation and interpretation as part of their daily operation. Through GBRMPA's Reef Guardian stewardship program, local stakeholders are encouraged to take hands-on actions to care for the Great Barrier Reef. The program includes schools, local councils, farmers, graziers and commercial fishers. Participants are encouraged to go beyond what is required by law in their day-to-day activities and to become active stewards. This includes sharing information about their actions. Other stewardship initiatives such as the Eye on the Reef program contribute vital information about Marine Park values from people who are in the Marine Park daily, such as tourism operators, researchers, students, as well as Queensland Parks and Wildlife Service officers. Participants contribute substantially to understanding trends in the condition of values through time and at many locations throughout the Marine Park.

Human health refers to the physical and mental health benefits that residents and visitors derive from the Marine Park. People benefit from relaxation and stress reduction through recreational activities and access to natural settings; healthy inputs to diets from freshly caught local seafood; and exercise from snorkelling, boating and fishing. Conversely, people may be negatively affected if Reef health declines –depression and anxiety have been associated with environmental decline.[4] The health benefits people derive from the Marine

---

[4] Louv, R. (2008). *Last child in the woods: Saving our children from nature-deficit disorder.* Chapel Hill, NC: Algonquin Books;
Speldewindea, P., Cook, A., Davies, P. & Weinstein, P.(2009) A relationship between environmental degradation and mental health in rural Western Australia *Health & Place.* Vol 15, Issue 3, pp 880–887. https://doi.org/10.1016/j.healthplace.2009.02.011

Park are diminished by those impacts that make the Marine Park a less attractive and fulfilling place to visit, and by those that reduce the quality and availability of its food resources, clean air, water or sediment.

Personal connection refers to people's aspirations, spiritual connections, cultural ties, employment, stewardship activities, places of residence and recreational activities that are associated with the Marine Park. It links each individual stakeholder, visitor, local resident and Traditional Owner to the Marine Park. The Great Barrier Reef is a key part of the identity of adjacent coastal communities. It is a major source of pride and distinction for these communities. More than 95% of nearby residents have visited the Great Barrier Reef at least once in their lives. Many coastal residents report that they chose where they live so as to be close to the Great Barrier Reef and that there are 'not many other places better than the Great Barrier Reef for the recreation activities they enjoy'.[4] Commercial fishers and tourism operators identify very strongly with their occupations and the places where they live and work. This is highlighted by the fact that few, if any, who were directly affected by Severe Tropical Cyclone Yasi or the central Queensland floods in 2011 changed their jobs or moved elsewhere, despite economic imperatives to find alternative income.[5] Traditional Owners continue to maintain connection to their sea country, for example, through stories and songlines, sites of cultural significance and important saltwater ceremonies. Australians in general also identify strongly with the Great Barrier Reef as a national icon. A 2014 survey conducted as part of the Social and Economic Long Term Monitoring Program found that 80% of Australians see the Great Barrier Reef as vital to their identity.[4] Across the world, people of many nations feel a strong personal connection to the Great Barrier Reef, even if they have never visited in person.

Equity relates to fairness in the distribution of benefits and impacts across the community and depends on sustainable use that meets the needs of the current generations without compromising the ability of future generations to meet their own needs[5]. Impacts to equity may result in changes to the current and future generations' access, enjoyment, appreciation and use of the Great Barrier Reef. Equity may also be compromised if there are impacts to human health through the decline of ecosystem health and/or contamination of air, water or sediments.

Empowerment is the process that enables citizens, groups, communities, stakeholders, and organisations to undertake actions and participate meaningfully in the protection and management of the Great Barrier Reef. Factors that enhance human wellbeing of Reef-dependent people may contribute to empowerment.

Employment and income

Employment refers to jobs created or maintained as a result of sustainable activities conducted in the Marine Park. Income refers to money that people receive as a result of activities conducted in the Marine Park. The benefits that businesses, individuals and

---

[5] GH, Brundtland, and World Commission on Environment and Development. (1987). *Our Common Future: Report of the World Commission On Environment and Development*. Oxford University,

communities derive from the Marine Park are founded on its biodiversity, species distribution and abundance, geomorphological features, and the range of social, Indigenous and historic heritage values. Employment and income are therefore affected by impacts that diminish the condition of these foundational values. Activities in the Marine Park generate income and employment for tens of thousands of people both within and outside the Marine Park, as the flow-on benefits reach far beyond the boundaries of the Marine Park. The Marine Park supports significant commercial uses linked to recreation, tourism and commercial fishing. These industries play an important role in regional Queensland and rely on a healthy Reef ecosystem for long-term economic stability. The economic contribution generated by tourism, recreation, commercial fishing and scientific research in the Great Barrier Reef catchment and the World Heritage Area in 2016 was estimated to be $5.6 billion. This has been relatively stable over the past five years.[6] Commercial marine tourism is a major use of the Marine Park, both in terms of economic value and employment. It is estimated that, in 2011–12, Great Barrier Reef-based tourism contributed approximately $5.2 billion to the Australian economy and supported employment equivalent to about 69,000 full-time positions.[6] It is important to note, the economic estimates are likely to be only a portion of the total economic value of the Great Barrier Reef, as most ecosystem services that are not traded in markets have not yet been calculated. For example, the non-market economic value of a healthy coral reef system in providing a physical barrier from wave and tsunamis impacting coastal areas, or mangrove habitats that also provide a buffer between land and sea and filter sediment and nutrients.

Reef & Rainforest
RESEARCH CENTRE

www.nesptropical.edu.au