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Final Report

Assessing the human dimensions of the Great Barrier Reef: A Burdekin Region focus

Margaret Gooch, Allan Dale, Nadine Marshall and Karen Vella

JAMES COOK UNIVERSITY AUSTRALIA

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Assessing the human dimensions of the Great Barrier Reef:

A Burdekin Region focus

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

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

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http://www.nesptropical.edu.au

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ACRONYMS

ABARES..... Australian Bureau of Agricultural and Resource Economics and Sciences
ABS ..... Australian Bureau of Statistics
ADF..... Australian Defence Force
BITRE ..... Bureau of Infrastructure, Transport and Regional Economics
BMP..... Best Management Practice
CCIQ..... Chamber of Commerce & Industry Queensland
CEO ..... Chief Executive Officer
COC..... Codes of Conduct
COTS..... Crown-of-Thorns-Starfish
DAE ..... Deloitte Access Economics
DEHP..... Department of Environment and Heritage Protection
DPM&C..... Department of the Prime Minister & Cabinet
ERA ..... Environmentally Relevant Activity
ERP..... Estimated Resident Population
FMP ..... Field Management Program
GBR..... Great Barrier Reef
GBRMPA ..... Great Barrier Reef Marine Park Authority
GBRWHA..... Great Barrier Reef World Heritage Area
GFC ..... Global Financial Crisis
GRP ..... Gross Regional Product
GVP ..... Gross Value of Production
HESB..... High Efficiency Sediment Basins
IECA ..... International Erosion Control Association
IPBES ..... Intergovernmental Panel on Biodiversity and Ecosystem Services
ISO..... International Organization for Standardization
LGA ..... Local Government Area
MOU..... Memorandum of Understanding
NERP..... National Environmental Research Program
NESMP ..... North-East Shipping Management Plan
NESP ..... National Environmental Science Programme
NQ ..... North Queensland
NQPHN..... Northern Queensland Primary Health Network
NRM..... Natural Resource Management
OUV ..... Outstanding Universal Value
PMP ..... Property Management Plan
PoT ..... Port of Townsville
QDAF..... Queensland Department of Agriculture and Fisheries
QDEHP ..... Queensland Department of Environment and Heritage Protection
QGSO ..... Queensland Government Statistician's Office
QoL..... Quality of Life
QPWS..... Queensland Parks and Wildlife Service
QRC..... Queensland Resources Council
RIMReP ..... Reef Integrated Monitoring and Reporting Program
RRRC..... Reef and Rainforest Research Centre
TE ..... Townsville Enterprise

TEK..... Traditional Ecological Knowledge
TO..... Traditional Owner
TCC..... Townsville City Council
TCD..... Townsville City Deal
TUMRA..... Traditional Use of Marine Resources Agreement
WH..... World Heritage
WHA ..... World Heritage Area
WPDA……..Waterfront Priority Development Area
WQ..... Water Quality
WQIP ..... Water Quality Improvement Plans
WSUD..... Water Sensitive Urban Design

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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 Burdekin Region and the adjacent GBR. To ensure GBR policy makers and managers better consider the needs of Reef-dependent 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 Burdekin 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 discussed in regional expert panel meetings using a consistent set of decision rules for scoring based on available evidence. Key findings from the evidence gathered so far for the Burdekin Region are summarised here.

Aspirations, capacities and stewardship

There is a sound level of societal awareness and concern about environmental issues across the Burdekin. Townsville City Council (TCC) provides commendable leadership in sustainability practices and community-based environmental education. The Port of Townsville fulfils its legislative requirements for environmental stewardship. Most commercial fishers are compliant with Great Barrier Reef Marine Park Authority (GBRMP) regulations, and there is good progress towards uptake of environmentally-friendly practices and eco-certification in the GBR tourism sector. Many of the regions' schools are Reef Guardian schools. However, within the region, there are some significant issues including the following: recreational fishing requires increased compliance effort; the Yabulu Nickel Refinery has significant outstanding remediation obligations; dredging of the Townsville Port has adverse impacts on Magnetic Island's fringing reefs; and many Burdekin graziers lack financial capacity and/or change management skills needed to improve their stewardship practices.

Community vitality

The region's population is concentrated in the centres of Townsville, Ayr, Bowen and Charters Towers. Many inland centres are very small, and service large, scattered pastoral properties or mines. These isolated communities face declining numbers and aging populations. The region has a high proportion of Aboriginal and Torres Strait Islander people; rural and remote persons, often living in social isolation; and mining communities with large numbers of fly-in fly out workers. The region's infrastructure can be severely damaged in cyclones and floods, leading to adverse impacts on communities and industries. Despite these drawbacks, the GBR plays an important role in the health and wellbeing of residents and visitors to the region.

Culture and Heritage

There is a strong overall cultural understanding of the importance of the GBR and many regional sub-cultures are respectful of GBR values. Social challenges in Indigenous communities such as Palm Island affects this integrity, although there is evidence of strong TO use of sea country resources across the region. There is an increasing capacity of Indigenous land and sea institutions, but much work needs to be done to progress rights and to progress planning, strategy development and implementation. Historical heritage is generally poorly

represented in management thinking. The evidence base concerning the identification, protection and management of historical maritime heritage remains limited and fragmented, although the *SS Yongala* is the most highly visited historic shipwreck site on the GBR.

Economic values

The region's economy relies on a solid primary industries base which is vulnerable to extreme weather events such as floods, droughts and cyclones. Unemployment in Townsville (the region's economic hub) is among the highest in Australia and the city's economic confidence is generally low, although expected to increase substantially with the implementation of the Townsville City Deal. Townsville is North Queensland's (NQ) focus for warehousing, retail, manufacturing, health care, education, research and defence. It has strong linkages to the region's natural resources, including mining and minerals; coal and gas; grazing; sugar cane, horticulture and GBR fisheries. Proposed new coal mines in the Galilee Basin are driving expansion proposals for several GBR ports. Burdekin Shire and Ingham together produce 26% of Australia's raw sugar. While agricultural production continues to grow, water availability and seasonal and storage proposals are expensive and may have viability limits. Challenges for GBR-dependent industries (recreation, tourism and fishing) include predicted climate change impacts, decline in water quality, lack of fish passage connectivity, adverse impacts on intertidal nursery habitats and marine ecosystems. Challenges for mineral resources industries include: fluctuating coal prices; high carbon emissions; potential environmental impacts to surrounding environment and GBR; risk to surface and groundwater; and high financial leakage from the region due to 'fly in fly out' workforce.

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. Strong framework for ongoing and adaptive monitoring, evaluation and review is emerging via RIMReP. 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) 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 are 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, Fabricus, Sweatman & Puotinen, 2012; Deloitte Access Economics [DAE], 2017; Great Barrier Reef Marine Park Authority [GBRMPA], 2014a; Hughes, Schaffelke & Kerry, 2016; Hughes et al, 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 (TOs), 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 (GBRMPA, 2014a).

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 (Ban et al., 2017; Christie et al., 2003; Cinner & David, 2011; Edgar, Russ & Babcock, 2007; Kittinger et al., 2014; Pollnac et al., 2010). 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 third in a series of six regional reports produced as part of a 12 month National Environmental Science Program (NERP) 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, 2016a). They extend beyond the coastline to include part of the GBR Marine Park and are shown in Figure 1.

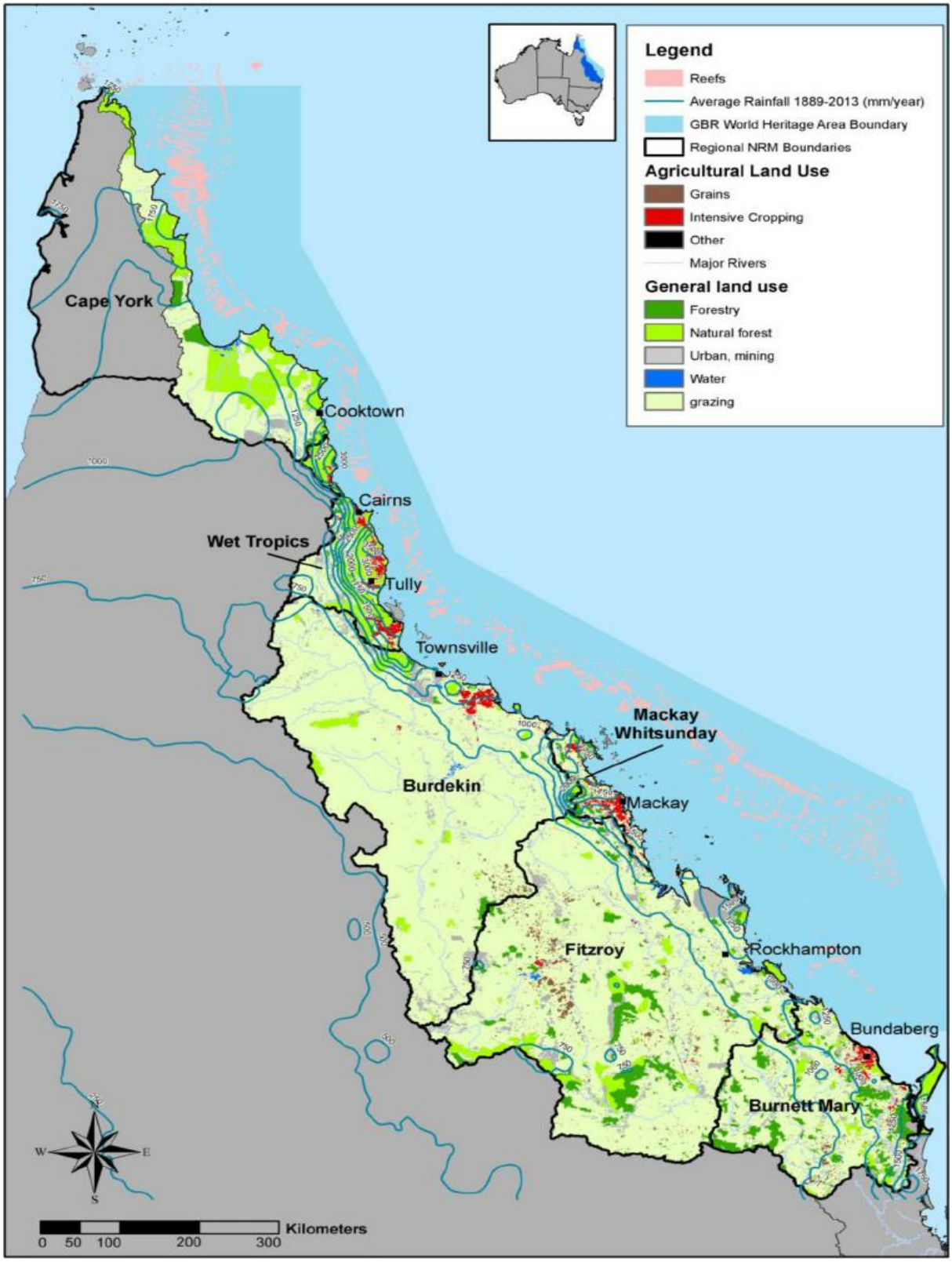

Figure 1: NRM Regions in the Great Barrier Reef catchment

(SOURCE: Thorburn, Wilkinson & 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

SOURCE: 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 (TOs) 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 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

[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.

- 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
- Levels of confidence and trust in GBR management (Gooch, 2016).

The GBR's human dimensions include residents in GBR catchment towns and cities (including TOs) 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
- Employment and income derived from GBR-dependent industries
- Heritage (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, Dale, Cottrell and Gooch (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 Millenium Ecosystem Assessment (Millennium Ecosystem Assessment, 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, George, Hill & Fraser, 2016a; Dale et al., 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 (Fitzroy Partnership for River Health, 2015; Gladstone Healthy Harbour Partnership, 2016; Healthy Rivers to Reef Partnership: Mackay Whitsundays, 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 Heritage Area and its catchments sustain the GBR's Outstanding Universal Value (OUV)	**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 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.

T

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 each regional analysis include the following:

- **ABS**. (2017a). *Data by region*. Retrieved from http://stat.abs.gov.au/itt/r.jsp?databyregion
- **ABS**. (2015a). *Information paper: An experimental ecosystem account for the Great Barrier Reef Region, 2015* (cat. no. 4680.0.55.001). 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**. (2017b). *Census*. Retrieved from http://www.abs.gov.au/websitedbs/D3310114.nsf/Home/Census?opendocument&ref=topBar
- **ABS**. (2017c). *Land account: Queensland, experimental estimates, 2011 - 2016* (cat. no. 4609.0.55.003). Retrieved from http://www.abs.gov.au/Ausstats/abs@.nsf/0/C513A7FD834B39C2CA25813F00120EFE?OpenDocument
- **ABS**. (2016c). *Community profiles*. Retrieved from http://www.abs.gov.au/websitedbs/censushome.nsf/home/communityprofiles
- **Australian Bureau of Agricultural and Resource Economics and Sciences [ABARES]**. (2017a). *Land use and management information for Australia*. Retrieved from http://www.agriculture.gov.au/abares/aclump
- **ABARES**. (2017b). *Data sets*. Retrieved from http://www.agriculture.gov.au/abares/data
- **GBRMPA**. (2017c). *Vessel registration levels for the Great Barrier Reef catchment area*. Retrieved from http://www.gbrmpa.gov.au/VesselRegistrations/
- **Queensland Government Statistician's Office [QGSO]**. (2018). *Queensland regional profiles*. Retrieved from http://statistics.qgso.qld.gov.au/
- **Troy, L., & Martin, C. (2017).** *Queensland rental vulnerability index: Final report*. Sydney: University of NSW. Retrieved from

https://cityfutures.be.unsw.edu.au/research/projects/queensland-rental-vulnerability-index/

- **Marshall, N., Bohensky, E., Curnock, M., Goldberg, J., Gooch, M., Nicotra, B., . . . Tobin, R**. (2014). *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
- **Tourism Research Australia**. (2016). Retrieved from https://www.tra.gov.au/
- **University of Canberra**. (2017). 2016 regional wellbeing survey: Results by RDA and LGA. Retrieved from http://www.regionalwellbeing.org.au/

The process involved 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 could represent them, then the proxy was 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, when considered were 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 helped 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* included 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 (Community & Regional Resilience Institute; Walker & Salt, 2006). 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 BURDEKIN REGION

The Burdekin NRM Region is primarily defined by the Burdekin River catchment. The largest population centre is Townsville which contains most of the region's population. Smaller centres include Charters Towers, Ayr, Home Hill and Bowen (ABS, 2015a). The Region covers 12 local government areas, including Townsville, Burdekin, Charters Towers and Palm Island, significant parts of Whitsunday, Isaac and Barcaldine and small sections of the Tablelands, Etheridge, Flinders, Hinchinbrook and Mackay (see Figure 2).

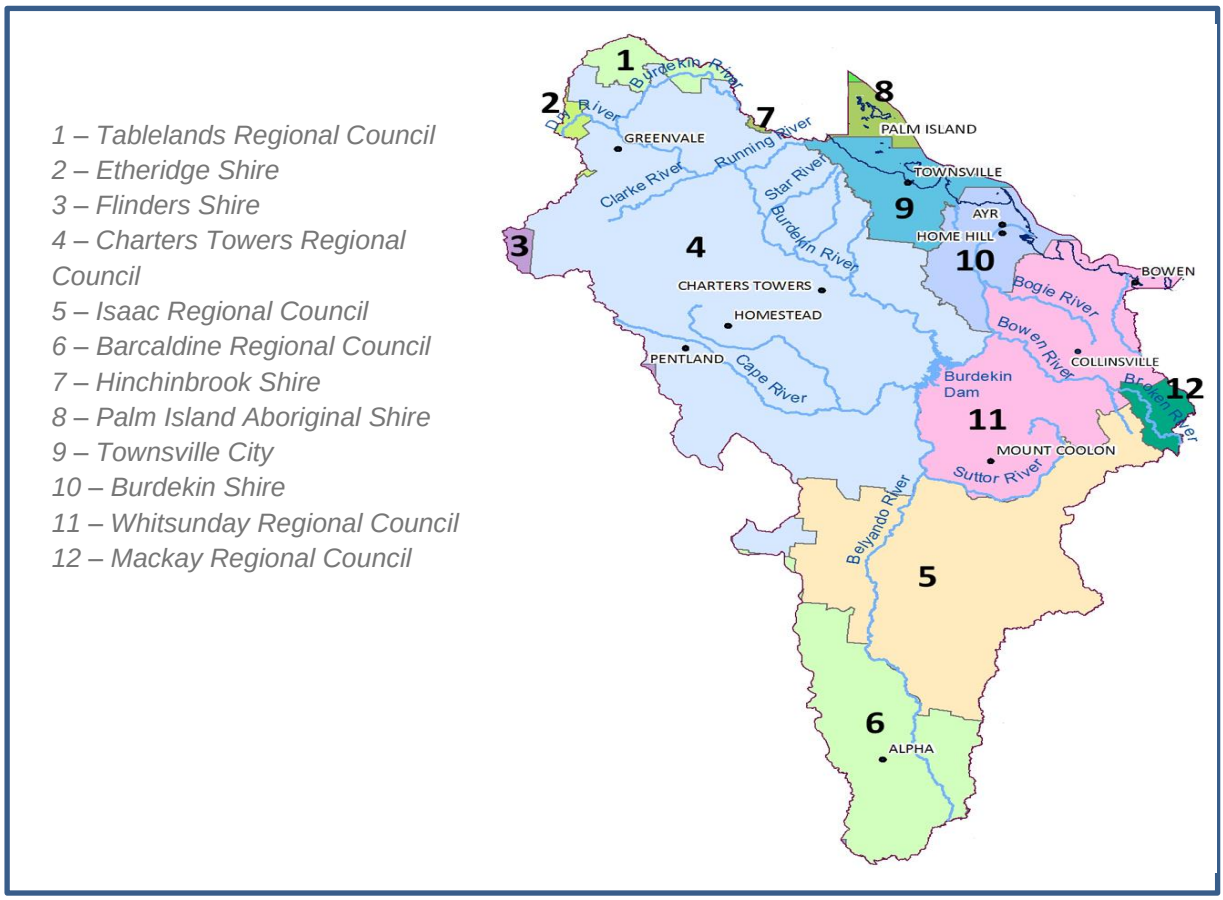

Figure 2: The Burdekin Region and adjacent GBR

Source: NQ Dry Tropics (n.d.) http://www.nqdrytropics.com.au/about-the-region/

The Burdekin Region is the largest in the GBR catchment, spanning 134,000km^2 land and 12,000km^2 of the GBR. It includes the Burdekin River catchment (about the size of Tasmania) as well as the smaller coastal catchments of the Don, Haughton, Black and Ross Rivers and Crystal Creek to the north. As well as including parts of the Great Barrier Reef and southern Wet Tropics world heritage areas, the Burdekin Region includes Bowling Green Bay National Park—an internationally-recognised Ramsar-listed site containing one of Australia's largest wetlands. The region's ecosystems are highly-productive and richly diverse, including two of Australia's National Biodiversity Hotspots. Pasture lands are extensive throughout the region as are soils suitable for dryland and irrigated cropping (NQ Dry Tropics, 2016). The region's population is concentrated in the city of Townsville, and the towns of Charters Towers, Ayr and Bowen (Queensland Government Statistician's Office [QGSO], 2017a).

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, 51.8% had non-school quals. (54.2% for Qld). Of those, 24% studied Engineering & Related Technologies; cw 16.8% for Qld (QGSO, 2017a). **NRM Awareness** • Strongly connected, NRM-aware communities are the region's greatest NRM asset - many involved in protecting, researching & managing natural resources, including rural land managers, TOs, community groups, industry, researchers & govt, however urban centres are better informed than rural agricultural communities (NQ Dry Tropics, 2016). • Regional communities identify water as the most important resource needing management & protection. Water issues include increasing water demand; water quality (WQ) of GBR waterways & Bowling Green Bay wetlands & altered surface & groundwater in the Lower Burdekin (NQ Dry Tropics, 2016). • 41.1% Burdekin residents perceive that *water quality* is a big problem c.w. 41.4% for rural & regional Aust & 43.7% rural & regional Qld; 44.4% perceive *soil erosion* to be a big problem c.w. 41% for rural & regional Aust & 39.4% % rural & regional Qld; and 40% perceive that *environmental degradation in general* is a big problem c.w. 40.4% for rural & regional Aust & 40.7% % rural & regional Qld (University of Canberra, 2017).	• Regional Yr 12 completion rates are below state average, however tertiary qualifications related to engineering & related technologies are above. • Strongly connected, well-informed & highly-skilled communities are the region's greatest NRM assets, especially in urban and coastal communities. • Within the whole GBR catchment, there is a broad societal awareness of catchment-based activities on the GBR. • There are high levels of agreement among national residents &	**4** Regional community perceptions of threats to local ecosystems & the GBR are variable, although generally higher than other GBR regions. More broadly, there is a high level of national & international awareness & concern about the GBR that does not always translate into cohesive policy

		Awareness of GBR and waterway condition & threats • Only 33% Burdekin residents agree that coral reefs in the region are in good condition; 49% agree that mangroves are in good health; 45% agree that estuarine & marine fish are in good condition; 71% are worried about the status of freshwater fish in the region; 51% DISAGREE that freshwater rivers & creeks in the region ARE NOT in good condition; 82% DISAGREE that they ARE NOT worried about climate change impacts on the GBR (Marshall & Pert, 2017). • 50% Burdekin residents say the greatest threat to the GBR is pollution; 45% believe climate change is the greatest threat to the GBR and 20% say coral bleaching is the greatest threat to the GBR (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% (Marshall et al., 2013a; Marshall & Pert, 2017). **GBR learning opportunities** • 78% Burdekin residents are interested in learning "more about the condition of the GBR"; only 42% agree they have knowledge & skills to reduce their GBR impacts; 93% value the GBR because it provides opportunities for learning through scientific discoveries; & 76% B-M residents value the GBR because it provides a place where people can continue to pass down wisdom, traditions and a way of life (Marshall & Pert, 2017). • *National Dugong & Turtle Protection Plan 2014–2017* includes education & compliance training for 28 Indigenous rangers in NQ & FNQ (GBRMPA, 2016a). • *Reef HQ- GBR Aquarium*, Townsville is the GBR's National Education Centre. Key Reef HQ messages reached > 7M people 2015–16. Messages include GBR values, threats to its future, and how everyone can help to protect it. Reef HQ has 16,076 members (8% Townsville's population). > 4 M people have visited since it opened in 1987. 53 Reef videoconferences to > 2300 students across the globe in 2015-16 (GBRMPA, 2016b)	catchment residents that it is the responsibility of all Australians to care for the GBR.	action related to key threats.

		GBR-wide Reef-education programs • GBR-wide Reef Guardians Program - 276 schools, 120,000 students, 7,400 teachers; 16 councils covering 300,000 km^2; 17 commercial fishers (line, trawl, net, collection); 24 sugarcane, banana, horticulture & broad-acre farmers & 5 beef graziers (GBRMPA, 2016a).		
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** • 85% Burdekin residents agree that they make every effort to use energy efficiently at home & at work; 77% DISAGREE that they RARELY CONSIDER environmental impacts of production processes for goods & services that they purchase; 83% DISAGREE that they DON'T USUALLY make any extra effort to reduce waste; 81% re-use or recycle most goods & waste; 10% B-M respondents are part of an environmental community-based group (Marshall & Pert, 2017). **Sense of responsibility towards the GBR & coastal waterways** • 85% Burdekin residents agreed they would like to do more to help protect the GBR; 85% agreed they like to do more to improve water quality in local waterways (including rivers, creeks); 73% DISAGREE that they CANNOT make a difference in improving GBR health; 86% DISAGREE that it is NOT their responsibility to protect the GBR; 71% agree that they feel a social expectation to reduce impacts they may have on the GBR; 73% DISAGREE that they DO NOT HAVE the time or opportunity to reduce their impacts on the GBR (Marshall & Pert, 2017). • In 2017, GBR coastal residents strongly agreed that they would like to do more to help protect the GBR (av. 7.3/10 in 2013 & 7.75/10 & generally agreed that they have a personal responsibility to protect the GBR would like to do more to help protect the GBR (av. 6.8/10 in 2017 (Marshall & Pert, 2017). • A $700,000 Reef Trust Marine Debris project (2015–16) engaged over 4000 people in marine debris removal across the length of the 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).	• NQ Dry Tropics NRM Group has a large influence on community capacity for stewardship, as does the GBRMPA's Reef Guardian School's Program. • 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. • Considerable levels of non-recognition of climate concerns remain embedded within society & national concern & awareness has not yet translated onto cohesive policy action	**3.5**

		Regional Reef-based stewardship activities • The strong spirit of regional collaboration is illustrated by a wide range of decision-making forums, & formal & informal partnerships between groups. TOs have a crucial role to play, given their connection with the land & their traditional ecological knowledge (NQ Dry Tropics, 2016). • TOs have the longest & deepest connection with Burdekin region's natural resources, & play an important role in NRM (NQ Dry Tropics, 2016). **Numbers & types of TO involvement in on-ground WQ improvement & monitoring** • Little data available.	on key climate threats to 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? • How do they get there? • What do they do? • Why people go	**Extent & type of stewardship practices** • Not enough evidence to assess. **Number of GBR visitors** • 92% B-M residents visited the GBR for recreation at least once in the past 12 months (Marshall & Pert, 2017). • No. recreational vessels registered in the Burdekin has risen steadily from 11, 931 in 2008 to 23,366 in 2016 (GBRMPA, 2017b). • In 2015-16 there were approx. 2M day trippers, 6M domestic overnight visitors & 2M international visitors to the Burdekin Region. Of these around 50% visited this part of the GBR (DAE, 2017). **Where recreational visitors go** • Not enough evidence to assess. **Why do they visit? What do they do?** • 7% Burdekin residents belong to a GBR-based club or community group (Marshall & Pert, 2017). • 21.4% of Townsville's pop'n fish at least once each year, higher than state av. of 17% (Department of Agriculture and Fisheries [DAF], 2015). • 22-28% of people in the region enjoy rec. fishing (Farr, 2013). • Top three activities contributing to Burdekin residents' GBR use & enjoyment (1-10 scale) were sightseeing/exploration (7.9); wildlife watching (7.41) & sunbathing / relaxing (7.23) (Marshall & Pert, 2017).	• Hard to get regionally specific data on use patterns & stewardship efforts of recreational/artisanal users. • Anecdotal evidence suggests that recreation fishing requires increased compliance effort.	**3.5** There is some anecdotal evidence of compliance issues in the recreation sector, but there is insufficient data to assess with confidence.

ACS4 Adoption of best practice systems – Agricultural & land sector (including Aquaculture)	• Extent & type of stewardship practices of agricultural industries. • Numbers of individuals & groups participating in GBR-based stewardship activities.	• Reef Plan Report Card for Burdekin industry adopting improved practices 2009 - 2013: 54% graziers (Target 50%); 55% sugar cane growers (Target 80%); 63% horticulture (Target 80%) (Queensland Government, 2016). • Cane farmers & graziers: (a) are very experienced (av. 18.9 yrs for graziers; 20.9 yrs for cane growers), often following inter-generational practices & involve family in decision-making; (b) >90% have no plans s to change future practices; (c) 61% cane growers & 30% graziers do not believe their practices adversely impact local WQ; (d) 66% cane growers; 39% graziers do not believe their industry plays a significant role in declining GBR health; & tend to shift blame to others (Farr, Eagle, Hay & Churchill, 2017). • Adopting sustainable ag. practices is strongly influenced by family, community & networks. New practices often occur only after others take a lead. Uptake also linked to more training & financial capacity (Greiner, Stoeckl, Stokes, Herr & Bachmeir, 2003; Pahl, 2015). *Grazing Target: 90 per cent of grazing lands are managed using best management practice systems by 2018* • 983 graziers farm 12.4M ha land & 37,000km streambanks. • In 2016 33% grazing land was under Best Management Practice (BMP) relating to pasture (hillslope) erosion; 72% for streambank erosion & 27% for gully erosion. Overall BMP for Burdekin graziers is D (Queensland Government [QG], 2016). • Adoption of improved management practices occurred with 16 graziers through collaboration with NQ Dry Tropics. • Queensland Department of Agriculture and Fisheries' [QDAF] beef extension team provided 121 beef businesses with activities & BMP follow-up services & information on BMP for improved water quality. (QG, 2016). • Burdekin grazing water quality risk over time, by pollutant: o Pastures: In 2014 12% mod.-high risk c.w. 11% in 2016 o Streambanks: 12% mod –high risk - unchanged from 2014-2016 o Gully: 18% mod –high risk - unchanged from 2014-2016 (QG, 2016). *Sugar Target: 90 per cent of sugarcane lands are managed using best management practice systems by 2018*	• Burdekin farmers & graziers could adopt practices that benefit the GBR, however, many lack financial capacity &/or change management skills needed to do this successfully.	**2.5** While substantial improvements in practice uptake, considerable progress still required to meet Reef 2050 Plan targets

		• 556 growers farm 83,000 ha sugarcane.
		• In 2016, 36% sugarcane land was under BMP for pesticides, 14% for nutrients & 17% for soil. Overall BMP for Burdekin cane farmers is E (QG, 2016).
		• Smartcane BMP program engaged with 179 growers; 24 undertook BMP accreditation process.
		• NQ Dry Tropics contracted 16 growers & achieved an annual reduction in fertiliser application equivalent to 183T of nitrogen.
		• RP20C Burdekin Nitrogen Project, funded by Queensland Department of Environment and Heritage Protection (QDEHP) & delivered by Sugar Research Australia engaged with 23 cane farmers & achieved an annual reduction of 499T of applied nitrogen.
		• DAF cane extension team engaged with 7 cane farmers.
		  ○ 2 farmers changed fallow management to include a zonal tilled legume/cover crop & changed to calculating N rate based on Six Easy Steps & farm or block yield history.
		  ○ 5 farmers reduced residual herbicide application (QG, 2016).
		Horticulture Target: 90 per cent of horticulture lands are managed using best management practice systems by 2018.
		• 200 horticulture producers farm 25,000ha land.
		• In 2016, BMP applied in 60% horticultural land for pesticides; 19% for nutrients & 67% for soil. Overall BMP for Burdekin horticulture farmers is C (QG, 2016).		

ACS5 Adoption of best practice systems – Industry & urban sector	• Extent & type of stewardship practices of urban councils & industries.	• TCC has several sustainability initiatives: Creek to coral; Water Quality Improvement Plans (WQIP); Water Sensitive Urban Design (WSUD) guidelines; Reef Guardian Council program; Shoreline erosion management plans; Dry tropics water smart residential outdoor water conservation program (Gunn & Manning, 2016). • TCC builds local knowledge through training *Erosion and Sediment Control.* This International Erosion Control Association (IECA) endorsed training is aimed site supervisors & regulatory staff. Training includes practical information is held at the Erosion & Sediment Control Demo Site (http://www.creektocoral.org.au/news/index.html) • Reports of millions of litres of contaminated water seeping into the GBR from a massive dam at Yabulu NQ nickel refinery every day	• TCC provides leadership in sustainability practices, e.g., WSUD training. • Implemented trial 'solar cities' program suggested strong focus on shift to renewable energy. • Yabulu NQ nickel refinery has major compliance issues.	**3** There is a strong regulatory framework for point source pollution, though issues with some industry–based pollution

		(Willacy, 2016). Yabulu Nickel Refinery has significant outstanding remediation obligations, including disposal & remediation of 3.2B litres of contaminated water in tailings storage facility (Plumb & Kennerley, 2017). • SPP (Department of Infrastructure, Local Government and Planning, 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 High Efficiency Sediment Basins (HESBs) (Turbid Water Solutions, 2017). To date NO Local Government Area (LGAs) in the GBR catchment have HESBs on working construction sites within their jurisdictions (S. Choudhury, personal communication).	• Across the GBR catchment, traditional sediment basins are often not designed or maintained to minimum standards & thus ineffective. Local councils are calling for support from other governments in the form of an independent, dedicated compliance team that would travel the State (S. Choudhury, personal communication).	
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. • Extent & type of stewardship practices of GBR-dependent industries (Fishing & Tourism).	**Ports & shipping - stewardship & safety** • Port of Townsville (PoT) manages its operations within legal frameworks: compliance with all Environmentally Relevant Activity (ERA); licence requirements under *Environment Protection Act 1994*; compliance with approval conditions for dredging & placement of dredge material under the *Environment Protection (Sea Dumping) Act 1981* (Cth); ISO 14001 accreditation for an independently certified Environmental Management System; undertaking ongoing environmental monitoring & annual reporting of results; recording & applying conditions specified through approvals (AECOM, 2013). • Nevertheless, evidence is mounting that PoT dredging has adverse impacts on nearly fringing reefs (Hughes, 2014). • Abbot Point Coal Terminal under investigation after satellite images show sediment-laden water flowing into Caley Valley wetlands (Kos, 2017). • World Wildlife Fund & Australian Maritime Safety Authority recognise that the North-East Shipping Management Plan (NESMP) provides important actions, but urgent changes are needed (e.g., compulsory	• Evidence suggests that ports & shipping comply with regulations. • Until recommended changes are made to NESMP, shipping accidents will continue to occur throughout the GBR. • Relatively low up-take of eco-efficient practices by commercial fishers, compared with marine tourism operators. •	**3.5** Significant progress has been made on tourism & ports. Best management practices in commercial fishing should improve with implementation of *Queensland Sustainable Fisheries Strategy 2017–2027*

	pilotage for the entire GBR; use of high-standard ships in GBR waters, & improved marine biosecurity (Commonwealth of Australia, 2014). **GBR Fishing & Fisheries** • 8% commercial fishers have fuel efficient vessels; 81% participate in industry best practice; 13% use an emissions calculator (Marshall et al., 2013a). • Several MOUs & Codes of Conduct (COCs) for comm. fishers, but formal information is lacking (Tobin et al., 2014). • Queensland Sustainable Fisheries Strategy 2017–2027 should improve management practices in the commercial fishing sector (DAF, 2017). **GBR Tourism** • Reef HQ aquarium is one of only 15 Aust. orgs to maintain its triple-tier ECO Certification (Advanced Ecotourism, Climate Action Business & Respecting Our Culture certification) (GBRMPA, 2016b). • 67 GBR tourism operators have ECO Certification through Ecotourism Australia & carry 69% GBR tourists (GBRMPA, 2016a). 52% tourists prefer those with 'green' credentials; 63% tourism operators said they "regularly get involved in GBR research &/or management"; 98% agreed they "try to encourage other people to reduce their GBR impacts"; 90% agreed that their operation "provides interpretation for tourists that promotes conservation or sustainable use of the GBR"; 88% use fuel efficient engines; 84% separate waste for recycling; 83% participate in industry best practices (e.g., codes of practice, MOUs); 45% participate in GBRMPA's Eye on the Reef monitoring program; 43% use green energy (e.g., solar); 28% use emissions calculator; 19% use carbon offsets; 8% use alternative fuels (Marshall et al., 2013a).	
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 and 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 Estimated Resident Population (ERP) ~ 240 000 (NB: poor alignment with LGA boundaries) 4,778,854 for Qld (QGSO, 2017a; 2017b; NQ Dry Tropics, 2016). • Mostly sparse & dispersed population, except for Townsville (195,914); Ayr (8883); Bowen (9, 535); Charters Towers (12,332). Region's av. growth rate of 1.2% over 5yrs & 1.5% over 10. In 2016, 12.6% born overseas, c.w. 21.6% for Qld; 7.2% Indigenous; Palm Is. LGA > % Indigenous persons – 93.9% c.w. 4% for Qld. 6.5% regional residents speak language other than English at home (QGSO, 2017a). • Many inland centres are very small, & service large, scattered pastoral properties or mines. These isolated communities face declining numbers & aging populations (NQ Dry Tropics, 2016). **Migration intentions in the next 12 months** • 11.7% Burdekin residents were likely to move in the next 12 months c.w. 10.8% for rural & regional Aust & 12.6% rural & regional Qld (University of Canberra, 2017).	• Major uncertainty in urban population based on decline in the resources sector and future uncertainty over coal mining. • The regional population is concentrated in urban centres of Townsville (largest city in Nth Aust), Ayr, Bowen & Charters Towers. • Maintaining human resources in rural areas & ensuring the intergenerational passing of knowledge is a significant challenge for future management of the region (NQ Dry Tropics, 2016).	**3** Demographic stability in the region is strong, but affected by rural decline & uncertainty in the resources sector. Modest growth, if well managed can progress without significant GBR impacts.

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. • Crime rates. • Perceptions of safety. • Housing including availability & affordability.	**% residents with high financial distress (2, 3 or 4 factors)** • 28.5% Burdekin residents have high financial distress c.w. 20.9% rural & reg. Aust & 22.3% rural & reg. Qld (University of Canberra, 2017). **Regional Crime Rates & domestic safety** • Regional crime rate 12,902 per 100,000 > Qld Av of 9,856/100,000 persons; offences against a person 1,094/100,000 c.w. 634/100,000 for Qld (QGSO, 2017a). • Within the region, Palm Is. has highest rate reported offences at 44,250 per 100 000; and Townsville the second highest at 14,100 per 100,000 persons (QGSO, 2017a). **Perceptions of safety** • Burdekin residents had a mean score of 77.3/100 in response to the question: *How satisfied are you with how safe you feel?* c.w. 80.1% rural & reg. Aust; 81.4% rural & reg. Qld (University of Canberra, 2017). • 81.9% Burdekin 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 (University of Canberra, 2017). **Housing availability & affordability**. • When low-income households have to spend > 30% income on housing, they go without other things, e.g., meals, health care & outings. Thus low-income households in unaffordable housing are in “housing stress” (Troy & Martin, 2017). *Rental Vulnerability Index (RVI)* extreme high = 1; extreme low = 0 • Townsville (postcode 48100) RVI 2011 = 0.244; RVI 2016 = 0.3 • Ayr & Bowen (postcode 4805) RVI 2011 = 0.59; RVI 2016 = 0.634 • Charters Towers (postcode 4820) RVI 2011 =0.641; RVI 2016 = 0.775 (Troy & Martin, 2017). *Insurance* • Tripling of insurance premiums & apartment corporate body corporate fees resulted from extreme weather events of 2011.	• Residents in the region experience higher levels of financial distress than other Queenslanders & Australians/ • Crime rates are higher than the state average, & even higher on Palm Island & in Townsville. • Modern building standards will help minimise cyclone damage to property in the future. • Insurance costs have increased significantly leading to insurance risks (e.g., less cover being taken out/none at all).	**2.5** Crime rate is well above the state average, although > 80% residents believe it is a safe place to live. Major disparities between Aboriginal & non- Aboriginal residents with respect to crime rates & feelings of personal safety.

		However, insurance rates have since dropped, easing pressure on body corporate fees (Raggatt, 2017a). • High risk of severe cyclones in NQ means housing is more expensive due to cyclone ratings; insurance premiums are higher than elsewhere in Aust. (Bureau of Infrastructure,, Transport and Regional Economics [BITRE], 2011; Harwood, Smith & Henderson, 2016). In 2011 following Cyclone Yasi house sale prices in NQ dropped 3% (Lynch, 2011) & insurance premiums for strata-titles increased up to 350% (Hayes, 2011). • However, in 2016 Suncorp released its Cyclone Resilience Benefit program which allows homeowners in cyclone-prone regions to receive up to 20% off premiums based on features of their home that reduce vulnerability in cyclones (e.g., window shutters) (Harwood et al., 2016).		
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. • **Decreasing 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	**Community wellbeing** • Rated as 5.5/7 by Burdekin region residents c.w. 5.5 rural & regional Aust; 5.5 rural & regional Qld (University of Canberra, 2017). **Perceptions of decreasing community liveability** • 19.9% Burdekin region residents perceive decreasing community liveability c.w. 20.2% rural & reg. Aust. residents; & 25.5% rural & reg. Qld residents (University of Canberra, 2017). • Higher temperatures, sea level rise & more intense extreme events associated with climate change may substantially reduce livability, particularly in low-lying islands & coastal locations (Moran & Turton, 2014). *Social isolation* • The Region has a high proportion of Aboriginal &Torres Strait Islander people; rural & remote persons, often living in situations of social isolation; & mining communities with large numbers of fly-in fly out workers (Northern Queensland Primary Health Network [NQPHN], 2016). **Perceptions of personal wellbeing**	• Broad indicators suggest generally high levels of happiness/wellbeing within the region, though this could be improved with better lifestyle choices to reduce rates of obesity/overweight. • Evidence suggests socioeconomic disadvantage is a key driver of regional health & wellbeing disparities (Beard et al., 2009). • Considerable wellbeing disparities emerge for key populations within the region (particularly Indigenous & remote communities).	**3** Major disparities between rural residents & those in regional centres; & between Aboriginal & non-Aboriginal residents with respect to wellbeing.

	part of community; (vii) future security. • **Health.** • **Mental illness.**	• Burdekin residents rated their personal wellbeing as 71.1/100 c.w. 73.7 rural & regional Aust; 73 rural & regional Qld (University of Canberra, 2017). **Health** • Only 1.4% Burdekin residents feel that they suffer poor health c.w. 5.2% rural & reg. Aust; 5.1% rural & reg. Qld (University of Canberra, 2017). • In 2006, life expectancy at birth for Townsville residents was 80.9 years, slightly lower than the Queensland average of 81.5 years. The difference is likely due to lower life expectancy of people of Aboriginal & Torres Strait Islander descent. Life expectancy also decreases with increasing remoteness & socio-economic disadvantage (Queensland Health, 2012). • Townsville has a high rate of obesity– 64.6% population are overweight/ obese c.w. the state av. of 63.3%. The rate was below the state av in 2007 (49.4), but rose to 74.2% in 2012, then dropped to 64.6% in 2015 (Department of Infrastructure and Regional Development, 2017). **Mental illness** • 9.1% Burdekin residents are likely to suffer from a serious mental illness c.w. 9.6% rural & reg. Aust; 10.8% rural & reg. Qld (University of Canberra, 2017).		
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) Quality of Life (QoL); (ii) desirable way of life & ecosystem services e.g., fresh seafood; (iii) optimism about the	**Stress associated with decline in GBR health** • 82% Burdekin residents DISAGREE that they would NOT be personally affected if GBR health declined; 72% 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** • 80% Burdekin residents agree that the GBR contributes to their quality of life & wellbeing; 90% value the GBR because it supports a desirable & active way of life; 62% value the GBR because it inspires artistic or thoughtful ways; 69% value the	• The GBR plays an important role in the health & wellbeing of residents, TOs & visitors. Most are very satisfied with GBR experiences, although many residents express links between declining GBR health and personal well-being (Reef grief).	**4** High levels of wellbeing related to the GBR are reported in both regional & Australian populations.

	future; (iv) satisfaction with GBR experiences; (v) GBR experiences (negative & positive); (vi) physical &/or mental health. • **Indigenous health associated with the GBR**. • **Commercial fishers' wellbeing**. • **Tourism Operators' wellbeing**.	GBR for the fresh seafood it provides; only 43% feel optimistic about the future of the GBR; 79% value the GBR because it makes them feel better physically and/or mentally (Marshall & Pert, 2017). **Indigenous wellbeing** • Indigenous health & wellbeing is affected by a significant collection of chronic health conditions which can & are being minimised by access to & use of GBR resources (Hill & Lyons, 2014). **Coastal residents' wellbeing** • 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). • A survey of 1,545 GBR catchment residents found that 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 the GBR & catchment such as jobs & incomes related to mining, agriculture & commercial fishing sectors (Larson, Stoeckl, Farr & Esparon, 2015). **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).	• Strong & growing levels of evidence exists concerning the health & wellbeing benefits of culturally strong & active connection & use to natural resources, particularly within Indigenous communities. • These benefits are mainly limited by the degree to which communities & people are able to access & enjoy the use of these resources. • Evidence suggests that the GBR plays an important role in the health & wellbeing of residents & visitors.	

		Commercial fishers' wellbeing • In 2013, the GBR contributed to quality of life & wellbeing of 91% Burdekin Region 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). **Australian Residents** • Some 54% of Australians would be personally affected if the health of the GBR declined c.w. 81% GBR coastal residents (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 • CV5.5 Perceptions of access to roads & public transport	**Energy/water security** • Av. electricity bill for Qld residents will rise by 3.3% pa; & 4.1% for Qld small businesses (Queensland Competition Authority, 2017). • Genex Power's $1 billion Kidston solar and pumped hydro energy hub project, 270km NW of Townsville will supply solar energy to the national electricity grid. By 2021, the Kidston facility will be using around 3.5 million solar panels and two water reservoirs to sustainably generate, store and transmit reliable and affordable power (Office of Northern Australia, 2017). • Townsville's Water Security Taskforce established in March 2017 identified several issues including: o Need a clear plan to meet future demand o Regional economic growth constrained due to uncertainty of water supply o Frequency, duration & severity of water restrictions o Sufficient bulk water transport capacity & reliability o Water affordability & suitable pricing for the dry tropics o Greater consumer choice through a user pays system o High energy cost of pumping o Cost of water storage & transport infrastructure o Concerns about efficient and wise water use o Optimal use of alternative local water sources o Long term regional water source reliability.	• All physical & social infrastructure can be severely damaged in extreme weather, leading to adverse impacts on GBR-dependent communities & industries. • Infrastructure & services are generally adequate, although there are major issues with infrastructure associated with water security. • There also appears to be major disparities between Indigenous & non-Indigenous communities & between rural & regional centres. • Major infrastructure issues for Townsville should be resolved through the new	**3.5** Region is reasonably well serviced by schools, hospitals, road, rail, airports, water, gas, electricity, however there are some capacity issues & variation across the region in terms of quality. Challenges remain due to the number of small scattered communities across the region & expanding urban areas along the Fraser Coast & Gympie (Wide Bay Burnett Regional Organisation of Councils, 2016).

		Quality of Infrastructure • Health infrastructure is inadequate (need to send people down to Brisbane for treatment which Townsville should have the capacity to do) (Chamber of Commerce and Industry Queensland [CCIQ], 2016). • A key requirement under Townsville's City Deal (Australia's first 'City Deal') is for targeted federal, state & local government investment in key enabling infrastructure - including vital rail, road & port infrastructure (Department of the Prime Minister & Cabinet [DPM&C], 2016). **Impacts on infrastructure** • After the 2011 floods infrastructure damage impacted commercial fishers' ability to get fish to market, & tourism operators were affected by damaged infrastructure, e.g., jetties, resorts, roads, rail & airports (Gooch, Vella, Marshall, Tobin & Pears, 2013). • The existing poor state of infrastructure & services in Indigenous communities such as housing, water, energy, sewerage & roads is likely to further deteriorate under climate change (Hill & Lyons, 2014). • When it rains in coastal towns such as Bowen & Ingham, the Bruce Hwy floods & many businesses come to a halt. Potholes are filled, but roads are not flood-proofed. Road transport costs continue to rise, while services from freight companies continues to decline (CCIQ, 2016). **Perceptions of access to infrastructure & services** • Burdekin residents rated their access to health, education, aged care & child care as 4.4/7 c.w. 4.8/7 for both rural & regional Aust & rural & regional Qld; they rated their access to roads & public transport as 4/7 c.w. 3.8 for rural & regional Aust & 53.9% rural & regional Qld (University of Canberra, 2017).	intergovernmental Townsville City Deal.	
Rating				**16**
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 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.

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** • Burdekin Region's marine & coastal habitats contain globally significant natural heritage, e.g., turtle & seabird nesting & roost sites; coral spawning, migrating whales, fish spawning aggregations; superlative natural beauty above & below the water; & provides some of the most spectacular scenery on earth. (Context, 2013). **Perceptions of natural beauty & other World Heritage attributes** • 91% Burdekin Region residents value the GBR because it attracts people from all over the world & 91% value the GBR simply because it exists, even if they don't use or benefit from it (Marshall & Pert, 2017). • 95% regional residents agree that the GBR's aesthetic beauty is outstanding & 96% value the GBR because it supports a variety of life, such as fish and corals; however only 44% residents like the colour/clarity of water along the beaches in their region, & 80% agree there is too much rubbish on these beaches (Marshall & Pert, 2017). **Impacts on GBR World Heritage values**	• Assessment & monitoring of Outstanding Universal Value (OUV) & aesthetics is a new field, & methods are being trialled now for application in the future. • 95% of Burdekin Region residents are proud that the GBR is a World Heritage Area (WHA) & believe it has outstanding aesthetic beauty; however only 46% are happy with water colour & clarity and 80% believe there is too much rubbish on local beaches. • Climate change is predicted to increase the	**3** Regional has not been subject to significant bleaching, Crown-of-Thorns-Starfish (COTS) and cyclonic events. Potentially threatened by coastal development & extreme weather events.

		• Between 2007-2013 hard coral cover declined by 28% in this section of the GBR, but abundance of selected fish species has remained stable (ABS, 2015a). • 2016 -2017 coral bleaching event had a significant impact on coral condition in this section of the GBR, detracting from the regions world heritage values (Hughes, Schaffelke & Kerry 2016; Hughes et al., 2017). • Evidence is mounting that PoT dredging has adverse impacts on nearby fringing reefs (Hughes, 2014).	intensity of extreme weather events, which are significant in driving impacts to coastal and marine ecosystems (Waterhouse et al., 2017).	
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. • Levels of TO satisfaction with: (i)	**ID, state & trend of Indigenous heritage values** • Only 44% Burdekin residents agree that the GBR is important for Traditional or cultural practices but 71% value the GBR because of its rich Traditional Owner heritage (Marshall & Pert, 2017). • 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 Field Management Program (FMP) manages cultural & Indigenous 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). • GBRMPA has prepared draft guidelines for TO heritage impact assessment in the permission system (GBRMPA, 2016a). **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*	• Strong TO use of sea country resources remain across the region, but this is poorly qualified & quantified. • Capacity of TO land & sea institutions has increased substantially in the past decade. • 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. • While progress has been made by GBRMPA in engaging with GBR TOs, further work is needed to develop a mutually agreed & culturally appropriate	**2** Strong TO use of sea country resources remains across the region, but this is poorly qualified & quantified. Capacities of land & sea institutions & formal agreements for managing use have improved dramatically over the past decade but generally continue to have capacity concerns. Significant work still remains in securing sea country rights & financially viable (Indigenous led) land & sea management capacities in sea country estates across the region.

	Identification, documentation & storage of cultural information; (ii) TO led methodologies; (iii) participation in GBR management; (iv) extent to which Traditional Ecological Knowledge (TEK) is identified, maintained & transferred. • Levels of TO use & dependency on the GBR.	• Several TO groups have local land & sea management plans, which identify NRM values, issues & actions. Capacity building in NRM activities is a priority for Indigenous people to improve personal, community & country health & wellbeing (NQ Dry Tropics, 2016). • About 8 Traditional Use of Marine Resources Agreements (TUMRAs) cover 24.6% of the GBR, i.e., 45,200 km^2 & involve 16 TO 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 TOs to determine how to store, handle & manage Indigenous knowledge appropriately (GBRMPA, 2016a). • GBRMPA has prepared draft guidelines for TO heritage impact assessment in the permission system (GBRMPA, 2016a). *(iii) TO-driven frameworks & participatory monitoring methods* • Insufficient data currently exists. **Traditional Owner satisfaction with GBR management** • Insufficient data currently exists. **TO use & dependency on the GBR** • Insufficient data currently exists.	processes for joint planning. • 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 change (Hill & Lyons, 2014).	
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** *% **disagreement** with: 'I like the environment & surrounds I live in':* • 3.5% Burdekin Region Residents disagree c.w. 4.2% for rural & regional Aust & 5.3% rural & regional Qld (University of Canberra, 2017). **GBR as 'culture'** • 57% Burdekin Region residents see the GBR as an important part of their culture; 93% love living beside the GBR; 96% B-M residents are proud the GBR is a WHA; 63% agree that the	• GBR values are deeply reflected in contemporary national culture, & at the GBR catchment scale, but less so at the Burdekin regional level.	**3.5** There is a high level of contemporary cultural integrity in relation to the GBR at a national level which is not necessarily reflected at the regional scale.

		GBR is part of their identity; & 51% 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; World Heritage (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).		
CH4 Historic maritime heritage (since European settlement)	• Identification, protection & management of historic heritage in GBR environments. • Cultural significance of historic heritage values for the GBR.	• QDEHP & GBRMPA have management plans for 6 historic shipwrecks including *SS Yongala* (GBRMPA, 2016a). • *Yongala* - Australia's most popular historic shipwreck diving experience & one of the world's top 10 dive site is a gravesite of 122 people. In 2011 it was extensively damaged by Yasi (Viduka, 2007; Waterson, Stieglitz, Wachenfeld & Hewitt, 2014). • A nationally significant RAAF WWII Catalina wreck off Bowen is protected through a GBRMP special management area. People can apply for a permit to access the site for cultural heritage purposes, including monitoring, research and stabilising the wreck (GBRMPA, 2015). • Across the GBR > 800 historic shipwrecks, but only ~ 40 located & ~ 20 positively identified (P. Illidge, personal communication). • Historic sites are under pressure from natural threats (cyclones, sediment erosion), vessel anchoring, & pilfering (GBRMPA, 2017c; P. Illidge, personal communication).	• Key historical maritime heritage assets tend to be considered & managed by a disparate range of institutions & agencies (e.g., historical societies, Queensland Parks and Wildlife Service (QPWS), Indigenous Land & Sea Institutions, etc.). • The evidence base concerning the identification, protection & management of historical heritage in the Burdekin & adjacent GBR remains limited & fragmented.	**2.5** While there is a strong historical heritage asset across the GBR coast, the asset remains poorly defined, planned & managed, with the exception of the *SS Yongala* & the Catalina wreck off Bowen.

		• Obligations under Reef 2050 Plan e.g., Action HA 11 not being met (P. Illidge, personal communication). • 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, personal communication).	
Rating			**11**
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	• Gross Regional Product (GRP). • Core industries.	**Townsville** • NQ's focus for warehousing, retail, manufacturing, health care, education, research & defence. It has strong linkages to the region's natural resources, including: mining – NW & NE Qld minerals; coal & gas; grazing; sugar cane, horticulture & GBR fisheries (TCC, 2013). • Important service hub, linked to supply chains & value- adding services. PoT - main sea link to region's mineral, ag. areas, & towns. PoT handles 1/8 Qld's international trade & is serviced by major road & rail networks (NQ Dry Tropics, 2016). **Gross Regional Product** • GRP of $697.9m pa for cropping & horticulture (ABS, 2016b). • Burdekin Shire & Ingham together produce 1.6M tonnes raw sugar (26% of Australia's production) (ABS, 2016b). • Broad acre crops $402.5m pa, (crushed cane/$355.2m; sorghum/$38.1m) (ABS, 2016b).	• Diverse economy, although dependent on natural resources, especially mining & minerals. • Townsville is often described as a 'garrison city' for its large defence base – Australian Defence Force (ADF) & RAAF.	**3.5** Economic uncertainty in the region remains high due to high dependence on resources sector. While Australia technically is not in recession, we have had negative growth over the last two quarters & wage growth is at a record low.

		• Horticulture $286.2m pa, main products are: tomatoes/$59.3m, capsicums/ $41.7m, melons/ $37.2m, beans/$15.6m, mangoes/ $14.4m, potatoes/$6.2m. (ABS, 2016b). • 9% of population graze 1,400,000 cattle across 90% of Region for local & global markets (ABS, 2015b). GRP $511.7m pa (ABS, 2016b). • Townsville exports a significant number of *Bos Indicus* feeder cattle to SE Asia.		
EV2 Economic viability of *Reef-associated industries* [2]	• Mining & minerals. • Ports & shipping. • Agriculture.	**Mining, extraction & mineral processing** • Employs around 4,295 people, 12,789 additional flow on employees. GRP of about $2.2b (Townsville, Charters Towers, Burdekin & Whitsunday LGAs only) (Queensland Resources Council [QRC], 2015). • Galilee is one of the largest untapped coal reserves on the planet. Coal shipped OS via Abbot Point bulk coal port (The Galilee Basin, 2015). • Townsville has 3 major mineral processing operations: Queensland Nickel refinery (currently under care and maintenance), Sun Metals Zinc refinery and Glencore Copper refinery (QRC, 2015; The Galilee Basin, 2015). **Ports & shipping** • Proposed new coal mines in the Galilee Basin are driving expansion proposals for several GBR ports (The Galilee Basin, 2015). • PoT is an international freight gateway for Northern Australia; facilitating import of goods to 700,000 people; & export of minerals, Ag. Products & general cargo to 240 countries. PoT has > 30 cargo types & is the largest port in Nth Aust. & the country's largest exporter of zinc, lead, sugar, fertiliser & molasses. Industries relying on PoT support 9000 jobs. During	• Intensification of agriculture will likely place pressure on marine & coastal areas through changes in water availability & water quality associated with increased chemical use. • While agricultural production continues to grow, water availability & seasonal & storage proposals are expensive & may have viability limits. • Challenges for Reef-associated industries in the Burdekin Region include: declining coal price & markets, high carbon emissions, potential environmental impacts to surrounding	**3.5** 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 viability limits.

[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).

		2015/2016, > $10B in cargo value moved through PoT (https://www.townsvilleportexpansion.com.au/). • Trade volumes through PoT are expected to treble over next 30 years & vessels are increasing in size, so PoT plans to widen & deepen its channel & build more berths (https://www.townsvilleportexpansion.com.au/). • PoT expansion requires 6M tonnes of dredging- spoil to be disposed onshore & in land reclamation (AECOM, 2013). **Regional Agriculture** • Challenges include climate variability, market drivers & global market shifts, (e.g., strength of AUD, export demand), business costs, regulation, protecting the GBR, ownership of abattoirs, ownership of sugar processing & marketing. Bio-security, declining soil health (NQ Dry Tropics, 2016). • Category 4 Tropical Cyclone Debbie hit Airlie Beach in March 2017 causing about $1M damage to horticulturalists including widespread damage crops & infrastructure in the Bowen-Gumluu area, which supplies about 80%-90% Australia's capsicums & tomatoes during winter. Farms are still slowly recovering (Wilson, 2017).	environment & GBR; risk to surface & groundwater; high financial leakage from the region due to 'fly in fly out' workforce (NQ Dry Tropics, 2016).	
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** • GBR tourism, recreation & fishing industries remain specifically vulnerable to the impacts of the Global Financial Crisis (GFC) & repeated extreme weather events (DAE, 2013; 2017; Marshall et al., 2013a; 2013b). • 2016 -2017 coral bleaching event had a significant impact on coral condition in this section of the GBR, highlighting the Office of the Great Barrier Reef vulnerability of the area & people who depend on it for their livelihoods to future climate change (Barber et al, 2016; Hughes, Schaffelke & Kerry, 2016; Marshall et al., 2013a).	• Challenges for GBR-dependent industries include predicted climate change impacts, decline in water quality, lack of fish passage connectivity, adverse impacts on intertidal nursery habitats & marine ecosystems (NQ Dry Tropics 2016).	**2.5** Repeated extreme weather events & coral bleaching means many corals do not have time to recover & even pristine reefs are not immune.

[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.

		• 97% Burdekin regional 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 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). • 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). **Economic viability** *Tourism & recreation* • GBR Tourism contributed $5,684B to the Australian economy in 2015-2016; Burdekin Region contributed about 1/5 ($ 1,050) – 2nd highest after the WT Region (DAE, 2017). • GBR tourism provides 58,980 jobs; 11,655 are in the Burdekin (DAE, 2017). • GBR recreation contributed $206M to the national economy; $53M came from this region (DAE, 2017). *Fishing* • Commercial fishing industry needs clean ocean waters & Burdekin Region's fishers are most concerned about impact of future PoT development on their future viability (NQ Dry Tropics, 2013). • Total GBR Gross Value of Production (GVP) of commercial fishing & aquaculture in 2015-16 was $199 M; $43M (24%) was generated in the Burdekin Region (DAE, 2017). • 184 people are employed in comm. fishing or aquaculture in the region – cw 814 across the whole GBR (DAE, 2017). • There are 79 active licences in this section of the GBR c.w. 603 GBR-wide (Tobin et al., 2014).	• Opportunities include expansion of sustainable aquaculture operations; using new technology; innovation to reduce barriers to fish passage & trawling by-catch (NQ Dry Tropics, 2016). • Extreme events, particularly those that damage important areas of the GBR for tourism, may generate severe & long-lasting reductions in visitation. Further, media portrayal of extreme weather events will negatively influence visitor perceptions & may exacerbate the negative economic consequences on the tourism industry (Stoeckl et al., 2014).

		• GBR commercial fishing is an aging industry. Most are owner-operators rather than 'investors', & operate in one fishery type - line, trawl, net, pot or harvest (Tobin et al., 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% resp. (ABS, 2017a). • Over the last decade the asset value of GBR coral trout commercial quota has reduced to <10% of peak value (i.e., numbers have declined (Tobin, Lewis, & Tobin, 2016). • 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).		
EV4 Inclusive-ness & economic fairness/ equity	• Income – personal & household. • Opportunities for GBR Traditional Owners. • Equity between Reef-dependent industries/activities.	**Regional Income** • 20.3% of Burdekin residents are in the in most disadvantaged quintile; 16.2 % in least disadvantaged (QGSO, 2017a). • In 2016 Isaac LGA had the highest median weekly family income with $2365 pw; Palm Island had the lowest of $927 pw. • In 2016, 27.3% Burdekin people earned < $20,800 pa c.w. 28.4% across Qld; 32.2% earned bet. $20,800 to $51,999 c.w.33% across Qld (QGSR, 2017a). • Opportunities for GBR TOs. • Aboriginal participation in GBR tourism is very low, as measured, by ads in local tourism trade literature (DAE, 2017). **Equity between industries/activities** • 63% Burdekin comm. fishers believe they have fair access to GBR resources (Tobin et al., 2014). • Commercial fishers feel under increased pressure for GBR access from recreational fishers, conservation based closures, & coastal development that impact where vessels may operate (Pascoe et al., 2016). • QDAF's 2014 harvest strategy allows coral trout stock recovery, but reduces annual commercial catch. Catch taken by	• Economic circumstances impacts families in a number of ways, for example their ability to afford healthy food or travel in order to access health care (NQPHN, 2016). • Some evidence reflecting inequities between commercial fishers & other GBR users. • Regional brain drain of high-skilled high-income professionals continues to drive reduced disposable income/ expertise. • Most of the Region's population is on low income (i.e., almost 1/3	**3** Ongoing resource decline & regional-capital city inequities could drive declining equity.

		recreational fishers may be hindering stock recovery (Tobin et al., 2016).
		Harvest labour
		• 3 types harvest workers:
		  ○ itinerant Australians – repeat workers
		  ○ 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, dependence upon a single contractor, poor language skills, exclusion from unions & regulatory protection, & social isolation. (Iaquinto, 2017; Underhill & Rimmer, 2016).
		• Backpackers - 25% Australia's ag. workforce & up to 85% for some seasonal harvests - few career paths for permanent residents; but sudden decreases in backpackers could adversely affect ag. production (Iaquinto, 2017).
			earn < $20,800 pa while costs of living is rising).
			• There are post-cyclone compensation disparities for fishing c.f. agriculture.
			• Issues with harvest labour highlight many inequities that need to be addressed by all levels of government.
			• Transient & 'backpacker' populations skew workforce participation figures & creates problems in building a diversified & stable workforce in GBR related industries.	

EV5 Workforce participation & employment	• Regional employment participation rates & trends. • GBR- related employment.	**Burdekin region** • Dec. 2016 - 10.7% of employed persons worked in Health care & social assistance industry cw 11.9% for Qld; 10.2% in Retail trade; c.w.10.7% in Qld. Highest specialisation ratio of 2.61 in Mining industry. Unemployment was 9.5 % c.w. 6.1% across Qld; Palm Island - highest rate of 57.3%; Isaac - lowest rate of 2.1% (QGSR, 2017a). • Since the collapse of Yabulu nickel refinery in 2016, Townsville's unemployment rate has skyrocketed. Townsville region has the 2nd highest unemployment rate in the state (11.3%), trailed only by Outback Queensland (11.4%) (Flaherty, 2017). **GBR- Related Employment.** • In the Burdekin in 2015-2016 there were 184 people directly employed in GBR commercial fishing & aquaculture; 843 in GBR-related recreation; & 11, 655 employed in tourism (DAE, 2017).	• Unemployment continues to run higher than most areas around Australia. Indigenous & youth unemployment is high. • Employment in resources, construction, agriculture, GBR-based fishing & tourism is particularly vulnerable to impacts of global economic shifts & climatic events. • Numbers employed in GBR-related industries	**2** The Burdekin economy is subject to volatility in resources sector & high dependence on backpackers. Unemployment is higher than the state average for most sectors/ groups, however GBR-

		• Approx. $106M was generated through Reef-related scientific research in 2012, contributing $98M to Australian economy & generating > 880 Full Time Equivalent (FTE) jobs. Most of these jobs are located within the Burdekin region (DAE, 2013).	in the region (apart from tourism) is higher than others in the catchment.	related industries are relatively healthy.
EV6 Economic confidence in the region	• Regional economic confidence.	**Regional Economic Confidence** • Opportunities for Reef-associated industries in the Burdekin Region include integrated multi-purpose pastoral land use & management, including tourism & carbon sequestration; regional expansion & diversification; ethanol production from sugarcane; application of new technologies; nine coal mega mines planned for region would generate large workforces in construction and operations; projects may include rail and port construction (NQ Dry Tropics, 2016). <u>Townsville City</u> • Highly entrepreneurial city with more than 1,600 new firms registered in 2014, the second highest number of business entries within Queensland in that year (DPM&C, 2016). • Outlook for Townsville continues to be one of gradual recovery. New projects, employment, & population growth are helping regional recovery from resources sector downturn & 2016 closure of Yabulu Nickel Refinery (Townsville Enterprise [TE], 2017). • Townsville respondents of the latest CCIQ Pulse Survey were extremely pessimistic about their economic outlook (Flaherty, 2017). • Primary economic indicators for Townsville are yet to show signs of improvement, but the PVW Partners business confidence index continues to show strength, with local businesses indicating positive confidence for the 6th consecutive quarter (TE, 2017). • Townsville City Deal (TCD) 15 year commitment bet. Comm. Gov., Qld Govt & TCC to support the city to be, by 2030: (i) Economic gateway to Asia & Nth Aust; (ii) A prosperous & lifestyle rich city for its community & visitors; (iii) A global leader in tropical & marine research & innovation.	• 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. • Region's economic confidence is generally low but changing due to initiatives described in the TCD & other regional initiatives.	**3** Future economic confidence currently rides on uncertainty in the resources sector. Emerging strategies are looking to stabilise & grow the economy.

		• TCD includes the following initiatives: (i) preferred NQ location for industrial development; (ii) attract new employment & diversify economy by building on natural advantages, embracing digital solutions, using the sharing economy & developing an appropriately skilled workforce; (iii) defence hub; (iv) port city; (v) enabling Infrastructure - reliable & secure energy & water supply; (vi) large-scale irrigated agriculture development NW of Townsville (vii) edu-tourism; (viii) NQ stadium & Waterfront Priority Development Area (WPDA) (DPM&C, 2016). • Construction is hoped to begin in 2018 on $2B lithium-ion battery plant south of Townsville. However, to date, there is no State or Federal support for the project (Cameron, 2017; Raggatt 2017b). **Consumer Confidence** • Townsville median house price: $367,000 in 2009; up to $378,000 in 2014 & drop to $300,000 in 2017 (REA Group Ltd, 2017a). • Bowen median house price: $335000 in 2009; up to $364,000 in 2014 & big drop to $253,000 in 2017 (REA Group Ltd, 2017b). • Ayr median house price: $250,000 in 2009; up to $253,000 in 2013 & drop to $205,000 in 2017 (REA Group Ltd, 2017c). • Charters Towers median house price: $203,000 in 2009; slight increase to $210,000 in 2010 & big drop to $125,000 in 2017 (REA Group Ltd, 2017d). • Building approvals are yet to improve - currently ½ required levels to service projected long-term population growth (TE, 2017). **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 the future of their business in the GBR; 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 • Only 64% comm. fishers in this region are optimistic about the future of the GBR & only **36%** are optimistic about the future of their business in the GBR (Tobin et al., 2014). • Across the whole GBR, 71% commercial fishers are optimistic about the GBR's future, but only 52% are optimistic about the future of their business in the GBR. They scored 5.4/10 in their belief that things will turn out well for them in future. 6.2/10 are uncertain of how to plan for change. They are more likely to adapt than other coastal residents (7.4) & many plan for their financial security (6.7). Many are keen to learn how to better prepare for change (6.7) (Marshall et al., 2013a).	
Rating			**17.5**
Maximum for this Cluster			**30**

Cluster Five: Governance

Governance 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.

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, Property Management Groups (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 (Dale et al., 2016c; Gooch et al., 2017).	• 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.

			• There is no cohesive framework for managing future land use & associated management actions in the Burdekin region context.	
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. • Sectoral/community contributions to decision-making. • Inter-generational equity in Reef-related decision-making. • Intra-generational equity in Reef-related decision-making.	**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. • 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 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). **Inter-generational equity in Reef-related decision-making** • Only 32% Burdekin residents feel that future generations have been adequately considered in GBR management (Marshall & Pert, 2017). **Intra-generational equity in Reef-related decision-making** • 77% regional residents agree that they have fair access to the GBR compared to other user groups (Marshall & Pert, 2017);	• 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) & the risk of implementation failure related to the catchment-based delivery of Burdekin Region actions envisaged under the Reef 2050 Plan.	**2**

		while 63% Burdekin 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% 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 19% Burdekin region residents think enough is being done to effectively manage the GBR & 46% are confident that the GBR is well managed; 45% are confident that local freshwater areas are well managed (Marshall & Pert, 2017). **Sectoral/community contributions to decision-making** • TOs are routinely marginalised in development of policy & delivery systems (Dale et al., 2016a). • 60% regional residents feel like they can contribute to GBR management (Marshall & Pert, 2017).	• Policy making capacities limited in regard to designing effective delivery systems, risking implementation failure. • Local residents are not confident that the GBR is well managed, & do not believe enough is being done to effectively manage the asset. More than half, however believe they can contribute to management.	**2.5** All required institutional actors play an important role in GBR governance, but capacities are limited across government, industry, community & Indigenous sectors.

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).	• 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 TO land & sea institutions.	**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				**11.5**
Maximum for this Attribute				**20**

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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 Park are diminished

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[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

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 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

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[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,

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 2012 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.

Heritage

A place's natural and cultural environment having aesthetic, historic, scientific or social significance, or other significance, for current and future generations of Australians.

Historic heritage includes places associated with the non-Indigenous cultural heritage of Australia encompassed in the country's history. It can include historic shipwrecks, World War II features and sites, lightstations, places of scientific significance – e.g., research stations, expedition sites; places of social significance – e.g., iconic sites such as Ninney Rise (Mission Beach), 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 places tell us about national and social developments in Australia over the past few centuries, technical and creative achievements, and provide a tangible link to past events, processes and people.

Indigenous heritage includes all places that are part of Aboriginal and Torres Strait Islander peoples' spiritual links to the land or which tell the story of Indigenous peoples from time immemorial to the present. It can include cultural practices, observances, customs and lore, sacred sites, sites of particular significance, places important for cultural tradition; stories, songlines, totems and languages; Indigenous structures, technology, tools and archaeology; ceremonial sites like bora rings and rock art, fish traps, burials, middens, scarred trees, camp sites and semi/permanent settlements.

World Heritage – sites of natural beauty and outstanding natural phenomena.

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