

# Effects of Natural Disasters on Social-Economic Dimensions of Reef-Based Industries

## Queensland Coastal Conference 2011

### Ancient Knowledge Contemporary Innovation

Wednesday 19 – Friday 21 October 2011

The Pullman Reef Hotel, Cairns

Margaret Gooch<sup>1</sup>, Karen Vella<sup>2</sup>, Katie Moon<sup>1</sup>, Nadine Marshall<sup>3</sup>, Renae Tobin<sup>4</sup>, Rachel Pears<sup>1</sup>, and Chloe Schauble<sup>1</sup>

<sup>1</sup> Great Barrier Reef Marine Park Authority, PO Box 1379 QLD 4810

<sup>2</sup> Griffith University School of Environment, Gold Coast Campus, Southport QLD 4222

<sup>3</sup> CSIRO, PMB Aitkenvale QLD 4811

<sup>4</sup> James Cook University, Townsville, QLD 4811

#### ABSTRACT

In coastal areas extreme weather events such as floods and cyclones can have debilitating effects on the social and economic viability of reef-based industries. In March 2011, the Great Barrier Reef Marine Park Authority implemented an Extreme Weather Response Program (EWRP) following a period of intense flooding and cyclonic activity between December 2010 and February 2011. In this presentation we discuss the results of one project within the EWRP which aimed to: 1) assess the impacts of extreme weather events on regional tourism and commercial fishing industries; and 2) develop and road test an impact assessment matrix to improve government and industry responses to extreme weather events. Results revealed that extreme weather events both directly and indirectly affected all five of the measured dimensions, i.e. ecological, personal, social, built and economic. The severity of these impacts, combined with their location and the nature of their business, influenced how tourism operators and fishers assessed the events (low, medium, high or extreme). The impact assessment tool was revised following feedback obtained during the workshops, and will prove useful in predicting the potential direct and indirect impacts of future extreme weather events.

#### INTRODUCTION

In 2010, Queensland was subjected to the wettest December on record (Commonwealth of Australia, 2011a). Swollen coastal rivers in central Queensland led to huge flood plumes contaminating Great Barrier Reef waterways with increased freshwater, sediments, nutrients and pesticides. North Queensland was also exposed to several cyclones including Category 5 Severe Tropical Cyclone Yasi, which crossed the coast at Mission Beach in the early hours of February 3<sup>rd</sup>, 2011 (Commonwealth of Australia, 2011b). Such extreme weather events can have debilitating effects on the social and economic viability of Great Barrier Reef industries which are economically important for communities, regions and for Australia as a whole.

In 2011 the Great Barrier Reef Marine Park Authority (GBRMPA) undertook an Extreme Weather Response Program which included a social and economic project to rapidly assess the social and economic impacts of floods and cyclones during 2010/2011 on commercial fishers and tourism operators in the GBR. Specifically, it sought:

- To improve collective understanding of the adaptive capacity of Great Barrier Reef fishing and tourism sectors impacted by extreme weather events; and
- To test and refine an approach that can be used in future long-term socio-economic monitoring of trends pertaining to relevant Great Barrier Reef industry and community groups.

As part of the social and economic project, GBRMPA staff held two workshops. This paper reports on these workshops – one focusing on reef tourism and one focusing on commercial fishing – and highlights the key learning's that emerged from these activities.

## **BACKGROUND**

Industries in the Great Barrier Reef are economically and socially important to Queensland and Australia as a whole. In 2005-6, the total (direct and indirect) economic contribution of tourism, commercial fishing, and cultural and recreational activity in the Great Barrier Reef towards Australian gross product was A\$6.9 billion (Access Economics, 2009). Tourism dominates these economic contributions, generating \$5.1 billion in 2006/2007 (Access Economics, 2009). Approximately 80% of all Reef tourism occurs in either the Cairns/Port Douglas region, or the Whitsunday islands and reefs (Great Barrier Reef Marine Park Authority, 2009). After tourism, the next major Reef contributor to the Australian economy is commercial fishing, valued at \$139 million in 2006/7 (Access Economics, 2009; Great Barrier Reef Marine Park Authority, 2009). There are 10 major commercial fisheries operating in the Great Barrier Reef. The main commercial sectors are the net, trawl, line and pot fisheries (Great Barrier Reef Marine Park Authority, 2009). In 2005-6, the total gross production value of the industry was \$251 million (Access Economics, 2009). These reef-based activities provide employment and, in the case of fishing, food security and are socially and culturally significant. Government, industry, and community stakeholders need to know which actions, policies and arrangements build and support resilient industries in the face of extreme events.

## **METHODS**

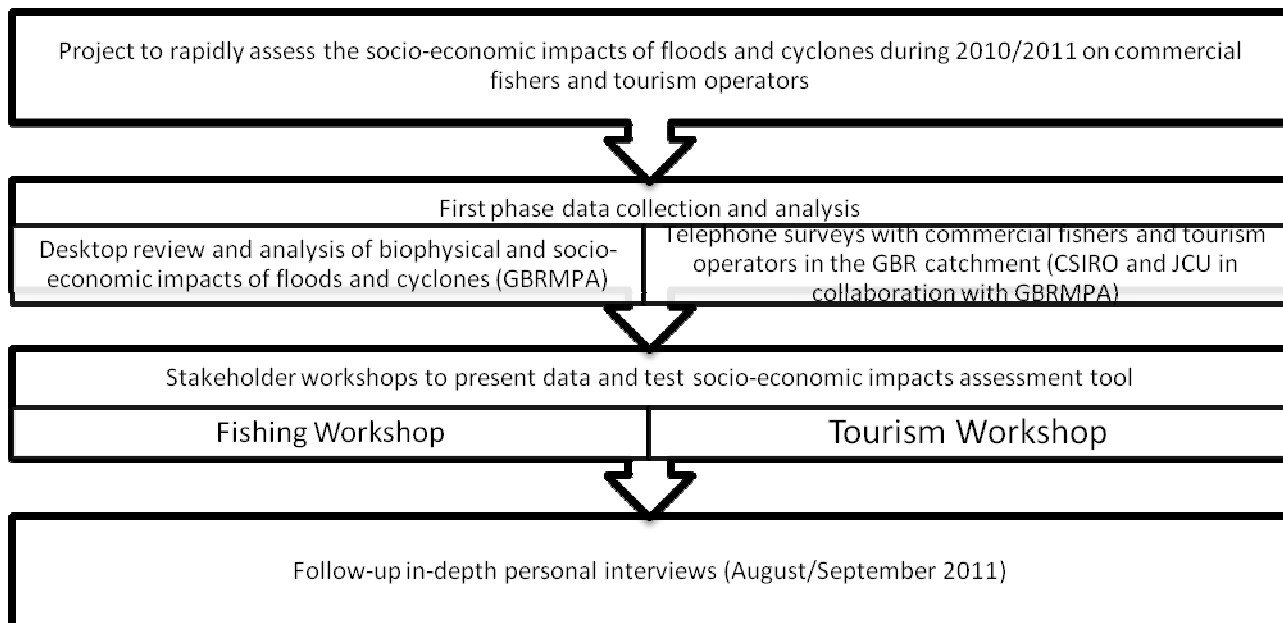
The social and economic project within GBRMPA's Extreme Weather Response Program involved a number of components to assess the socio-economic impacts of extreme events on GBR fishing and tourism industries (figure 1). This paper focuses on describing the process and outcomes from the stakeholder assessments via the workshops. In the lead up to the stakeholder workshops GBRMPA undertook the following:

- a) A desktop review of biophysical and socio-economic impacts of floods and cyclones in the GBR using information from a variety of Queensland and Commonwealth government agencies as well as from non-government sources including media releases. Data were collected and analysed on five dimensions of impacts related to the health of the socio-economic systems in the Reef Fishing and Tourism industries. These five dimensions of impacts were classified as follows: 1) natural system impacts, 2) personal impacts, 3) social/ local community impacts, 4) impacts on infrastructure, and 5) business impacts (industry health).
- b) Developed an Extreme Weather Event Impact Assessment Matrix tool (refer Attachment 1) to facilitate rapid and integrated socio-economic assessment of the impacts of recent events on reef industries. The Extreme Weather Event Impact Assessment Matrix categorises the possible consequences of the recent floods/cyclones. It is used in conjunction with Definitions of Extreme Weather Impact (Attachment 2) to classify the impacts of extreme weather along a continuum from low impact to extreme impact. Both the Extreme Weather Event Impact Assessment Matrix and the Definitions of Extreme Weather Impact are adapted from the Climate Change Risk Management Matrix developed by the Queensland Government. Like GBRMPA's Tourism Response Framework for Environmental Incidents, the new tool seeks to help government and industry stakeholders to determine the level of response required after extreme events by providing an accurate snapshot of the socio-economic impacts of the event. The aim is to allow accurate communications with visitors, stakeholders and media regarding the actual impacts of extreme events and assist in building a clear case for the need for recovery funding and/or specific resources (when required) from state and federal incident management / response agencies.
- c) Commissioned CSIRO to undertake over 200 telephone surveys of affected commercial fishers and tourism operators.

### **Stakeholder Workshops**

Using the background information collected in the first phase, GBRMPA staff convened two workshops in June, 2011 – one each for commercial fishing and marine tourism. The goals of the workshops were simply to: a) present the results of the 200 telephone surveys and secondary data analysis to participants for discussion and reflection, and b) invite participants to use their knowledge and experiences to assess the social-economic impacts of floods and cyclones on the tourism and fishing industry across the GBR using the impact assessment matrix tool. Participants in the workshops were given Attachments 1 and 2 to

support rapid assessment and they were also asked to provide feedback on the usefulness of the matrix tool.



**Figure 1 Project Methodology**

Nineteen people participated in the Reef tourism workshop including: ie Reef tourism operators and industry associations (n= 11); GBRMPA (n=5); other Australian Government (n=2); and Tourism Queensland (n=1). Thirteen people participated in the commercial fishing workshop including experts from the Fishing Industry/Queensland Seafood Industry Association with expertise in different kinds of operations and different parts of the Great Barrier Reef (n=7); Queensland Government (Queensland Fisheries ) (n=3); and GBRMPA (n= 3).

Firstly, participants individually rated the impacts of recent weather events along a five-point scale where *catastrophic* =5; *severe* = 4; *major* = 3; *moderate* = 2; and *minor* =1. Participants then combined their scores to produce an overall rating of the weather event as being either low (total ratings 0-9), medium (total ratings 10-15), high (total ratings 16-20) or extreme (total ratings 21-25). In the Commercial Fishing workshop, participants broke into groups and used the Matrix, together with their own knowledge, experiences and secondary data, to undertake an assessment of the impact of the recent floods and cyclones in (a) Cairns/Port Douglas, (b) Innisfail - Cardwell, (c) Townsville, and (d) Bowen. These areas were chosen as they best reflected the areas represented by the participants. Participants in the Reef tourism workshop followed exactly the same procedure, except that they focussed on the following areas for their assessments: (a) Cairns/Port Douglas, (b) Cassowary Coast (Cardwell-Mission Beach), (c) the Whitsundays, and (d) the Southern sub-regions.

## RESULTS AND DISCUSSION

### Impacts of Extreme Weather Events in the GBR

A highly summarized account of results of the impact assessment can be found in Table 1. According to the workshop participants, the extreme weather events directly and indirectly affected all five of the measured dimensions - natural systems, personal, social/ local community, infrastructure, and business (industry health) across the Great Barrier Reef although the nature and extent of impacts varied by industry and Great Barrier Reef sub-region. We will now present a summarized account of industry findings by sub-region which emerged from the workshops.

#### *Impacts In The Cairns/Port Douglas Area*

Cyclone Yasi had a **medium** overall impact on **commercial fishing** in the Cairns/ Port Douglas Area. It should be noted that this assessment focused on the Marine Aquarium Fishery based on participation from this fishery (together with government agency staff). The group did not feel collectively that it had the

necessary expertise to assess other fisheries. Specific impacts of the cyclone included the damaging effects of brown-outs on generators and motors, disrupted transportation and lack of supplies (e.g., Chlorine). Participants also noted that it was difficult to retain staff without income. Participants also felt that this event had made them more vulnerable to extreme future weather (and other) events. Participants noted that financial pressures pushed people to engage in risky behaviour, which had negative impacts on the environment and on people (e.g., getting out on the water when it was not safe).

Even though **tourism** in the Cairns/Port Douglas area had declined since the extreme weather events, the actual impact of cyclones on tourism in the area was assessed as **low**. This was because damage to the Reef was thought to be minor and isolated, and operators have alternative sites. Despite this, tourism numbers were down, and this was thought to be due to negative media stories following Cyclone Yasi.

**Table 1: Impact assessment of extreme weather events on commercial fishing and tourism per area of interest**

AREA	Estimate of impacts on tourism	Estimate of impacts on commercial fishing
Cairns/ Port Douglas	Low	Medium NB: aquarium and coral fisheries only
Hinchinbrook/ Cardwell/ Mission Beach	High	Extreme
Townsville	NOT assessed	Medium
Bowen	NOT assessed	High
Whitsundays	Medium	NOT assessed
Southern Great barrier Reef	Impacts of floods - <b>Medium</b> Impact of cyclones – <b>Low</b>	NOT assessed

*Impacts In The Hinchinbrook/ Cardwell/Mission Beach Area*

Cyclone Yasi was assessed as having an **extreme** impact on **commercial fishing** in the Hinchinbrook/ Cardwell/Mission Beach area. Participants in this group comprised government agency staff together with multi-endorsed fishers. These fishers identified feelings of uncertainty about their capacity to bounce back in the future after this cyclone, particularly because people had only just recovered from Cyclone Larry in 2006. At the time of the workshop, many participants had not been back to work since Cyclone Yasi. Participants reported that they had experienced damage to homes and other private property and that there had been substantial damage to public infrastructure. Their first priority was to ensure their houses and personal possessions were repaired before attempting to go back to sea; that is, the post-cyclone clean up took priority because of the extent of the damage and the need to re-establish the household. Some residents here were without power for approximately eight (8) weeks. Other impacts included major damage to roads, boat ramps and boats. For those who ventured out to fish following the cyclone, some experienced damage to their boat motors from debris in the water. Participants reported that due to infrastructure damage, and ongoing poor weather, many fishing areas were still inaccessible at the time of the workshop some 4 months after the cyclone. Strong winds and rough seas had prevailed for weeks at a time, reducing fishing time. When fishers were able to get to sea, the large amounts of debris left in the water after the cyclone damaged nets beyond repair. One participant commented that he had to take a chainsaw to clear logs and other debris in the water to access the Reef. As a result, participants were uncertain about the impact of the cyclone on actual catch rates. Participants identified impacts to the fishery, including debris, leaf litter, black water (toxic), and fish kills of unicorn/reef fish and eels. It was noted that all fisheries had been affected and so the capacity of fishers to diversify was reduced. Participants stated that they were involved in informal networking and that there had been a strong focus on assisting others within their small community but that this had also cost time. Many communities in the area did not have a State Government appointed Recovery Officer in place for some time after the cyclone causing delays in accessing funding guidelines. Participants also reported that since the cyclone, the decline in Cairns tourism had impact on the market demand for seafood.

Impacts of cyclones on **tourism** in the Hinchinbrook/ Cardwell/Mission Beach area was assessed as **high**. Each category was rated as 4 on the 1-5 scale, with *Infrastructure Impacts* being rated at 4+. Members of this group added a whole new row for media perception. The point was that 'Canberra saw Queensland was closed, the World saw Australia as closed'. This group felt that within each impact category some of the descriptors were less relevant than others, and some seemed to have more weighting than others (e.g. in the Personal category the reference to large numbers of serious injuries in the *Major* category seemed to rule out choosing *Major* although other parts within that category were met).

#### *Impacts On A Variety Of Fisheries In The Townsville Area*

Participants determined that the cyclone had a **medium** impact on the **commercial fishing** in Townsville. They felt that it was too hard to assess the impact of the event on biodiversity and that the Reef Surveys conducted by GBRMPA should be replicated in other habitats. Some positive impacts were noted by participants, including improved access and that the council-led recovery had built community spirit. Participants in this group felt that the best measure for looking at business impact is income and that weather events have reduced profit margins. Participants were not optimistic about the future.

#### *Impacts On A Variety Of Fisheries In The Bowen Area*

Participants determined that the cyclone had a **high** impact on the **commercial fishing** in the Bowen Area. This was largely to do with the cumulative impact of Cyclones Hamish, Ilii, Anthony, and Yasi on the Reef, people, and the industry. Participants only wanted to discuss areas that they were familiar with. They reported that in terms of the Fishery, Mackerel was absent but that high catch rates were observed for other species. Participants noted that different communities have different dependencies. Impacts noted by participants included out-migrations (lost employment); husbands kicked out of homes, impacts on transport, low catch rates, low tourism and declines in tourism dependent seafood markets. Vulnerabilities reported included that many people are locally specialized so they may not be flexible to move, and that some boats were still not working, which meant cuts in staff numbers, owners working more, and greater impacts on family. The issue of the media coverage was raised by participants and the inconsistent messages emerging from the media, government and the industry. Participants noted ambiguities about what grants/funding and assistance packages were available and also that fortnightly payments had helped to retain staff (50% hours). Nevertheless, some participants reported that there had been up to 50% staff loss in some fishing operations.

#### *Impacts On Tourism In The Whitsundays*

Extreme weather events have had a **medium** impact on **tourism** in the Whitsundays. Because of the floods, operators had to contend with road closures and damage to the Bruce Highway as well as airport closures which meant that tourists couldn't get to Reef destinations. Power cuts due to cyclones (Anthony and Yasi) and negative media coverage of the damage caused by floods and cyclones to the area resulted in fewer people visiting the Reef.

#### *Impacts On Tourism In The Southern Great Barrier Reef Area*

Impacts of floods have had a **medium** impact on **tourism** in the southern Great Barrier Reef area, while the impact of cyclones Anthony and Yasi have had a **low** impact on **tourism** in this area. Although there were obvious impacts on infrastructure due to flooding (particularly to roads and airports) participants thought that the most adverse impact on the area was due to negative media reports.

### **Overall findings and reflections on the approach**

The floods and cyclones during 2010/2011 have had high, and in some cases extreme, socio-economic impacts on commercial fishing and tourism operations in the GBR. Unsurprisingly the nature and extent of impacts from extreme weather events vary for industries within locations and certainly across the regions of the GBR. Interestingly there was strong consensus among participants in the tourism workshop that the direct impacts of both floods and cyclones were exaggerated in the media, leading to a downturn in domestic and international tourists visiting the Reef. The biggest take-home message from the tourism operators was to ensure all media get accurate accounts of reef damage early, as the perceived negative

media may cause enormous damage. This was somewhat at odds with views from participants in the commercial fishing workshop who believed that damage to coastal and reef ecosystems had resulted in reduced catch rates in a number of fish populations. Further, damage to infrastructure including boats, jetties, sheds, roads and other transport links further impeded their capacity to get fish to market. Debris in the water and dangerous conditions due to rough seas for several months after the extreme weather (especially in the northern parts of the Marine Park) meant that some fishers had not yet returned to work. Participants in both workshops made the point that there was a strong public perception that governments and others could do more to help reef-dependent industries after critical environmental incidents. Nevertheless, participants realised that this was not necessarily the case, because different government agencies have specific mandates and legislation to work within.

Each workshop provided a useful forum for developing and testing the 'Matrix', and provided valuable insights into how it could be modified and used in future to support assessment of the socio-economic impacts of extreme events on reef-based industries. Details about modifications to the Matrix are beyond the scope of this paper, but Attachment 3 shows the next iteration. Participants recommended that in the future, surveys seeking to identify impacts on businesses should consider all business sizes (small – large). The commercial fishers suggested that future assessments should include more industry people with first-hand experience, especially those from across the different fishery types. They also recommended that separate assessments be undertaken for each of the major fisheries, as the impacts of the extreme weather events are likely to vary according to each fishery. Participants also suggested that business impacts may increase with time. There was also some discussion about the timing for post-event monitoring and the assessment of impact. Some participants in the commercial fishing workshop suggested that a phased assessment might be undertaken:

- 1 month after the event (measure direct impacts)
- 4-6 months after the event (gather data on direct impacts and begin assessments)
- 12 months after the event (summarise direct and indirect impacts).

At the end of each workshop, participants were asked whether it would be useful to derive a set of 8-10 questions from the Matrix that could be used immediately following an extreme weather event or other critical incident to assess impacts on industries. This idea was not overly supported in the tourism workshop, and Reef tourism operators cautioned GBRMPA not to ask questions of Reef tourism operators *immediately* after a severe impact. Further, they stressed that if GBRMPA staff were to ask key questions of operators immediately, sensitivity is very important. They also recommended that GBRMPA undertake the rapid assessment internally, based on the five categories and using anecdotal and secondary data sets. Reef tourism operators also recommended that GBRMPA contact disaster recovery units directly to obtain information about impact, rather than contacting operators.

## CONCLUSIONS

Using an Impact Matrix comprising five dimensions of impacts (ecological, personal, social, built and economic), two expert panels concluded that the extreme weather events of 2010/2011 adversely affected both reef-based tourism and commercial fishing to a greater or lesser extent along the length of the Great Barrier Reef. The full social and economic impacts of the extreme weather events are still to be calculated, and these workshops provide limited but potentially useful insights into how management agencies might respond to these events in future. Participants in the tourism workshop felt that the major impact of the extreme weathers event was caused by the sensational media coverage of the events, rather than the direct impact of the events themselves.

Limitations of the rapid impact assessments include the lack of representation of each of the ten commercial fisheries and the full range of tourism operators at each of the workshops. However, the workshops were really useful in bringing affected operators together to discuss common problems and to think about ways to better cope with future events. The Matrix has been changed considerably since the workshops, and will be piloted again, in preparation for future events.

## **TAKE HOME MESSAGES**

Recent extreme weather events (floods and cyclones) have directly and indirectly affected all five of the measured dimensions of impact (i.e. ecological, personal, social, built, and economic) for the commercial fishing and tourism industries across the GBR.

The severity of these impacts, combined with their location and the nature of their business, influenced how tourism operators and fishers assessed the events (low, medium, high or extreme).

The impact assessment tool was revised following feedback obtained during the workshops, and will prove useful in predicting the potential direct and indirect impacts of future extreme weather events.

## **ACKNOWLEDGEMENTS**

The authors would like to thank Tara Smith (Fisheries Queensland) for helping to organise the commercial fisheries workshop, and allowing us to conduct the workshop within Fisheries Queensland's two day meeting about the Reef Line Disaster Response Strategy. We would also like to sincerely thank Peter Frawley (Chair of the TRRAC) and Chris Briggs (GBRMPA Director, Tourism and Recreation) and all other members of the TRRAC for allowing us to conduct the workshop within their two day meeting. Both workshops took up a considerable amount of their meeting time. We would also like to acknowledge the way in which all participants engaged in the activities and helped us to work towards the development of a useful management tool. Finally, we would like to thank all of the Reef tourism operators and commercial fishers who were interviewed for the CSIRO telephone surveys and acknowledge their generous contributions to the project, despite having to contend with their own difficult circumstances.

## **REFERENCES**

- Access Economics. (2009) Research Publication No. 98: Economic contribution of the GBRMP, 2006-2007  
Townsville: Great Barrier Reef Marine Park Authority.
- Commonwealth of Australia (2011a). Monthly Weather Review, Queensland, December 2010. Available from <http://www.bom.gov.au/climate/mwr/>. Accessed on 25th August, 2011.
- Commonwealth of Australia (2011b). Monthly Weather Review, Queensland, February 2011. Available from <http://www.bom.gov.au/climate/mwr/>. Accessed on 25th August, 2011
- Great Barrier Reef Marine Park Authority. (2009) Great Barrier Reef Outlook Report. Townsville: Australian Government.

### Attachment 1: Extreme Weather Event Impact Assessment Matrix

IMPACT CATEGORY	Catastrophic (5)	Severe (4)	Major (3)	Moderate (2)	Minor (1)
<b>Natural systems</b>	Extreme, permanent and widespread damage to site access, scenic quality; &/or biodiversity. Widespread irrecoverable ecosystem damage. Visitor access to key sites is permanently lost.	Severe, widespread damage to site access, scenic quality, &/or biodiversity. Most visitors unable to access one or more key sites for at least one season. Significant marine tourism industry resources needed to repackaging this experience.	Major, semi-permanent damage to at least one of the following: site access, scenic quality, biodiversity. Most visitors unable to access one or more key sites for several months OR some visitors unable to access one or more key sites for more than a season. a long period.	Isolated but significant instances of damage. Visitor access to key sites may be lost for a few weeks. Integrity of iconic sites maintained. No overall decline in visitor experiences.	Low proportion of visitors prevented from accessing non-iconic sites for a short to long period. No decline in visitor experiences.
<b>Personal</b>	Loss of lives, mass outmigration, family ties destroyed, no sense of security, safety, no plans to stay in the same location, future plans destroyed	Significant numbers of serious injuries, severe outmigration, family ties severely disrupted, little sense of security and personal safety, no plans to stay in the same location, future plans severely disrupted	Large numbers of serious injuries, higher than usual outmigration, family ties disrupted or destroyed, little sense of security and personal safety, uncertain plans to stay in the same location, current plans disrupted, future plans uncertain	A number of minor injuries, some outmigration, family ties may be disrupted, sense of security and personal safety may be undermined, plans to stay in the same location may be affected, current plans disrupted, future plans disrupted	Few cases of minor injuries, family ties not disrupted, sense of security and personal safety may be diminished, current plans may change, future plans may change
<b>Social/ local community</b>	Complete breakdown in networks/communication, loss of regional support institutions; regionally economy is destroyed negative media reporting and market perception.	Severe breakdown in networks/communications, gross reduction in regional institutions, only limited support services provided; regionally economy is severely affected; negative media reporting and market perception.	Major reduction in networks/communications, limited access to regional institutions, support services unreliable; regionally economy is affected; negative media reporting and market perception.	Moderate disruption to networks /communications, reduced services provided by regional institutions, necessary support services provided with minor disruptions; minor impact on regional economy; some negative media reporting.	Isolated instances of breakdown in networks/ communications, limited disruption to services; positive market perception.
<b>Infrastructure</b>	Infrastructure unable to support industry, potential inability to rebuild.	Severe devastation to infrastructure, loss of essential services; high repair costs; major alteration of routes &/or pick-up, drop off points	Major devastation to infrastructure; high repair costs; significant alteration of routes &/or pick-up, drop off points.	Low repair costs; minor alteration of routes or pick up or drop off points.	Little or no damage to infrastructure, services easily restored, safe transportation not impeded.
<b>Business (Industry health)</b>	Large proportion (>50%) of operations fail to re-establish; irreplaceable loss of labour and other permanent impacts. No alternative sites available. Increased operating costs. No clients; no intention to remain in industry, no capacity to diversify	Large proportion (>50%) of operations likely to become unviable; significant loss of labour. Most operators need alternative sites to remain viable; increased operating costs; few clients; may not remain in industry, little capacity to diversify	Many operators need to relocate to alternative sites to remain viable; some loss of labour; increased operating costs; client numbers down; still intend to remain in industry, some potential to diversify within industry	Some operators need access to alternative sites, which offer a comparable experience. Some loss of unskilled labour. Some increased operating costs; client numbers down; intend to remain in industry, capacity to diversify	Business remains profitable with slight reductions in growth. Alternative site not needed. May have increased operating costs; Client numbers slightly down; intention to remain in industry, capacity to diversify



## Attachment 2: Definition of Extreme Weather Impact.

(Adapted from Climate Change Risk Management Matrix: a process for assessing impacts, adaptation, risk and vulnerability, Qld Gov 2011).

<b>Definition of Extreme Weather Impact</b>	
<b>Extreme</b> (Total ratings 21-25)	This level of impact demands urgent attention at the most senior leadership levels of industry and government. Effective responses are always transformational and not part of routine action.
<b>High</b> (Total ratings 16- 20)	This level of impact needs attention at senior levels of industry executives, agency management and policy development. More senior industry and government representatives need briefing. Effective responses are usually transformational and not generally incremental routine action.
<b>Medium</b> (Total ratings 10-15)	This level of impact needs close monitoring and reporting on at senior levels (industry and peak body executives, agency senior management). Effective responses may be incremental and part of routine action.
<b>Low</b> (Total ratings 0- 9)	This level of impact requires that they be maintained under review but existing controls should be sufficient and no further action is required unless the situation changes.

# Attachment 2: Definition of Extreme Weather Impact

Time since event \_\_\_\_\_ months \_\_\_\_\_ Region \_\_\_\_\_

1	Extent of impact to site access	Sites destroyed -10 -9 -8 -7 -6 -5 -4 -3 -2 -1	Inaccessible -5 -4 -3 -2 -1	No impact 0 1 2 3 4 5 6 7 8 9 10	Increased accessed 3 4 5 6 7 8 9 10
2	Extent of impact to ecosystems	Ecosystems destroyed -10 -9 -8 -7 -6 -5 -4 -3 -2 -1	Ecosystems damaged -4 -3 -2 -1	No impact 0 1 2 3 4 5 6 7 8 9 10	Improved ecosystem health 3 4 5 6 7 8 9 10
3	Extent of impact to productivity	No productivity -10 -9 -8 -7 -6 -5 -4 -3 -2 -1	Lost productivity -4 -3 -2 -1	No losses 0 1 2 3 4 5 6 7 8 9 10	Increased productivity 3 4 5 6 7 8 9 10
4	Extent of impact catch rates	Annual losses -10 -9 -8 -7 -6 -5 -4 -3 -2 -1	Monthly losses -4 -3 -2 -1	No losses 0 1 2 3 4 5 6 7 8 9 10	Monthly gains 3 4 5 6 7 8 9 10
5	Extent of impact to scenic quality	Sites destroyed -10 -9 -8 -7 -6 -5 -4 -3 -2 -1	Quality diminished -4 -3 -2 -1	No impact 0 1 2 3 4 5 6 7 8 9 10	Quality improved 3 4 5 6 7 8 9 10
6	Extent of personal injuries	Multiple deaths -10 -9 -8 -7 -6 -5 -4 -3 -2 -1	Multiple injuries -4 -3 -2 -1	No impact 0	No impact
7	Extent of impact to personal property	Homes destroyed -10 -9 -8 -7 -6 -5 -4 -3 -2 -1	Homes damaged -4 -3 -2 -1	No impact 0	No impact
8	Extent of out-migration	Permanent outmigration -10 -9 -8 -7 -6 -5 -4 -3 -2 -1	Temporary outmigration -4 -3 -2 -1	No movement 0 1 2 3 4 5 6 7 8 9 10	Temporary immigration 3 4 5 6 7 8 9 10
9	Extent of impact within families	Divorce -10 -9 -8 -7 -6 -5 -4 -3 -2 -1	Stress -4 -3 -2 -1	No impact 0 1 2 3 4 5 6 7 8 9 10	Cooperation 3 4 5 6 7 8 9 10
10	Extent of impact to safety/security	Very insecure/unsafe -10 -9 -8 -7 -6 -5 -4 -3 -2 -1	Moderately insecure/unsafe -4 -3 -2 -1	No impact 0 1 2 3 4 5 6 7 8 9 10	Moderately secure/safe 3 4 5 6 7 8 9 10
11	Extent of impact of media coverage	Lasting negative international media -10 -9 -8 -7 -6 -5 -4 -3 -2 -1	Negative national media -4 -3 -2 -1	No impact 0 1 2 3 4 5 6 7 8 9 10	Positive national media 3 4 5 6 7 8 9 10
12	Extent of impact on community spirit	Spirit lost -10 -9 -8 -7 -6 -5 -4 -3 -2 -1	Spirit damaged but recoverable -4 -3 -2 -1	No impact 0 1 2 3 4 5 6 7 8 9 10	Spirit lifted 3 4 5 6 7 8 9 10
13	Extent of government support	No support -10 -9 -8 -7 -6 -5 -4 -3 -2 -1	Inadequate support -4 -3 -2 -1	None needed 0 1 2 3 4 5 6 7 8 9 10	Adequate support 3 4 5 6 7 8 9 10
14	Extent of community support	No support -10 -9 -8 -7 -6 -5 -4 -3 -2 -1	Inadequate support -4 -3 -2 -1	None needed 0 1 2 3 4 5 6 7 8 9 10	Adequate support 3 4 5 6 7 8 9 10
15	Extent of impact to networks	Networks destroyed -10 -9 -8 -7 -6 -5 -4 -3 -2 -1	Networks failed -4 -3 -2 -1	No impact 0 1 2 3 4 5 6 7 8 9 10	Networks functional 3 4 5 6 7 8 9 10
16	Extent of impact to road/rail infrastructure	Damaged > 1 month -10 -9 -8 -7 -6 -5 -4 -3 -2 -1	Damaged > 1 week -4 -3 -2 -1	No impact 0 1 2 3 4 5 6 7 8 9 10	Services improved/increased 3 4 5 6 7 8 9 10
17	Extent of impact to airports	Closed > 1 month -10 -9 -8 -7 -6 -5 -4 -3 -2 -1	Closed > one week -4 -3 -2 -1	No impact 0 1 2 3 4 5 6 7 8 9 10	Services improved/increased 3 4 5 6 7 8 9 10
18	Extent of impact to marine infrastructure	Extensive irreparable damage -10 -9 -8 -7 -6 -5 -4 -3 -2 -1	Moderate reparable damage -4 -3 -2 -1	No impact 0 1 2 3 4 5 6 7 8 9 10	Infrastructure improved/increased 3 4 5 6 7 8 9 10
19	Extent of impact to industry infrastructure	Extensive irreparable damage -10 -9 -8 -7 -6 -5 -4 -3 -2 -1	Moderate reparable damage -4 -3 -2 -1	No impact 0 1 2 3 4 5 6 7 8 9 10	Infrastructure improved/increased 3 4 5 6 7 8 9 10

20	Extent of impact to telecommunications	No services > 1 month -10 -9 -8 -7 -6 -5 -4 -3 -2	No services > 1 week -1	No impact 0	1	2	3	4	5	6	7	8	9	10
21	Extent of impact to profit	Nil in foreseeable future -10 -9 -8 -7 -6 -5 -4 -3 -2	Nil in immediate future -1	No impact 0	1	2	3	4	5	6	7	8	9	10
22	Extent of impact to staff	Unable to recruit -10 -9 -8 -7 -6 -5 -4 -3 -2	Unable to retain -1	No impact 0	1	2	3	4	5	6	7	8	9	10
23	Extent of impact on willingness to remain in industry	Will not remain -10 -9 -8 -7 -6 -5 -4 -3 -2	May not remain -1	Undecided 0	1	2	3	4	5	6	7	8	9	10
24	Extent of reliance on new loans	Totally reliant -10 -9 -8 -7 -6 -5 -4 -3 -2	Moderately reliant -1	Not reliant 0	1	2	3	4	5	6	7	8	9	10
25	Extent of impact to business	Irrecoverable damage -10 -9 -8 -7 -6 -5 -4 -3 -2	Recoverable damage -1	No damage 0	1	2	3	4	5	6	7	8	9	10