NCCARF Synthesis and Integrative Research Program

NCCARF
National
Climate Change Adaptation
Research Facility

Case studies of extreme events

The 2008 floods in Queensland: A case study of vulnerability, resilience and adaptive capacity

Image: Hydro Response

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Published by the National Climate Change Adaptation Research Facility 2010

ISBN: 978-1-921609-18-3 NCCARF Publication 16/10

Please cite this report as:

Apan, A, Keogh, DU, King, D, Thomas, M, Mushtaq, S & Baddiley, P 2010, *The 2008 floods in Queensland: A case study of vulnerability, resilience and adaptive capacity,* National Climate Change Adaptation Research Facility, Gold Coast, 171 pp.

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Acknowledgement

This work was carried out with financial support from the Australian Government (Department of Climate Change and Energy Efficiency) and the National Climate Change Adaptation Research Facility (NCCARF). The role of NCCARF is to lead the research community in a national interdisciplinary effort to generate the information needed by decision makers in government, business and in vulnerable sectors and communities to manage the risk of climate change impacts.

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Preface

The National Climate Change Research Facility (NCCARF) is undertaking a program of Synthesis and Integrative Research to synthesise existing and emerging national and international research on climate change impacts and adaptation. The purpose of this program is to provide decision-makers with information they need to manage the risks of climate change.

This report on the 2008 Floods in Queensland: Charleville and Mackay forms part of a series of studies/reports commissioned by NCCARF that look at historical extreme weather events, their impacts and subsequent adaptations. These studies examine particular events – primarily extremes – and seek to explore prior vulnerabilities and resilience, the character and management of the event, subsequent adaptation, and the effects on present-day vulnerability. The reports should inform thinking about adapting to climate change, i.e. capacity to adapt, barriers to adaptation, and translating capacity into action. While it is recognised that the comparison is not and never can be exact, the overarching goal is to better understand the requirements of successful adaptation to future climate change.

This report highlights the 2008 floods in Queensland. In this case study, we compare the impact of flooding, the response at the time and subsequent adaptations in two Queensland towns, Charleville and Mackay. Both towns were flooded in early 2008: Charleville in a widespread and slowly developing event in January; Mackay in a flash flood in February. In January 2008, flood-producing rains occurred along the Queensland coast between Townsville and Mackay and inland over central and southwestern Queensland. These heavy rains were associated with a low pressure centre tracking southward across the state, the remnant of Tropical Cyclone Helen. Coastal and inland river catchments flooded. The Warrego River, which flows along the northern edge of Charleville, rose by 6m, peaking on 22 January, and Bradley's Gully, which flows through the middle of town, rose by 3m, peaking on the 18 January. The coastal region of Mackay experienced minor flooding in the January event. However, on 15 February, an intense and localised rainstorm produced a flash flood that damaged 4000 houses, caused schools to close and damaged the local road network. Power was lost to 6200 homes and mobile and land line communications were disrupted.

Other reports in the series are:

- Cyclone Tracy
- East Coast Lows and the Newcastle-Central Coast Pasha Bulker storm
- Storm tides along east-coast Australia
- Heatwaves: The southern Australian experience of 2009
- Drought and the Future of Rural Communities: Drought impacts and adaptation in regional Victoria, Australia
- Drought and water security: Kalgoorlie and Broken Hill

To highlight common learnings from all the case studies, a Synthesis Report has been produced which is a summary of responses and lessons learned.

All reports are available from the website at www.nccarf.edu.au.

Table of Contents

List of Figures

List of Tables

Executive Summary

Climate change is a major and urgent issue of global significance. In Australia, its effects are already being experienced in the form of higher temperatures and more frequent extreme events. A warmer climate will increase the risk of floods, while continued and frequent severe flooding will be "virtually certain" during the twenty-first century. This could cause more severe damage to people, property, and the environment in Australia where flooding is already the nation's costliest form of natural disaster. Losses from floods are estimated at over $300 million a year.

Adaptation strategies are needed for floods at local and regional scales which consider the impacts on both individuals and societies. To this end, a sound understanding is needed of not only an area's bio-physical and socio-demographic attributes, but of a community's vulnerability, adaptive capacity and resiliency. It is important to evaluate the effectiveness of flood mitigation measures and also gain insights into how communities may cope with repeated and more frequent events and their ability to cope and endure.

This report presents an historical case study of the 2008 floods in Charleville and Mackay. These towns were considered representative of a small inland outback town and a large coastal city (respectively), and both towns have significant areas situated on highly vulnerable flood plains.

The aim of this study was to understand how societies that are regularly flooded respond and adjust to flood events and the extent of their resilience; the characteristics of communities that may be considered 'on the edge', where flooding might push them into non-viability; the extent to which flood mitigation measures (including *State Planning Policy 1/03*) have been applied to reduce the vulnerability to flood events; and to identify the characteristics of vulnerability, resilience and adaptive capacity to flooding of households, businesses and institutions.

Charleville has a well-documented history of floods since 1910 mainly from the Warrego River and has suffered more than 10 major floods which have isolated the town and caused major disruptions to road and rail links. Its most recent major floods occurred in 1990, 1997 and 2008. The 2008 inundation flood occurred when Bradley's Gully peaked at 3.1 m. In comparison, flooding from the Pioneer River poses the greatest geohazard threat in Mackay with the highest flood recorded in 1958 peaking at 9.14 m. The 2008 flood studied was a flash flood, caused by intense local rainfall.

A purposive sampling research design was used to conduct three phases of data collection. Each phase targeted at a different group of stakeholders: *household residents, businesses* and *government institutions*. Two types of survey instruments were used, i.e. structured questionnaires and semi-structured face-to-face interviews. Household and business participants were restricted to those affected by the 2008 floods in the case study regions. Data were analysed using appropriate quantitative and qualitative techniques

The study found that in terms of vulnerability to flood, only 32 % of Charleville residents and 57 % of businesses had flood insurance cover making them more vulnerable to economic losses. Insurance in that town is difficult to obtain and very expensive. Mackay householders were found to lack initiative in seeking out information on flood risk, despite the fact that they live on a floodplain, and only about half felt that it is not necessary to prepare for floods as they can rely on Council and/or Emergency Services for assistance. They demonstrated low levels of personal responsibility in terms of flood preparedness.

The elderly were found to have lower levels of resilience, and in Charleville, temporary accommodation resources were limited. Psychological impacts of the flood were highlighted particularly in the Mackay population, who due to a large itinerant population are less likely to be experienced in coping with flood events, as compared to Charleville residents. Only 8 % of Mackay businesses felt they were significantly or very prepared for the flood event with only 15 % receiving a warning of the flood event and few considered floods a threat to personal safety. In comparison, Charleville businesses consider the risk of floods as a threat to business activities and they actively think about, talk about and source information on floods.

A variety of **flood mitigation measures** (including *State Planning Policy 1/03*) have been applied to different extents to reduce the vulnerability of communities to flood events. In Charleville, the Murweh Shire Council has a flood overlay as part of the Town Plan. The industrial area is outside the flood prone area, and new commercial premises in the flood area are required to have an upstairs area or an Evacuation Management Plan. Habitable dwellings need to be at least 300 mm above the last known flood height (i.e. 300 mm above the 1997 flood height level), and the Council is using the Queensland 1-in-100 height.

In Mackay, the minimum building floor level is 300 mm above the defined flood event. This has resulted in the building of houses on slabs on the ground to reach this height. Consequently, this policy may be having the effect of contributing to the development of wetlands, storm surge and flood prone areas by effectively advocating infilling or reclamation of land to ensure that development is above the 1 % AEP (100-year Annual Recurrence Interval (ARI). It is cheaper to build houses on slabs as opposed to traditional methods that use houses built on stilts.

Charleville residents displayed high levels of **resilience** having strong personal networks, high levels of sense of belonging in the community, participation in community activities and good levels of tertiary education. Residents believed that they have a responsibility for preparing for floods. Similarly, Mackay households were found to have high sense of belonging to the community. However, they expressed low levels of personal responsibility when it came to preparing for flood events. In addition, just over half the Mackay residents had never experienced a flood event before and hence may have few frameworks for coping. The community itself has low rates of formal volunteerism rates (although there may be informal networks) and generally lower participation rates in the community. In both case study regions, more than 60 % of residents had lived in their town for more than 10 years.

With regards to **adaptive capacity** of householders, many Charleville and Mackay residents were found to be putting into practice advice given on floods. Most respondents would not move to another town or to another area of either Mackay or Charleville, respectively, if another flood affected their property. The decision to stay may be interpreted as in indication of resilience. However, a decision to move can be seen as an adaptive response (rather than a lack of resilience).

While most of the populations in both towns would not consider moving within the town or to another town in response to future floods, a significant proportion (37 % in Mackay and 44.5 % in Charleville) expressed a positive consideration of moving in response to future events. Furthermore, in carrying out the initial survey drop in Mackay, it was clear that significant numbers of households had already moved out of the area since the 2008 flood, although we cannot know why. However, if significant numbers of households respond to future increased occurrences of floods by shifting location, the impact on each town will be considerable, and this is clearly a household adaptive response.

A large proportion of Mackay residents rated government and community groups highly in terms of their preparedness, suggesting strong levels of capacity amongst government and community groups. Charleville residents rated the preparedness of State Government, utility providers and their local hospital highly (78 %, 59 % and 49 %, respectively).

About half the Mackay residents had not experienced a flood event before and most importantly this group seemed to have quite a neutral attitude as to whether resources such as skills, cost and the need for cooperation with others, may limit their ability to prepare for future events. They may consider this responsibility as someone else's and not theirs. Little evidence was found of factors which may weaken the adaptive capacity (apart from low levels of insurance) amongst Charleville residents.

A large proportion of Mackay businesses are putting in practice advice given on floods. The majority are not likely to move out of Mackay or Charleville or to another area of Mackay or Charleville, respectively, in the event of another flood. While the numbers of businesses considering relocation are low, the impact of around 20 % of the businesses in each town shifting location is considerable. As with households, relocation is an adaptive change. Moving businesses within Charleville is not feasible as there is only one business centre, but 18 % of businesses stated that they would consider leaving the town in the event of future flood impacts. In Mackay, none of the businesses considered leaving town, but 21 % saw relocation to a less flood prone business centre within Mackay as an adaptive strategy.

Charleville businesses appear to have strong networks with others in terms of cooperation. This group rated Charleville Hospital highly in terms of being very prepared for future flood events. Adaptive capacity could be improved by solving the Bradley's Gully problem and/or other mitigation measures to improve risk from floods. Consequently, the insurance industry could be approached with evidence of these new measures so that new insurance products can be designed to enable residents and businesses to take up affordable insurance for flood. The Mackay Regional Council intends to implement mitigation strategies including various engineering solutions to direct floodwaters from the Gooseponds Creek away from the Glenella Industrial Estate.

Few Mackay businesses intend joining groups to discuss flood risk and many were unsure how prepared different government and community groups were for future floods. They believe that local residents could be better prepared for future flood events and expressed concern about the level of preparedness of other groups as well. They were unsure whether skills or cooperation with others is a barrier to them preparing for future floods. This may stem from a lack of knowledge on their part as to what skills and cooperation is needed and how much it might cost. They may also consider this the responsibility of someone else.

Charleville businesses saw cost as a barrier in terms of preparing for future flood events, as well as the fact that they have other things to think about apart from floods. They believed local residents could be better prepared for future flood events. As in the case of Mackay businesses, few intend joining groups to discuss flood risk, and many were unsure how prepared different government and community groups were for future floods.

The study found little evidence of resilience amongst Mackay businesses. Most businesses in Mackay have operated in the area for 6 or more years and 67 % had never experienced a flooding before. This group had low formal volunteer rates amongst business staff (23 %). In the case of Charleville businesses, most had operated in the area for more than 10 years and had substantial formal volunteer rates of around 54 %. This group's main low resilience characteristic

is its low levels of insurance cover, as discussed above. A lot of businesses in Charleville commented that they are reluctant to move out of town as they will lose substantial business. They said it is very important that they remain close to town for the convenience of customers.

The study **concluded** that those established in areas that are vulnerable to regular flooding, who had greater connections within the community, displayed more resilience in the event of a disaster flood event. The Charleville community was found to be staunchly resilient, with high levels of sense of belongingness and commitment on the part of residents, businesses and institutions to remain in the community irrespective of future flood events. By comparison, Mackay had low community participation and formal volunteerism rates and a general belief that they have a limited personal responsibility to prepare for floods. Divergent views were found in Mackay on the question of belongingness, suggesting weaker levels of resilience in Mackay.

In Mackay, the length of time a business had been established was linked to flood impacts indicating a complacency to flood events at some point as evidenced by the expansion approved for the development of industrial estates and retail outlets in lower lying areas of Mackay. The Mackay community could be considered a *less resilient community* as compared to Charleville in terms of *social capacity* but Charleville was considered to be a *less resilient community* in terms of *economic capacity*.

Whilst this study found the elderly was a social group vulnerable to disaster flood events, it particularly highlighted the psychological impacts of the flood on the community. The research of the Mackay 2008 flood indicated that lack of prior exposure to disaster events was a critical factor contributing to mental health and reducing the resilience of communities in the post-disaster phase. Consequently, it is recommended that mental health be included as a component in the consequences phase in addition to the 'macro-economic' impacts that may in turn increase the vulnerability of a population.

The research conducted did not show any direct correlation between implementing mitigation measures and avoidance of flood impacts in Mackay. However, due to the purposive methodology used in the research design where those households and businesses that received flood damage were selected, this may subsequently indicate that those who were not impacted by the floods had implemented a greater number of mitigation measures which provided greater resilience to the flood event. Planning and development was found to play a critical role in the resilience of communities to disaster events such as flooding.

This research indicates a significant increase by households and businesses affected by the disaster flood event to implement flood mitigation actions. Data from the research found both residents and businesses may consider moving to other parts of Mackay but the majority indicated that they would not move to another town which highlighted the preference to live in the urban coastal city despite its vulnerability to natural disaster events such as flooding. However, there may be some scope to recognise that households affected by natural disasters move to another suburb or town as a means to increasing their adaptive capacity. Businesses in Charleville had no alternative location to move to and few of their residents contemplated relocation.

1 Introduction

1.1 Background

Climate change is currently considered a major and urgent issue of global significance. In Australia, its effects are already being experienced in the form of higher temperatures, more frequent extremes, including heatwaves, bushfires, droughts and floods (McAlpine *et al.,* 2009). For example, the year 2009 in Australia will be remembered for its extreme heatwaves, bushfires, dust-storms, flooding and rainfall deficiencies. The Bureau of Meteorology data indicates that in 2009, Australia's annual mean temperature was 0.90°C above the 1961-1990 average, making it Australia's second warmest year since reliable records commenced in 1910 (BOM, 2009a).

A warmer climate, with its increased climate variability, will increase the risk of floods (Wetherald and Manabe, 2002; IPCC, 2007). According to the IPCC 2007 report, more severe coastal storm surges and flooding will be "virtually certain" during the twenty-first century. Coupled with the projected intense precipitation events that can inundate certain areas, flooding could cause more severe damage to people, property, and the environment. In Australia, extreme events (including flooding) tend to inflict large environmental and economic costs, which are exacerbated by the fact that they can be difficult to adequately manage through adaptive processes (Preston and Jones, 2006).

The characteristics and causes of floods vary, as do their impact on individuals, communities, societies and the environment. Consequently, the implementation of flood mitigation measures (either using structural and non-structural approaches) needs to accommodate varying flood-people-environment attributes. Moreover, as floods depend on many factors (e.g. precipitation intensity, volume, timing, etc.) and can occur in several forms (e.g. river floods, flash floods, urban floods, rural floods, etc.), adaptation strategies to flooding are specific to the affected entities, location and spatial scales (e.g. Kirshen *et al.,* 2008; IPCC, 2007; Adger *et al.,* 2005). As challenging as it seems, adaptation measures to flooding are needed to reduce the damage potential.

Individuals and communities exhibit differential abilities to cope with flood hazards. Various studies in Australia and overseas have identified a number of different factors which contribute to vulnerability (e.g. Nelson *et al.,* 2007, 2009a,b; McEntire, 2005; Clark *et al.,* 1998). Similarly, people and organisations have varying capacities and resources to adapt to flooding, characterised by their access to resources, extent of social capital, structure and functionality of institutional arrangements, ability to generate knowledge, and capacity for social learning (Smith *et al.,* 2008). Some communities may not have the adaptive capacity to cope with intense and frequent flooding to the extent that their viability and ability to survive remains at stake.

1.2 Significance of the Study

Over the past three decades, floods in Australia have accounted for 29 % of total natural disaster costs (BTE, 2001). Overall, flooding is Australia's costliest form of natural disaster, with losses estimated at over $300 million a year (BTRE, 2002). In Queensland alone during 2008, flooding costed the state and local government approximately $234 million in damages to infrastructure, due to heavy rainfall events that spanned north-west Queensland to Mackay, when approximately one million square kilometres of the state (or 62 % of the area) was underwater (Queensland Government, 2009).

Changing risks associated with climate change are placing further strain on community systems and their capacity to recover from emergencies and disasters brought about by climate change. Hence questions may arise as to the processes, practices and strategies needed to promote or maintain community resilience in this changing climatic environment. Consequently, understanding a community's characteristics is important for understanding its relative vulnerability to human or natural hazards (Gazley *et al.,* 2009). It is important not only to estimate damages incurred from the impact of natural hazards, but also to consider social factors. Technical risk assessments often neglect to examine how affected communities cope and recover after a natural hazard (Geoscience Australia, 2005).

There is also a need to examine the extent to which flood mitigation measures have been applied to reduce the vulnerability to flood events. It is essential to review which processes and instruments have been implemented, as well as to identify those plans and strategies that worked well or not in previous floods. The information is vital for decision makers in formulating and implementing policies for flood emergency management. Moreover, some communities in coastal and inland Australia are currently vulnerable to flooding. With the increased risk of more flooding in the future to these areas, it will be important to gain insights as to whether (and how) these communities can possibly cope and endure.

1.3 Objectives and Hypotheses

The objectives of this project were:

1. To understand how societies that are regularly flooded respond and adjust to flood events and the extent of their resilience;
2. To understand the characteristics of communities that are 'on the edge', where flooding might push them into non-viability;
3. To understand the extent to which flood mitigation measures (including *State Planning Policy 1/03*) have been applied to reduce the vulnerability to flood events; and
4. To identify the characteristics of vulnerability, resilience and adaptive capacity to flooding of households, businesses and institutions.

The following hypotheses were formulated for this study:

Hypothesis 1: *That those households established in areas that are vulnerable to regular flooding, that have greater connections within the community, display more resilience in the event of a disaster flood event;*

Hypothesis 2: *That social groups with special needs such as the elderly are less resilient to a disaster flooding event than other members of a community;*

Hypothesis 3: *That those who had applied flood mitigation measures were more resilient to disaster flooding events; and*

Hypothesis 4: *That those who have more adaptive capacity, move from areas that are vulnerable to regular flooding, achieving increased resilience.*

2 Literature Review

2.1 Introduction

Floods in Australia over the past three decades have accounted for 29 % of total natural disaster costs (BTE, 2001). Overall, flooding is Australia's costliest form of natural disaster, with losses estimated at over $300 million a year (BTRE, 2002). In Queensland alone during 2008, flooding cost the state and local government approximately $234 million in damages to infrastructure, due to heavy rainfall events that spanned north-west Queensland to Mackay, when approximately one million square kilometres of the state (or 62 % of the area) was underwater (Queensland Government, 2009).

During significant floods, lives can be lost, stock losses may be in the tens of thousands, and damage to homes, businesses, roads, etc., can run into hundreds of millions of dollars. Lost production can add considerably to the costs, as can the intangible costs, such as effects on health.

2.2 Flood Management in Australia

In Australia, the Natural Disaster Mitigation Program (NDMP) is the national program that identifies and addresses natural disaster risk priorities. It deals with natural disasters, such as bushfires, floods and tropical cyclones that regularly occur (AGD, 2009). These events cause over $1 billion damage to homes, businesses and infrastructure, and cause serious disruptions to communities.

In 1999, the Regional Flood Mitigation Program was incorporated into the NDMP and allocated around $75 million to more than 270 projects nationwide. It funded various flood-related measures, such as the construction of levees, house raising, flood proofing buildings, bypass floodways, flood control dams, retarding basins, channel improvements, flood warning systems, and activities to raise community awareness (AGD, 2009).

At the state and local levels in Australia, initiatives which seek to reduce floods and their negative effects focus on activities which raise community awareness and levels of resilience. Measures to prevent floods can include zoning, land use management, framing of and compliance with relevant legislation and by-laws, education, provision of relevant information and alerts, and development of local flood prevention plans.

Australian Governments currently use regional and urban planning, land use and development planning, building codes and a range of associated engineering standards for disaster risk treatment. In Queensland, the Government mitigates against the major impacts of natural disasters through instruments and planning regimes under the South-East Queensland Regional Plan and associated Climate Change Management Plan, the *State Planning Policy 1/03, Sustainable Planning Act (QLD) 2009*, *Disaster Management Act 2003*, and various local government planning schemes and by-laws. The *State Planning Policy 1/03*: Mitigating the Adverse Impacts of Flood, Bushfire and Landslide (SPP 1/03) was implemented under Schedule 4 of the now superseded *Integrated Planning Act 1997* (IPA) and took effect on 1 September 2003. State Planning Policies are now enacted under Chapter 2 Part 4 of the new Queensland planning legislation, the *Sustainable Planning Act 2009* (SPA) which took force as of 18 December 2009.

For the purposes of IPA, State and Regional Coastal Plans were treated as State Planning Policies and were taken into account by assessment managers (generally local Council) when development applications were assessed (HSCCCWEA, 2009). The Planning Minister can require such Plans be considered in local planning schemes and prior to assigning land for community infrastructure (HSCCCWEA 2009). In a recent report, they stated that in order to be more effective, these Plans needed to be given elevated status under the IPA to ensure their provisions are implemented (HSCCCWEA, 2009). This Standing Committee report postulates that, in practice, details of the State and Region plans "*are not clearly and thoroughly implemented in local planning schemes*" as an integral part of the process of checking state interest on draft local planning schemes (HSCCCWEA 2009). The SPA is largely a redraft of the IPA and functions in a broadly similar manner. The SPP 1/03 has a 10-year life, before substitution, and it is to be hoped that its replacement policy will strengthen its effectiveness, and give local government greater power and responsibility to mitigate the impact of floods.

Australian Governments currently use regional and urban planning, land use and development planning, building codes and a range of associated engineering standards for disaster risk treatment. In Queensland, the Government mitigates against the major impacts of natural disasters through instruments and planning regimes under the South-East Queensland Regional Plan and associated Climate Change Management Plan, the SPP 1/03, SPA, *Disaster Management Act 2003*, and various local government planning schemes and by-laws.

Floods cost the Australian community, on average, in excess of $300 million per annum (BTRE, 2002). In terms of resourcing the development of flood prevention measures, one of the ongoing challenges facing Government is competing Government priorities for funding from other portfolios (such as health, education, transport etc).

In Australia the State and Territory Governments generally coordinate disaster management, however the Commonwealth Government will respond to their requests for assistance. The Commonwealth Government provides support through the Commonwealth Government Disaster Response Plan and Emergency Management Australia, who provide operational and financial assistance through response, recovery and measures to reduce floods (Williams *et al.,* 2009). State and Territory governments have responsibility, through legislation, to establish their own emergency management and disaster management entities which are linked to Fire, Police and State Emergency Services (SES). These governments provide warning systems, planning and education, direction and support to local government bodies working within the disaster area (Williams *et al.,* 2009).

State Housing Authorities play a key role in disaster management and link to government and the wider community, providing emergency shelter, accommodation, financial and other support to communities. However, rarely has their practical experience been examined and featured in the published literature (Williams *et al.,* 2009). This practical experience is likely to be a very good source of data on challenges that need to be considered in planning procedures and protocols (Williams *et al.,* 2009).

In Queensland, the main legislation relevant to flood events and their prevention is the *Sustainable Planning Act 2009* (SPA), which places responsibilities on local governments; and the SPP 1/03 which is used to clarify the State's interest in land use planning as it relates to natural hazards (BTRE, 2002). Considerable variation is found between how different Queensland councils implement measures to prevent floods (e.g., setting minimum floor levels) (BTRE, 2002).

The SPP 1/03 deals with mitigating the adverse impacts of the natural hazards of flood, bushfire and landslide and, under SPA, takes effect when planning schedules are developed or amended, land is designated for community infrastructure, or development applications are assessed (DOLGP/DES, 2003). The SPP 1/03 only relates to development issues associated with minimising the potential adverse impacts of natural hazards (e.g. development proposals for works such as firebreaks, filling or retaining structures), which could, under normal circumstances, place unacceptable impacts on amenity and heritage values and the natural environment (DOLGP/DES, 2003).

The natural hazard management area for flood hazard is dependent upon a local government adopting a flood event for the management or development in a particular locality and in identifying the affected area in the planning scheme. Until this occurs, the SPP 1/03 does not take effect for development assessment in relation to flood hazard in that particular locality (DOLGP/DES, 2003).

Following a disaster event, the Queensland Department of Communities works with those communities affected to restore social, economic, emotional and physical well-being, providing and coordinating information, resources, personal support, specialist counselling, community development and mental health services (DOC, 2009a).

For those whose property is uninsured and who have suffered damage as a result of flooding or storms, once-off emergency and other financial assistance is available to eligible applicants (DOC, 2009a). In Queensland, those affected by natural disasters such as floods may be eligible for grants, including the Emergent Assistance Grant available to individuals and families unable to meet immediate or unexpected basic costs such as for medical supplies, accommodation, food and clothing. The grant is not means tested and is a once-off payment of $170 per person, up to a maximum of $780 for a family of five or more (DOC, 2009b).

Essential Household Contents Grants may be available for essential household contents lost or damaged in the disaster for those who do not have contents insurance. This grant is means tested and is a once-off payment of $1,660 per adult, up to a maximum of $4,980 for a couple/family (DOC, 2009b). Eligible household contents may include essential contents such as furniture, white goods, clothing, cooking utensils, bedding and linen, floor coverings, food lost due to damage, and can be used to assist with the repair or replacement of essential items, with maximum limits applying for individual items (DOC 2009b).

The Structural Assistance Grant may be available to property owners whose home is damaged in a disaster and is uninsured for this event. It must be their sole place of residence at the time of the event, and the grant contributes to repair of the property to a secure and habitable condition (DOC, 2009b). It is means-tested and is a once-off payment of up to $10,250 per individual, and up to $13,800 for a couple/family (DOC, 2009b).

Other financial assistance is available for eligible primary producers in a disaster-declared area, including freight subsidies of up to $5,000 per disaster event, available under joint Commonwealth/State Natural Disaster Relief and Recovery Arrangements (NDRRA) (DOC, 2009b). Low interest rate loans of up to $250,000 for small businesses and eligible primary producers located within a disaster-declared area can be obtained through the Queensland Rural Adjustment Authority (QRAA) (DOC, 2009b).

2.3 Social Impacts and Social Capital

It has been suggested that it is important not only to estimate damages incurred from the impact of natural hazards, but also to consider social factors. Technical risk assessments often neglect to examine how affected communities cope and recover after a natural hazard (Geoscience Australia, 2005). Community recovery issues need to be considered in addition to geological, economic and engineering assessment of natural hazards.

Factors influencing community recovery are widely recognised as being complex, and may include economic, physical, community, environmental, financial, psychological and emotional factors (COAG, 2004; EMA, 2004; Ministry of Civil Defence and Emergency Management, 2004), as well as business interruption, local economic activity and issues related to infrastructures (Geoscience Australia, 2005).

An important aspect of community resilience is social capital, which is generally defined as relating to social networks and cohesion, trust and support or how a community functions (Geoscience Australia, 2005); and social capital theory, which considers the way individuals organise to pursue common goals (Kaufman, 1999). Numerous international agencies, such as the World Bank, the United Nations and the Australian Bureau of Statistics have been endeavouring to develop measures of social capital, and acknowledge it can be difficult to measure (ABS, 2004; Geoscience Australia, 2005; World Bank, 2004).

To date, common data collected by agencies to measure social capital has included data on community groups and volunteerism, membership of organisations, contact with friends and family, feelings of trust and safety in the community (ABS, 2004; Geoscience Australia, 2005; World Bank, 2004). These interactions and relationships may appear to have little economic value, however this could be a substantially flawed assumption. A case in point is volunteerism. In 1997, volunteering activities in Australia were valued at $24-$31 billion (ABS, 2000). The economic value to societies of social capital in preparation, response, recovery and adaptation to flood events is likely to be very significant if quantified. Hence the value of social capital, coupled with government funding allocated to these activities, collectively contribute to the overall economic cost of building community resilience and adaptive capacity.

2.4 Natural Disaster Preparedness, Resilience, Vulnerability and Adaptation

2.4.1 Natural Disaster Preparedness

In terms of disaster preparedness, Gazley *et al. (*2009) contended that three situational factors support the ability of an emergency manager to determine if their jurisdiction is appropriately prepared for disasters and have the capacity to cope:

- *Risk profile,* which relates to the geophysical location of the community, the type of risk being faced, the likely severity of its impact on vulnerable populations, and the public managers' perception as to the level of threat;
- *Incident experience,* what has been the community's past experience with human and natural disasters; and
- *Collaborative capacity,* which includes the social capital of the community, joint planning activities from the past, and the likely ability of the community to procure voluntary resources when needed.

These general concepts focus on experience and information.

A UK study which reviewed resilience indicators of climate change found no pre-existing, specific measures available in the published literature and concluded that neither a single indicator nor a set of 3-4 individual indicators were suitable for measuring the resilience of a region (Sivell *et al.,* 2008). The view of these researchers was that indicators suitable for monitoring climate change adaptation need to be based on measuring sustainability in terms of three aspects related to a community, viz., social, economic and natural (or environmental) factors and their characteristics. A range of aspects can be expanded for discrete sectors, such as environment, health, housing, infrastructure and transport.

A bibliometric analysis was conducted by Janssen *et al. (*2006) involving 2,286 publications between 1967 and 2005 of the knowledge domains *resilience*, *vulnerability* and *adaptation* within research on the human dimensions of global environmental change. They found few interlinkages exist among these knowledge domains. The analysis found that resilience has a background in ecology and mathematics focused on theoretical models, while vulnerability and adaptation knowledge domains centre on natural hazards and geography research, with a focus on climate change research and case studies. They found indications of an increasing integration of the different domains of knowledge by an increasing number of cross citations and published literature classified in multiple knowledge domains.

2.4.2 Vulnerability

Vulnerability is a function of exposure to climate factors, sensitivity to change and capacity to adapt to that change (The Allen Consulting Group, 2005). Systems that are highly exposed, sensitive and less able to adapt are vulnerable (Figure 2.1).

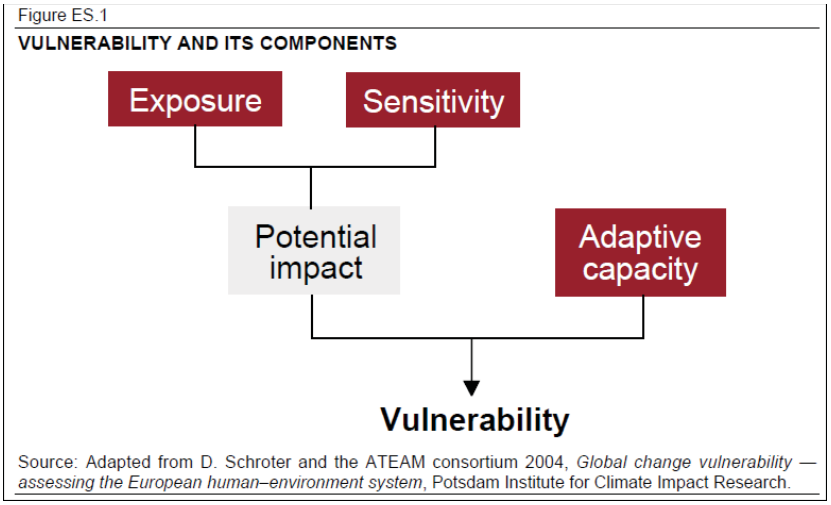

Figure 2.1. Vulnerability and its components (Source: The Allen Consulting Group, 2005)

Understanding a community's characteristics is important for understanding its relative vulnerability to human or natural hazards (Gazley *et al.,* 2009). From an emergency management point of view, vulnerability can be seen as a lack of capacity to perform vital public management functions, including resource allocation, training and planning (McEntire, 2005).

Clark *et al. (*1998) define vulnerability as a function of two main characteristics: *exposure* ("the risk of experiencing a hazardous event") and *coping ability*, which includes *resistance* ("the ability to absorb impacts and continue functioning") and *resilience* ("the ability to recover from losses after

an impact"). They pointed to the differential ability of people to cope with hazards, and summarised sources of vulnerability themes as relating to age, disabilities, family structure and social networks, housing and the built environment, income and material resources, lifelines (these include hospitals, transportation, communication, emergency response, utilities, etc.), occupation, race and ethnicity.

The inclusion of vulnerable sections of the community and vulnerable social-ecological systems within decision-making entities is very important and an area which has received little attention in the research literature (Nelson *et al.,* 2007). Hence, the principles of equity need to be integrated with what is identified as vulnerability and important parts of decision-making as they relate to adaptation. Figure 2.2 shows age as an indicator of social vulnerability that influences the overall vulnerability of a community and their susceptibility to a natural disaster, where recovery is beyond the day-to-day capacity of the prescribed statutory authorities.

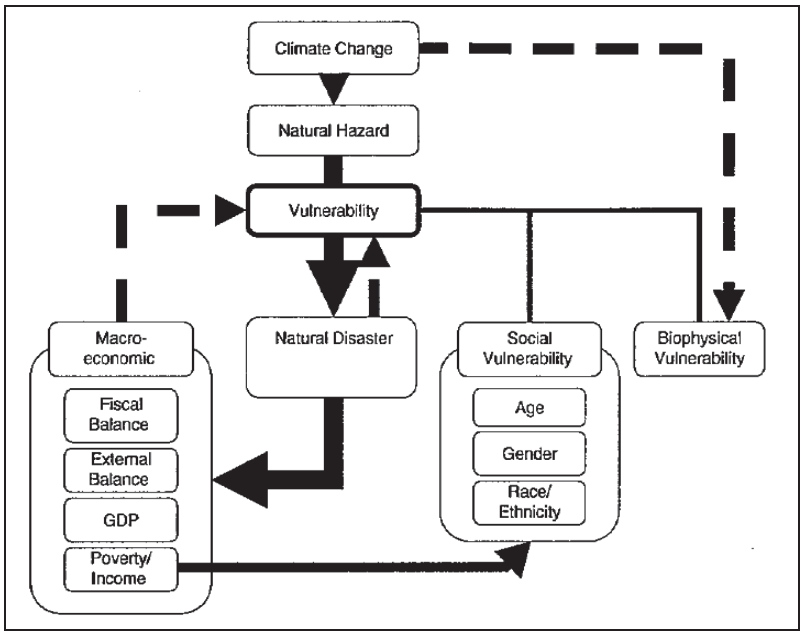

Figure 2.2. Characteristics of vulnerability in the context of natural disasters (Source: Ibbararan and Ruth, 2009).

Community vulnerability in terms of risk and vulnerability to hazard impact was discussed in detail in AGSO (2000) and focused on five elements:

- *Setting* (physical environment, access, administrative arrangements, population and its distribution);
- *Shelter* (buildings for home, work and recreation, mobility and access to shelter);
- *Sustenance* (lifelines – reliance on service and utility infrastructures – water, sewerage, telecommunications and power supply; food, medical, clothing and other personal items);
- *Security* (measured in terms of wealth and health and by protection that is provided, e.g. availability of facilities, such as police and ambulance stations, fire stations, industry, commercial premises, agricultural land use, works such as levees and flood retention basins; as well as economic and socio-demographic issues related to the disabled, very young, the elderly, home ownership, unemployment and resources at police and fire stations); and

- *Society* (e.g. language, religion, welfare and community groups, education, meeting places, cultural activities, facilities such as churches, meeting halls, clubs, libraries etc and levels of education).

Nelson *et al. (*2009a,b), in their studies analysing the vulnerability of Australian rural communities to climate variability and change, presented a complex array of interacting economic, social and environmental factors that contribute to vulnerability. They highlighted that there is little agreement on how to convert the concept of vulnerability into analytical measures (and it is rarely done) which can be used to prioritise and evaluate policy options. They state that increasing awareness of the potential impacts of climate change on rural landscapes is motivating research which can prioritise adaptation responses. They caution that relying solely on hazard/impact modelling can lead to inappropriate conclusions about rural community vulnerability.

2.4.3 Resilience

Measurement and management of resilience has been studied extensively during the last decade in a number of countries. Although demographic and economic aspects have received considerable attention, its pre-requisites and social dimensions are less well understood. Moreover, the qualities of community resilience have been difficult to accurately measure or quantify (McIntosh *et al.,* 2008). Resilience can raise questions around the defining governance structures that are appropriate and their relationship to contextual factors, as well as procedural and outcome equity (Nelson *et al.,* 2007).

Resistance is a type of adaptation action which places a barrier or blocks climate change effects. An example of resistance is protecting an area using a flood barrier (Sivell *et al.,* 2008). Resistance is defined as *the ability of a system to prevent floods*, while resilience *"is defined as the ability of the system to recover from floods"* (De Bruijn, 2005*).* A more detailed definition of resilience is provided by the United Nations (2007) as:

> *"The capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organising itself to increase this capacity for learning from past disasters for better future protection and to improve risk reduction measures."*

One approach to measure resilience involves measuring its parts, namely *stability*, *learning* and *self-organisation* (Carpenter *et al.,* 2001; Thomas *et al.,* 2005). Another approach is based on the premise that a system's natural state is one of change, as opposed to one of equilibrium (Holling, 1973). Resiliency generally refers to processes and factors that limit negative behaviours associated with stress and which, despite the presence of adversity, enable adaptive outcomes to be achieved (Gwimbi, 2009).

Resilience may not necessarily involve physical measures, and can be attained through changes in awareness, procedure and management and may not involve spending significant funding (Sivell *et al.,* 2008). For example, changing the way in which existing funds are distributed can be a means for building effective resilience.

Individual resilience is suggested as being influenced by factors such as adaptability, awareness, dependence, disposable income, location, poverty, and state of housing. On the other hand

collective resilience may be influenced by ecology, economic structure, geography, inequality, institutional networks and structures, landscape, resources and governance (in particular, how various actors coordinate) (Sivell *et al.,* 2008).

Examples of *social sources of resilience* can include:

- Social networks (Eriksen *et al.,* 2005);
- Social security payments, lessons learned from past events (Finan and Nelson, 2001; Nelson and Finan, 2008);
- Heightened awareness of thresholds which pose as critical and learning through building of consensus (Brown *et al.,* 2002); and
- Learning and strong national and international support networks (Tompkins, 2005).

Key themes impacting on resilience can include individual incomes (particularly disposable income, such as whether people can afford to keep vulnerable family members cool in severe heat events); access to important services (which may be limited for those in rural areas) or could relate to events such as blockage of transport routes (Sivell *et al.,* 2008). A key question posed by Sivell et al (2008) relates to whether societies have a plan showing where vulnerable people live.

Regional social resilience is related to the interrelationship between the adequacy of government and social networks and the resilience of individual members of society (Sivell *et al.,* 2008). Resilient societies have individuals and networks which are both resilient.

Economic resilience is concerned with a range of issues such as relating to local infrastructure, availability of contingency funds, business resilience, flood defences, and transport utilities. It may also include other issues, such as the number of businesses that have strategies for climate adaptation, the number insured against extreme weather events, and the nature of the businesses and their practices (Sivell *et al.,* 2008). Mostly importantly, Trosper (2002) expounded the view that resilient communities must be able to demonstrate the ability to buffer the event, self-organise before, during and after, and adapt and learn from the event.

2.4.4 Adaptation

Adaptation involves change and the practice of individuals, communities and societies as they adjust their locations, life courses and activities to maximise new opportunities (Nelson *et al.,* 2007). Plummer and Armitage (2007) suggested analysing three components of adaptation processes – *livelihood outcomes*, *ecosystem conditions* and *institutional and process conditions*. Carlsson and Berkes (2005) considered that evaluating adaptation management should be focused on functions and process, as opposed to structure and results.

Adaptation is a process of change that is deliberate in anticipation of reaction to stress and external stimuli. A resilience approach is systems-orientated and dynamic which can view adaptive capacity as a central feature of social-ecological systems which are resilient (Nelson *et al.,* 2007). *Adaptation to environmental change* has been defined as adjustment in social, ecological, or economic systems in response to expected or observed changes in stimuli in the environment and their impacts and effects, so that the adverse impacts of change may be alleviated (Berkhout *et al.,* 2006; Janssen, 2006; Smith and Wandel, 2006; Pielke, 1998).

Examples of *adaptive actions* which may be taken in response to resource stresses in social-ecological systems can include:

- Changing occupation, drought relief and selling assets (Eriksen *et al.,* 2005);
- Livelihood diversification, risk management in agriculture, humanitarian relief, crop insurance, irrigation schemes (Finan and Nelson, 2001; Nelson and Finan, 2008);
- Developing community-based resources, community monitoring of natural resources, such as reefs, consensus building for future zoning (Brown *et al.,* 2002); and
- Regulatory changes such as enhancements to building codes and zoning, developing plans and committees (Tompkins, 2005).

In the US, researchers have found that communities rely not just on federal, state and local authorities and voluntary organisations for assistance in disasters, but on a broad range of other entities in the community, including spontaneous volunteers, local business, social service and philanthropic non-profit (e.g. Wal-Mart) and faith-based organisations (Brudney and Gazley, 2009; Gazley *et al.,* 2009; McGuire *et al.,* 2009). There is a growing realisation that, with the exception of smaller emergencies, no one organisation is capable of doing it all (Gazley *et al.,* 2009).

Adaptive management is concerned with emergency management's capacity in terms of its emphasis on managerial flexibility, organisational learning and level of responsiveness as a source of an institution's level of resilience (Wise, 2006). Examples of building adaptive capacity include creating standards and legislation, institutional change, undertaking research and management, developing policies, strategies and plans and partnerships (Sivell *et al.,* 2008).

2.5 Flood Mitigation Measures

Flood mitigation can be defined as measures aimed at eliminating or decreasing flood impacts on the environment and society, using structural and nonstructural approaches (BTRE, 2002). Mitigation measures can be classified into three main groups:

- *Flood modification* (e.g. structural measures which modify floodwater flow such as levees, diversions and channel improvements, dams, detention basins, flood gates);
- *Property modification* (using siting and materials, building design or land use planning approaches, e.g., zoning and land use planning - a non-structural approach, voluntary purchase or acquisition, building regulations, house raising, other flood-proofing); and
- *Response modification* (modifying community behaviour through activities such as education, warning systems, planning and awareness campaigns, which recognise that losses may be substantially affected by people's reactions to warnings and impending floods, e.g. preparedness (planning for emergency), warning systems and forecasts, information and education programmes, state and national emergency services response) (BTRE 2002).

Implementing long-term planning strategies, such as retrofitting key buildings, flood proofing roads, relocating critical facilities and maintaining dynamic campaigns to raise community awareness and involvement in risk management can lower disaster risk (AGSO, 2000).

Strategies for managing hazard risk can include involving the whole community in various ways (AGSO, 2000):

- Developing a strong commitment to risk management and raising their awareness through risk communication;
- Providing appropriate information for decision-making;
- Operating effective monitoring and warning systems;
- Updating and reviewing planning and building codes and standards;
- Enhancing emergency management training, plans and resources;
- Implementing plans to protect key facilities (e.g. hospitals) which if impacted could increase community risk and hardship; and
- Building cost-effective structures for defence.

With Queenslanders building, on average, 35,000 dwellings per annum, it is vital that local councils ensure they are built to withstand future flood events, or built in areas where potential flood damage is likely to be minimised (Queensland Government, 2009).

Although disease outbreaks following flood events are not common in Australia, there is an increased risk of infection if direct contact is made with polluted waters, resulting in conditions such as conjunctivitis, dermatitis, ear, nose and throat infections, wound infections, and risks can increase for diseases such as dengue fever, diarrhoeal diseases, leptospirosis and melioidosis (QH, 2008). Hence, it is strongly recommended that contact with flood waters, stormwater creeks and drains during flood events, and contact with mud and dirt during clean-up be avoided. It is also recommended that protection measures such as gloves and covered shoes be used (QH, 2008). Most deaths occurring in Australia are as a result of people walking, swimming or attempting to drive through flood waters (QH, 2008).

2.6 Insights from International and Local Flood Studies

"*Flood risk management systems are defined as the socio-economic and physical characteristics of the river and the adjacent flood-prone area"* (De Bruijn, 2004). Brilly and Polic (2005) argued that the hydrometeorology of floods can be extremely complex and uncertain; yet it is noted that despite this complexity their technical aspects are better recognised than present knowledge about people's behaviour (Montz and Gruntfest, 2002).

International flood studies have highlighted some interesting insights with respect to public and decision-maker levels of understanding about flood information and their behaviour. For example, in the October 1988 flood in Nimes, France, which damaged the homes of 45,000 residents, a community survey (n=187 householders living in ground-level buildings) revealed that only 17 % of interviewees were aware that they lived in an area that is subject to flood (Duclos *et al.,* 1991).

Krasovskaia *et al. (*2001), in their study of the perception of flood risk by decision makers in Norway, found that the perception of flood hazard by the general public was not realistic: the message about flood risk needed improvement, as did transparency in terms of decisions made during the flood events and how these impacted on the degree of risk. They also found that if given an order to evacuate, less than half their public respondents would obey such an order immediately and about one third would wait and see what transpires. This study found that

amongst decision makers, there was poor insight about the economic issues of measures to prevent floods, and there was difficulty visualising the likely costs and results of actions associated with approaches that can be used to reduce floods. The study suggested that ongoing training of personnel involved in decisions about floods was very important.

A study by Pfister (2002) of the March 2001 flood in Grafton, NSW, using telephone and face-to-face interviews conducted just after the peak of the flood, found that successful evacuation depends on the readiness of the public to respond to a warning issued to evacuate. The study concluded that the Grafton residents were not ready to evacuate, did not have a realistic appreciation of the threat of flood, generally did not accept that there was a need to evacuate, and did not understand the evacuation strategy (Pfister, 2002). The author suggested that studies are needed to check the veracity of current best practice.

Levee protection can create a sense of invulnerability in a community which is not unjustified (Keys and Campbell, 1991; O'Brien and Payne, 1997). Communities also often believe that a flood will not exceed the record of the previous flood, as Heatherwick (1990) found was the case in the April 1990 Charleville flood.

Bell and Tobin (2007) emphasised the importance of investigating the relationship between understanding and persuasion in flood plain management and flood risk communication in order for it to be more effective. For example, community response to flood warnings was reported as being problematic in the March 2001 Grafton floods in NSW when fewer than ten percent of the population left the city during the nine hour evacuation (Pfister, 2002). Pfister (2002) suggested that although operational debriefs are important for exploring potential areas for improvement and enable emergency managers to include lessons learned into future operational planning, they generally do not capture the public perspective. This highlights the importance of consulting the public on their experiences, lessons learned, insights post major flood events and possible needs in terms of planning for future events.

One aspect related to recovery occurred in a case where up to 70 % of small businesses impacted by the 2005 flood in the City of Carlisle, England were unable to recover despite having sufficient levels of flood insurance (Sivell *et al.,* 2008). This was because their customers had found alternate sources of supply by the time they recovered from the physical impacts of the flood.

Bell and Tobin (2007) identified that problems exist between the concepts of persuasion and understanding, when they investigated levels of understanding relating to four terms used in US policy's benchmark flood. Their study investigated residents living both within and outside an official flood plain area. They studied four descriptive methods used: "*a 100-year flood*", "*a flood with a 1 percent chance of occurring in any year*", "*a flood with a 26 percent chance of occurring in 30 years*", and "*a flood risk map*". They found disjuncture between the concepts of understanding and persuasion, and problems with the descriptive method that used certain terms. For instance, the description of a flood that has a 26 percent chance of occurring in 30 years "*induced confusion, vehemence, and dismissal*" among the sample of residents.

They also found that respondents preferred definitive references for describing risk, such as damage estimates in dollar terms. Bell and Tobin (2007) found that participants were more concerned about the level of the flood than its frequency, and were more easily persuaded when they were provided with specific physical references and examples which were concrete, as opposed to abstract, such as damages estimates. This was also found in studies by NRC (1995, 2000, 2006); Smith (2000); Siegrist and Gutscher (2006); ASFPM (2007).

The reasons for warning failures have been investigated by Handmer (2000) who classified these according to whether shared meaning was achieved between the issuing authority and the public. Reasons could relate to impediments such as language barriers, the public not receiving the warning, lack of mobility options, an individual's attitude to risk, a lack of faith in the warnings, and the impact of false alarms on future evacuations (Pfister, 2002).

It is important to note that the heterogeneity of populations at risk adds to the complexity of designing relevant and meaningful messages (Pfister, 2002). A potential barrier to adaption was raised by Preston *et al. (*2009) in their study of lessons learned from a bushfire vulnerability assessment. They found that when presenting vulnerability maps in a workshop setting, stakeholders appeared reluctant to accept representations of vulnerability which differed from their own understanding. This provides evidence of potential mismatches in understanding between technical professionals and the public in the use of terms, such as 'hazard' and 'vulnerability assessment'.

A study in 2001, which involved consultations with key representatives in flood mitigation in Australian States and Territory, found common problems associated with flood mitigation (BTRE, 2002):

- Differences in community needs and low levels of community awareness;
- Lack of funding and lack and uncertainty of information;
- Urban infill and higher density redevelopment;
- Uncertainty in terms of legal liability and court outcomes;
- Political pressures and limited coordination;
- Design levels and land use planning decisions were generally based on the level of the 1 in 100-year flood and revisions, as information improved, of the 1 percent Annual Exceedance Probability (AEP); and
- As few major floods had occurred in the last 10-50 years community knowledge and awareness of floods was poor.

The study found that an increasing focus was being placed on non-structural measures. Community support and understanding was seen as fundamental for assessing measures to prevent floods, and generally the economic effectiveness of these measures were not formally assessed after they were introduced (BTRE, 2002).

The importance of providing information on the cost of measures which can be used to prevent floods is highlighted in research by Grothmann and Reusswig (2006). They suggest that monetary flood damage can be reduced by around 80 % in urban areas prone to flood by residents exhibiting self-protective behaviour, reducing the need for public risk management. To motivate such behaviour, residents need to understand not only the risk of flooding and its likely consequences, but also the likely effectiveness and cost associated with private precautionary measures.

Brilly and Polic (2005), in their study of flood perception with the community in Slovenia, concluded that people need to be educated and trained about floods, and motivated to take proper preparation methods (e.g. take out insurance), and that the most vulnerable members of the community (such as the elderly, children, and the handicapped) need to be protected. They found local radio was the most important source of information, and highlighted the need to be mindful of the possible problem of false alarms.

Kulig (2000) expressed the view that disaster risk reduction needs to focus on building communities that are resilient, as opposed to merely responding to natural disasters. The author noted that the causes of vulnerability need to be addressed, which can be considered an investment toward building resilient communities able to face future disasters. Another important public health issue for determining victim support is the lasting psychological consequences associated with disasters (Verger *et al.,* 2003).

Bell and Tobin (2007) suggested that more research is needed to evaluate the effectiveness of communicating flood risk information, and believed that democratic approaches in description might help restructure the relationship between persuasion and understanding.

3 Case Study Area

3.1 Charleville and its Flood History

Charleville is situated 756 km west of Brisbane in the heart of Queensland's mulga country on the left bank of the Warrego River (Wagner, 1991). Its climate varies from -3 to 21°C in winter and in summer from 27 to 46 °C, with average rainfall of 450 mm (Lord, 1982). Charleville covers an area of 13,924 km^2 (ABS, 2006a); and was laid out in the form of a grid by a Government surveyor (Wagner, 1991). Most of it lies on the flood plain which is constricted to a width of around 3.5 and 5 km upstream (Figure 3.1). The Bradley's Creek catchment covers 200 km^2 and flows through Charleville running almost parallel to the Warrego River before it discharges into this river downstream of the town (Sargent, 1991).

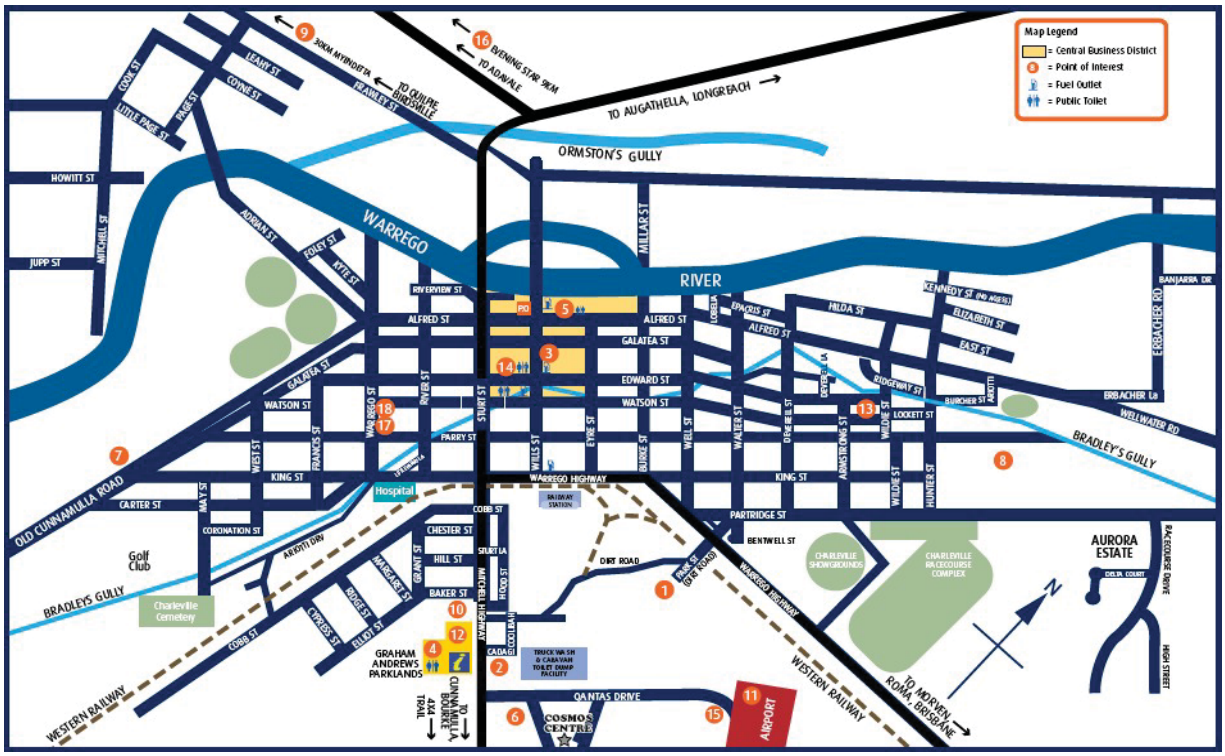

Figure 3.1. Charleville town Map (Source: Murweh Shire Council)

Charleville's population grew from 58 persons in 1871, peaking at 5,154 in 1961 (CGQ 2009) and since that date has steadily declined to 3,278 people recorded in the 2006 census (ABS, 2006a,b). The decline in population is reportedly linked to the downturn in the pastoral industry, fluctuating sheep-wool and cattle prices, a number of poor seasons and the effect of rising costs (Lord, 1982). Of the 3,278 people recorded in the 2006 census in the urban centre/locality, 12.9 % are indigenous (more than five times the national average). Languages spoken at home include English (90 %), Vietnamese, Maori, Hindi, Tagalog and Cebuano (ABS, 2006b). The unemployment rate is 3.1 %, lower than the national average (ABS, 2006b). Charleville lies in the broader region of the South-West Statistical Division and is the main town servicing a large area for the Central West and Warrego regions.

The Warrego River (Figure 3.2) has a well documented history of flooding with records of the larger floods dating back to 1910 (BOM, 2009b). In Charleville, over 10 major floods were recorded since this period that caused inundation of large areas, isolating towns and cities, including major disruptions to road and rail links.

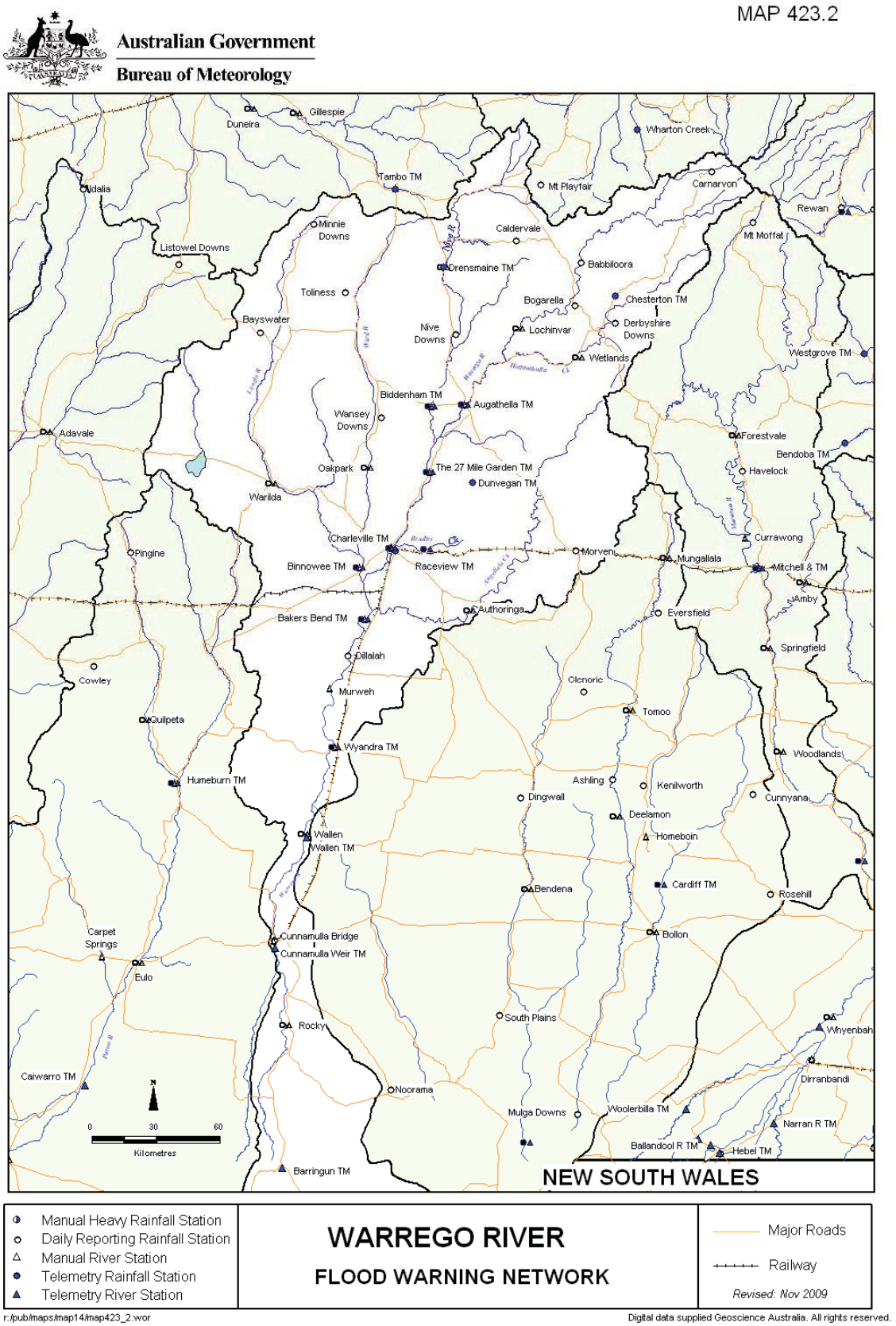

Figure 3.2. Warrego River Catchment (Source: Bureau of Meteorology)

The significant flood peaks which have occurred at Charleville since records began are illustrated in Figure 3.3.

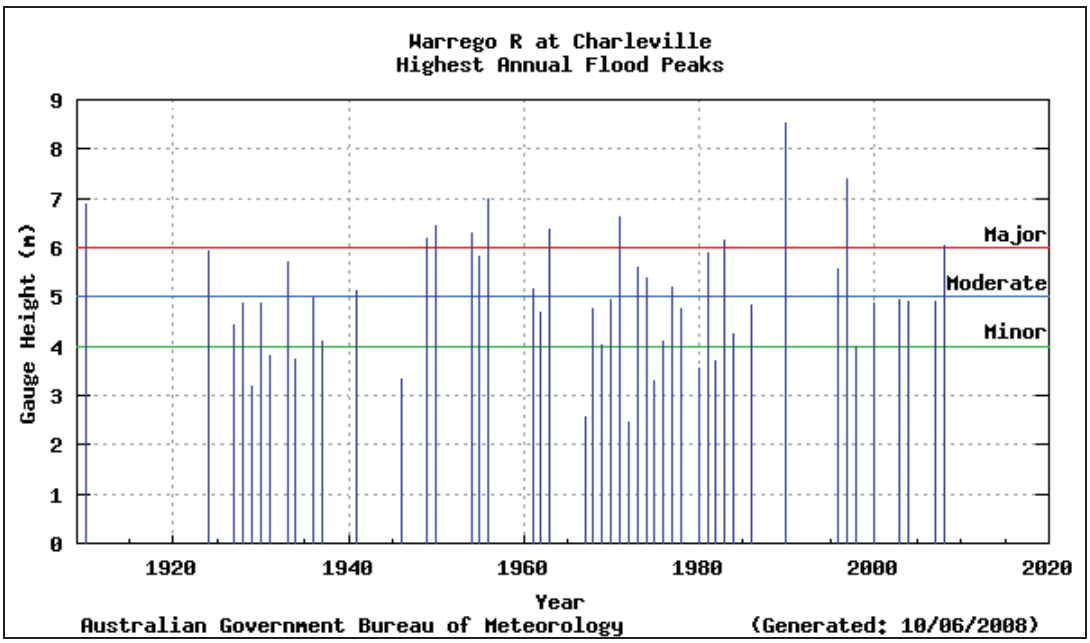

Figure 3.3. Significant flood peaks which have occurred at Warrego River in Charleville (Source: Bureau of Meteorology)

3.1.1 The 1990 Flood in Charleville

A wide area of Western Queensland experienced a record or near record flooding in April 1990. Charleville was the town most affected, where all buildings in the business centre and 1,180 of the 1,470 houses were inundated, with most of the town flooded to depths of 1.2 - 2 m up to 3 m adjacent to Bradley's Gully (Sargent, 1991). The floods caused widespread damage over a broad area of inland Queensland and produced record flood heights. The townships of Alpha and Charleville were devastated and the smaller towns of Augathella, Blackall and Jericho underwent serious flooding (BOM, 1990).

At 4.30pm on 20 April the BOM issued a warning to the Murweh Shire Council that record flooding could be expected of one or two m above the previous recording of 6.96 m. At 2.30pm on 21st April, the Warrego River peaked at Charleville at 8.54 m, 1.5 m higher than the previous record height in 1956 of 6.96 m, with peak discharges estimated at around 3000 m^3/s (Sargent, 1991). The SES coordinated the complete evacuation of the town to temporary accommodation situated at the airport (BOM, 1990).

In Charleville, the SES and rural newspapers reported significant damages: inundation of 1,180 houses, approximately 2,800 residents were displaced (from a population of about 4000), the post office, police station, telephone exchange and banks were affected (BOM 1990), and 113 of 150 business premises were inundated (McMahon, 1994). The total flood damage was estimated to be in the vicinity of $45 million. Personal interviews conducted with 63 of the 113 business units revealed that there was sustained damage. The total loss of profits per business unit was estimated at $49,000-$54,000, with total damage to physical assets of $6.5 million (McMahon, 1994).

3.1.2 The 1997 Flood in Charleville

Western Queensland experienced flooding in January and February 1997 after very heavy rainfall fell in several catchments including the Warrego River. Several towns were affected. In Charleville, evacuation of about 780 people was necessary, and around 60 properties were affected by flood waters which reached above floor level. Repairs of flood damaged buildings were estimated to be around $150,000 (BOM, 1997). Rail and road traffic underwent severe disruption with large groups of travellers stranded at various areas in the flood affected region (BOM, 1997).

Flooding in the Warrego River was so significant, because at its peak at Charleville, it was the highest recorded since the record flood of April 1990 and was the second highest on the flood record which commenced about 1900 (BOM, 1997). In terms of comparing the rainfall totals recorded in the 1997 event with those during the April 1990 event, it is noted that the April 1990 floods occurred from prolonged rainfall over a 20 day period, whereas the February 1997 event resulted from a 6 day rainfall period (BOM, 1997). When comparing the most intense 24-hour period at Augathella and Charleville, this shows that the April 1990 rainfalls were much higher those recorded for 1997 (BOM, 1997). Flood river peaks for the Warrego River at Charleville were 8.54 m in the April 1990 flood, and 7.39 m in the 1997 flood.

3.1.3 The 2008 Flood in Charleville

The 2008 flood in Charleville was a Bradley's Creek flood, not a Warrego River flood. On 17-20 January 2008, Charleville experienced its biggest Bradley's Gully flood event since 1963. The Bradley Gully flows through the middle of the town, and flood waters reached approximately 3.1 m.

In contrast with the Warrego River, there is lack of quantitative information with regards to rainfall and flood water height at Bradley's Creek during the 2008 flood. It was reported that the automatic river height gauge monitoring station on Bradley's Creek was not working at the time of the January flood.

The impacts of the 2008 Charleville flood were described in Section 3.3 below.

3.2 Mackay and its Flood History

The City of Mackay, situated in Northern Queensland, lies approximately 970 km north of Brisbane. The Mackay Statistical Division, covering a total area of 90,340 km^2, had a population of 150,175 persons (ABS, 2006c). About 3.6 % of this was indigenous. The main employment industry was coal mining, which employed 9.4 % of the workforce (ABS, 2006c). The average annual population growth rate in the Division during 2003-2008 was 3 % (compared to 2.4 % in the state of Queensland) (OESR, 2009c). As at 30 June 2007, the resident population in the Mackay Statistical Division was estimated to be 163,629. Languages spoken at home include English (89 %), Italian, German, Afrikaans, Maltese and Tagalog (ABS, 2006c). The unemployment rate is 3.5 %, lower than the national average (ABS, 2006c).

Mackay is known as the '*sugar capital*' and produces around one-third of Australia's cane sugar. The region experiences a humid climate and is a developing city, with its main export-oriented industries being sugar and mining, with coal mining a prominent industry. The region is vulnerable in terms of its heavy reliance on disaster-sensitive industries such as tourism and agriculture (AGSO, 2000). Mackay can be subject to a range of hazards, including floods, earthquakes, severe wind and storm tide from tropical cyclones.

3.2.1 Major Flood Events in Mackay

Flooding from the Pioneer River poses the greatest geohazard threat (AGSO, 2000). The Pioneer River runs out to sea through the city of Mackay and has a catchment area (Figure 3.4) of about 1,500 km^2 (BOM, 2009b).

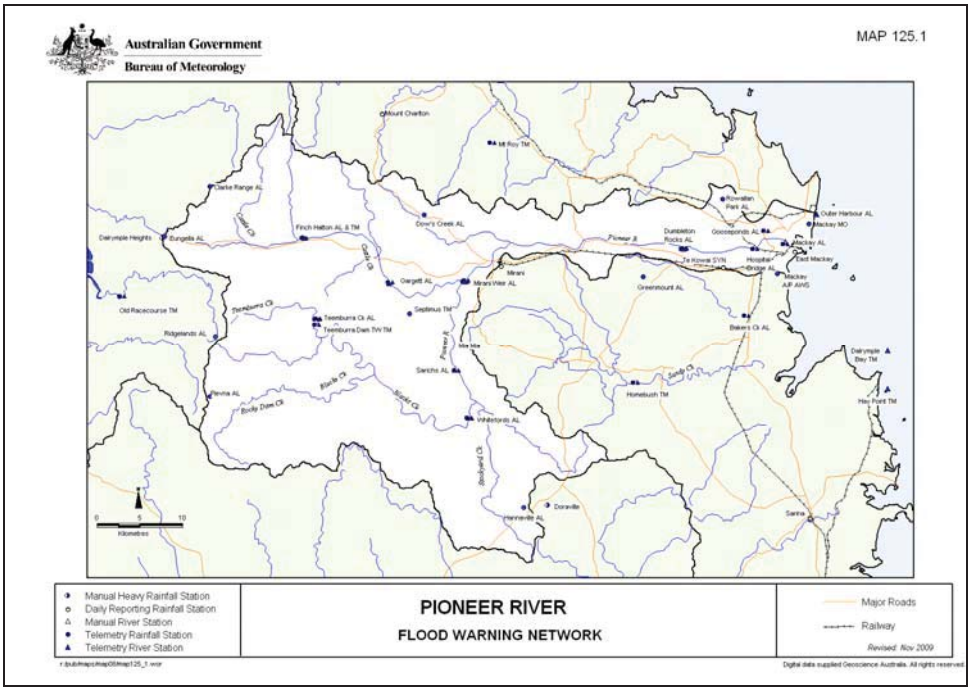

Figure 3.4. Pioneer River Catchment (Source: Bureau of Meteorology)

The history of flooding from the Pioneer River is illustrated in Figure 3.5 and dates back to 1884 (BOM, 2009b). The highest occurring flood recorded was in February 1958 which peaked at a height of 9.14 m on the Mackay flood warning gauge at the Forgan Bridge. The February 2008 flood was not a riverine flood but a flash flood, caused by intense local rainfall, with the river peaking at only 7 m (BOM, 2009b).

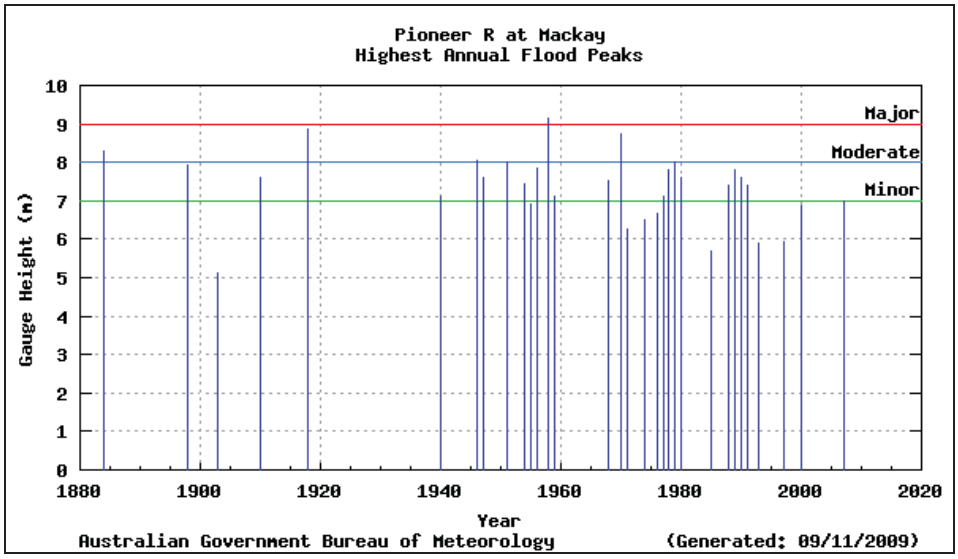

Figure 3.5. History of Mackay floods caused by flooding of the Pioneer River (Source: Bureau of Meteorology)

3.2.2 The 2008 Flood in Mackay

February 2008 proved to be another significant month of severe flooding and weather in Queensland, with river and flash floods occurring in many areas. Most significantly between 10-18 February along the central coast of Queensland, many rivers and towns between Townsville and Bundaberg were affected by floods (BOM, 2008). The worst damage occurred in the Mackay region on 15 February where an extremely intense and rare rainfall event occurred resulting in the flooding of up to 4,000 houses (BOM, 2008).

During the 2008 floods, the most statistically significant rainfall occurred in the lower Pioneer River around Mackay on the morning of 15 February when more than 600 mm was recorded in approximately six hours (Figure 3.7). Intensity-frequency-duration analysis of the rainfalls at Gooseponds and Mackay revealed that "*rainfall intensities for all durations from 30 minutes to 72 hours significantly exceeded 1 % AEP (100 year Average Recurrence Interval) intensities*" (BOM, 2008).

Unofficial records of the total rainfall recorded over 24 hours for the Goosepond Creek catchment included 985 mm recorded at Glenella (GHD, 2009). A flood study on the Goosepond and Vines Creek was completed by GHD and the report was released by the Mackay Regional Council in October 2009 (Figures 3.6, 3.7 and 3.8). The report found that 886 residential properties were inundated during the February 2008 Mackay flood event. The 2008 month of February resulted in the largest recorded rainfall for the city of Mackay in the history of the BOM records.

The whole city was generally affected by the rainfall and in particular low lying areas such as South Mackay. However it appeared that a wave of runoff travelling from the north-west in Glenella via the Gooseponds using roads as channels in an effort to get out to sea through the city, resulted in the largest readings inside residences in the low lying areas of the suburbs of Glenella and North Mackay (also heavily determined by gradient) and caused the most significant disaster impacts. A build up of water behind the railway line located north-west of the suburb of Glenella broke and had the same effect as a levy bursting resulting in the wave-like phenomenon. It was particularly notable that the areas located adjacent to new developments that had infilled former swamp areas that appeared to receive the greatest amounts of water in their homes: Glenella and North Mackay suburbs in particular.

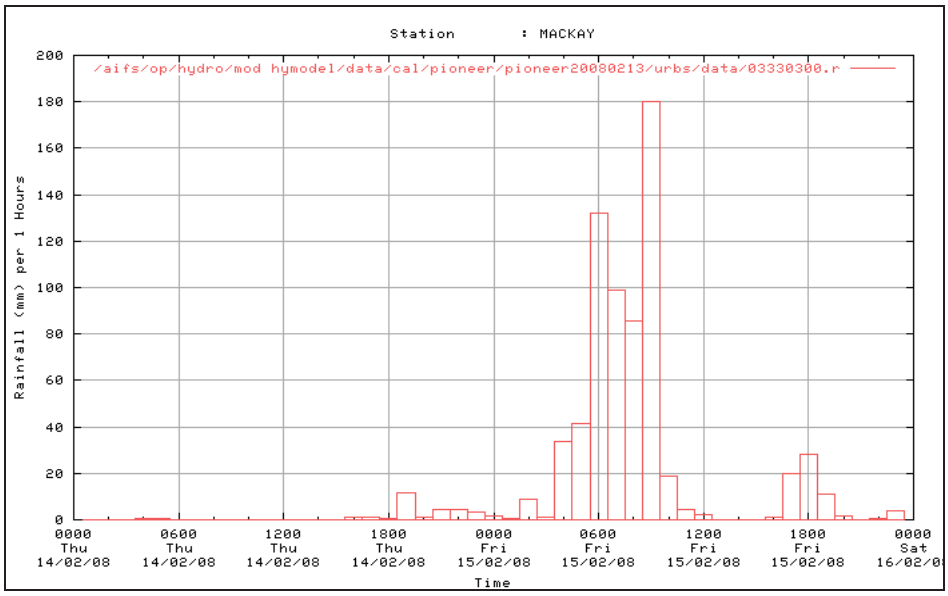

Figure 3.6. Hourly Hyetographs for Mackay ALERT station

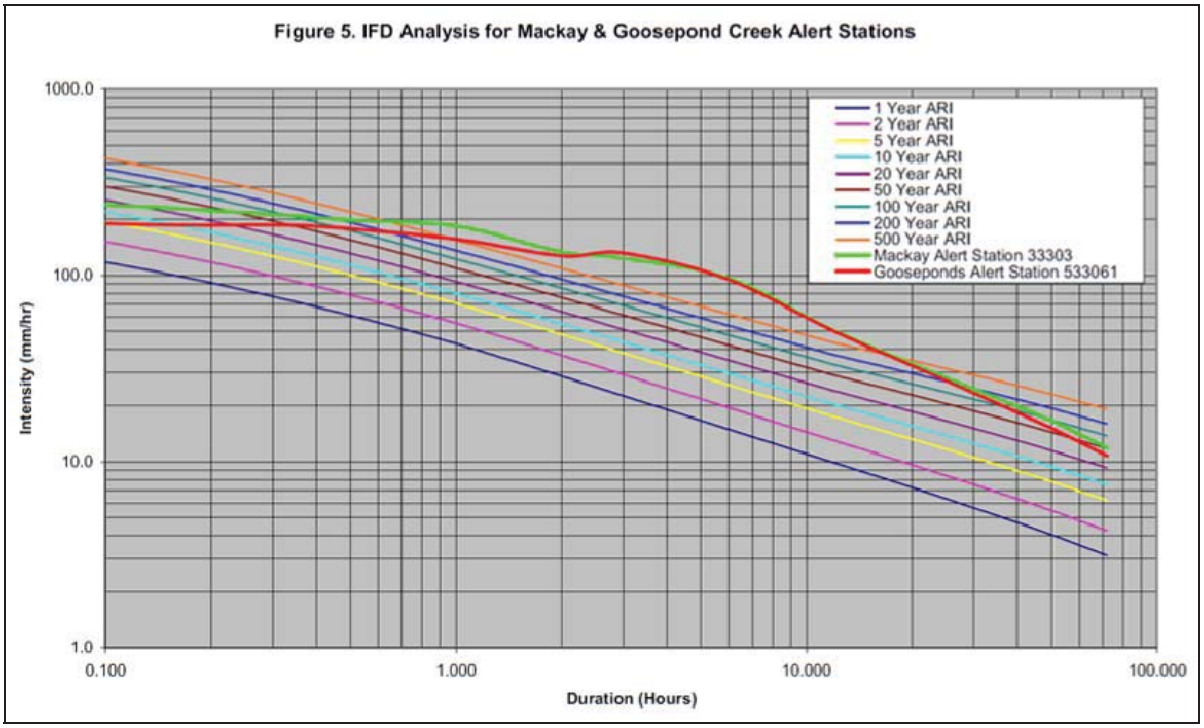

Figure 3.7. GHD calculations of 1-in-500 year ARI flood event of 15 February 2008 flood disaster event (Source: GHD, 2009)

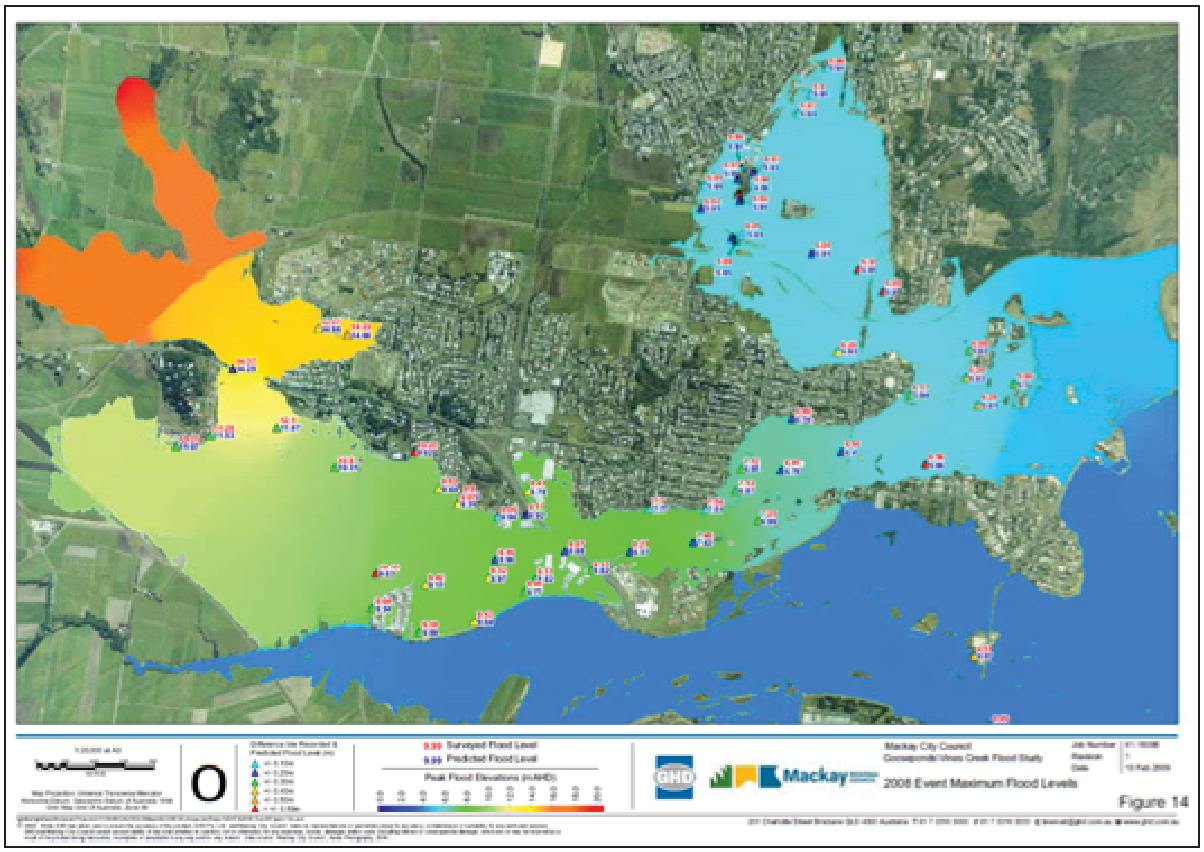

Figure 3.8. Hydrological map by GHD of 15 February 2008 flood disaster event (est. 1-in-500 year ARI flood event (Source: GHD, 2009)

3.3 Impact of the 2008 Charleville Flood

The 1990 and 1997 floods in Charleville were the impetus for the construction of Charleville's flood mitigation levee which was almost completed prior to the 2008 flood. The levee has largely prevented flooding of the township from the Warrego River. However, flooding did occur in lower-lying properties from Bradley's Gully which flows through the township of Charleville.

Approximately 40 residents and businesses in the low-lying areas of Charleville were evacuated and Queensland Health flew some hospital patients out of the town (ABC, 2008). For safety reasons, power was cut to some areas (EMA, 2009).

In relation to the 2008 Charleville flood, 920 families were assisted through the *Natural Disaster Relief and Recovery Arrangements* (NDRRA) grants totalling over $446,000 in *Emergency Assistance and Essential Household Contents Grant* payments (*pers. comm. Jill Peters, Community Recovery Unit, Queensland Department of Communities, Brisbane, 23/12/2009*). Concessional loans paid out to primary producers under NDRRA grant in Charleville related to 5 applicants, and the total assistance provided was $658,000. Small business grants valued at $298,000 were also provided, while 96 primary producer grants valued at $1.341 million were paid out (QRAA, 2010).

The total estimated cost of the January 2008 flooding in Charleville for the Department of Infrastructure and Planning for restoration of essential public assets for Local Government was $2,526,835; Emergency Management Queensland counter disaster operations costs for Murweh Shire were $216,000, and restoration of essential public assets for State Government was $482,000. No freight subsidies were paid out to primary producers by the Department of Employment, Economic Development a Innovation (*pers. comm. Stephen Hinkler, Queensland Department of Community Safety, 18/1/2010*).

Funding of $2.5 million was approved to reinstate the Murweh Shire road network to its previous condition prior to the flood, under Natural Disaster Relief and Recovery funding (pers. comm. Allan Pemberton, Murweh Shire Council, 2/11/09).

The South-West Health Service District at Charleville Base Hospital reported that presentations to the hospital's Emergency Department rose in the March 2008 quarter to 1447, up from 1190 in the December 2007 quarter, falling to 1091 in the June 2008 quarter. However, the hospital's clinical coder advises they are unable to identify admissions specifically related to the 2008 flood (*pers. comm. Sarah Charlwood, Queensland Health, 4/1/2010*).

Estimates of total general insurance claims for the 2008 Charleville flood are not currently available.

3.4 Impact of the 2008 Mackay Flood

Flash flooding in Mackay occurred during 15-17 February 2008 and flood waters damaged approximately 4,000 homes when more than 500 mm fell in the region within a few hours (EMA, 2008). Schools were shut, the local road network was badly damaged, more than 6,200 homes lost power, and mobile and land line communications were disrupted. One person died (17 year old man) when he disappeared in the Pioneer River. Mackay airport was closed and SES crews answered 2,000 calls for assistance. Six evacuation centres were established, and the Minister for Emergency Services declared 27 local government areas impacted by the floods eligible under the *Natural Disaster Relief and Recovery Arrangements* (EMA, 2008). To oversee the rebuilding of the town, the President of the Master Builders was appointed (EMA, 2008).

For NDRRA grant, a total of 5,369 Emergent Assistance Grants ($1,996,450) and 1,512 Essential Household Contents Grant applications ($2,334,002) were provided. More than 5,400 families were assisted in the Mackay region and over 30 families homes were also assisted by way of a Structural Assistance grant payment to assist in repairs to homes damaged in the floods (*pers. comm. Jill Peters, Community Recovery Unit, Queensland Department of Communities, Brisbane, 24/12/2009*).

Concessional loans paid out to primary producers under NDRRA in Mackay related to 1 applicant with total assistance provided of $100,000; 187 small business grants valued at $1.739 million, and 722 primary producer grants valued at $8.062 million were also spent (QRAA, 2010). The total estimated cost of the February-March 2008 flooding in Mackay for the Department of Infrastructure and Planning for restoration of essential public assets for Local Government was $13,885,296, and for Road Base Saturation, it was $17,784,070. For Emergency Management Queensland, the counter disaster operations costs for Mackay were $896,000, while restoration of essential public assets for State Government cost $6.58 million. No freight subsidies were paid out to primary producers by the Department of Employment, Economic Development and Innovation (*pers. comm. Stephen Hinkler, Queensland Department of Community Safety, 18/1/2010*).

The total cost of general insurance claims paid out for the Mackay 2008 flood event was approximately $410 million, based on reported data of insured loss where this may exceed $10 million (ICA, 2009). These claims related to items such as damage to building and contents, motor vehicles, business interruption, fencing in rural areas, etc.

Presentations to the Mackay Base Hospital Emergency Department rose in the March 2008 quarter to 9471, up from 9,406 in the December 2007 quarter, falling to 9301 in the June 2008 quarter. The Mackay Health Service District reported that 29 presentations were recorded at the Mackay Base Hospital, with the majority related to injuries sustained either during the flood, while rescuing people or cleaning up after the event. There were also some check ups after being in the flood, and included one mental health presentation (*pers. comm. Sarah Charlwood, Queensland Health, 4/1/2010*).

In terms of scope and damage, the Mackay 2008 flood event was substantially larger than the 2008 event in Charleville. In Charleville, under the NDRRA grant scheme, a total of $446,000 was paid out, compared to more than $4.2 million paid out in Mackay. Nonetheless, Charleville grapples with a number of challenges, including the remoteness of its location and reduced access to city resources. With its geophysical location (i.e. being situated on a floodplain in close proximity to the major waterways of Bradley's Creek and the Warrego River), Charleville has limited options for town relocation.

3.5 Disaster Management and Flood Warning Systems

The government authority with the main responsibility for disaster management in Charleville and Mackay is their Local Council. This is managed by a Local Disaster Group run by Council, with representatives from Ambulance, Emergency Management Queensland, Fire, local Council, Police, Rural Fire Service, SES, Telstra, electricity provider/s, a local medical representative. In Mackay, this group also includes a representative from the Port Authority.

At the District level, disaster management is run by the District Disaster Coordinator, who is a representative from the Police. This group also comprises representatives from Department of Communities, industry groups, local Council and Q Build. The hierarchy is such that if the Local Disaster Group is unable to obtain particular resources they need (e.g. sand bags), a request is then made to the District level, and so on, up the government hierarchy until the request can be met.

Charleville and Mackay townships currently have flood warning systems which are operated by the Australian Government and the Bureau of Meteorology based on rainfall and river height observations. The BOM flood warning system uses a rainfall and river height observations network, consisting of volunteer observers who forward data by phone when the initial flood height is exceeded at their station, and automatic phone telemetry stations run by the BOM, Department of Environment and Resource Management and Murweh Shire Council (BOM, 2009b).

During floods, the BOM issues regular Flood Warnings and River Height Bulletins by radio, via the internet and recorded voice retrieval system to local Councils, emergency services and a large number of agencies who are involved in managing flood response activities (BOM, 2009b). The flood warning system may provide future predictions for minor, moderate or major flood for a given period. River Height Bulletins are also issued for each river station located near a road crossing. This information is regularly issued by the BOM during flooding via radio stations, the internet, voice recorded retrieval systems and is communicated to local Councils, police, and emergency services and a large number of agencies who manage flood response activities (BOM, 2009c).

In Charleville, the flood warning system is for the Warrego River catchment (approx. 65,000 km^2), with major towns on the Warrego River being Augathella, Charleville, Wyandra and Cunnamulla (BOM, 2009b). Floods have been recorded for the Warrego River since 1910; and generally rainfall in the catchment of 100 mm or more in 24 hours over a wide area is likely to cause major flooding (BOM, 2009b).

In Mackay, the flood warning system is for the Pioneer River Basin Catchment (approx. 1,500 square kilometres), and lies between the headwaters of the Burdekin and Fitzroy Rivers (BOM, 2009c). Floods have been recorded at the Pioneer River since 1884 and many have occurred since then (BOM, 2009c). In February 1958, one flood peaked at 9.14 m on the flood warning gauge at the Forgan Bridge in Mackay (BOM, 2009c).

An extensive levee system has been introduced in Mackay that offers some protection for small to medium flows, but not for large floods. Installed in 1995, the Pioneer ALERT system collects information on rainfall and river heights which are reported by radio to base station computers in Mackay and then forwarded on to the BOM (BOM, 2009c).

Frequently, within 10 hours of heavy rainfall in the upper section of the catchment, a river rise can occur at Mackay. However, major flood problems will not generally occur until the river at Mackay rises to around 7.2 m on the Forgan Bridge gauge (BOM, 2009c). For this reason, the Bureau of Meteorology issues flood height predictions at Mackay when the Pioneer River is expected to exceed 7 m on the Forgan Bridge gauge. It aims to provide at least 3-9 hours warning of flood heights that may reach over 7 m. These forecasts are then updated every three hours whilst the river rises (BOM, 2009c).

In the Pioneer River Basin catchment, average rainfall exceeding 200 mm in 24 hours can cause flooding (moderate to major) and disable traffic. Falls of more than 300 mm in 24 hours can cause major flood and traffic disabilities, particularly in the lower to middle reaches downstream of Mirani (BOM, 2009c).

4 Research Methods

4.1 Data Collection

4.1.1 Study Area Selection

A project committee of researchers and state government stakeholders discussed the emphasis of the research and choice of locations in order to develop a case study of severe floods that could, under climate change scenarios, become more frequent in the future. The project committee consequently determined the study sites as case studies that compared a rural inland town with a large coastal town in Queensland. Various regions were discussed, but the Northern Gulf was determined as too remote and difficult to access such that Charleville was chosen as a rural inland town still displaying the study characteristics that were required. On the other hand, Mackay was preferred as a coastal city in contrast to Ingham.

Both case studies were selected to be representative of different levels of impact and types of settlement. Mackay is a medium sized city in which the issues, experiences and responses are expected to be representative of major urban areas. It lies on a highly vulnerable flood plain and experiences sustained population and economic growth. Mackay's flood vulnerability derives from its proximity to the Pioneer River, as well as flash flooding which may also accompany cyclone events. These two characteristics are common to a number of other coastal cities in Australia, including large cities such as Brisbane.

Charleville is representative of the inland and outback regions, with a small population and economy, vast hinterland service area, basic infrastructure and slow population and economic growth. It lies on an extremely vulnerable extensive flood plain with no significant elevated areas for relocation. Like many inland regions, Charleville experiences frequent flooding, thereby representing a community "on the edge" in terms of its susceptibility to repeated floods, and often experiences long periods of flooding leading to isolation and disruption of services.

The three primary levels of information gathering were from a) households and b) businesses in flood affected areas (in Mackay this will be concentrated in the vulnerable sections of the city whereas in Charleville this will include the whole town) and from c) local and State government institutions and authorities that provide services to the community. The project was a qualitative study which focused on reconstructing an event rather than social modelling (which applies computational methods and techniques to the analysis of social processes and human behaviour).

4.1.2 Gathering of Secondary Data and Documents

Reconstruction of the flood events and assessment of their overall impact was conducted from data and viewpoints of Bureau of Meteorology (BOM), Emergency Management Queensland (EMQ), media and local governments (Mackay City Council and Murweh Shire Council) using secondary data, interviews and text analysis of news media. Records were consulted of previous and subsequent flood events in order to place the 2008 floods in context. Related literature were collected and reviewed. Sources of information included Commonwealth and Queensland Government reports, policy documents, manuals, newspaper articles, journal papers and web pages.

4.1.3 Primary Data Collection

A purposive sampling research design was used to conduct three phases of data collection. Each phase of data collection was targeted as a different group of stakeholders: *household residents*, *businesses* and *government institutions*. Two types of survey instruments were used, i.e. *structured questionnaires* and *semi-structured face-to-face interviews*.

Structured questionnaires were administered in personal interviews, or were dropped off with respondents and picked up on the same day or a couple of days later (Appendix 4.1). The same questions were used for both case study regions, and their design was based on a questionnaire developed in the 1990s for use in NSW floods and was further developed for use in post-flood events study in 2004, by the Bureau of Meteorology, in Queensland's Central and Western inland areas. A prototype of the original questionnaire was designed in the 1990s by Linda Anderson-Berry and David King from James Cook University, Townsville, in consultation with Emergency Managers in New South Wales. An overview of the topics covered in the structured questionnaires is presented in Table 4.1 below.

Table 4.1. Questionnaire topics relevant to sample group surveys

Questionnaire topics	Household	Business	Institutions	Objectives Addressed
Experience in the 2008 flood event	✓	✓	✓	1,2,3,4
Recovery after the flood	✓	✓	✓	1,2,4
Precautions taken before the flood	✓	✓	✓	1,2,3,4
Previous experience of flooding	✓	✓	✓	1,2,4
Warnings of the January/February 2008 flood	✓	✓	✓	1,2,4
Preparations before the flood	✓	✓	✓	1,2,3,4
Thoughts about floods (to help with public education campaign planning).	✓	✓	✓	1,4
Demographic information	✓	✓	✓	1,2,4
The *State Planning Policy 1/03* Guideline (SPP) and the *Integrated Planning Act 1997* (IPA)	na	✓	✓	3
Assisting your clients during the 2008 floods	na	na	✓	1,2,4
Institutional preparedness for flood events	na	na	✓	1,2,3,4
What other organisations and members of the community can do to better prepare for flood events	na	na	✓	1,2,3,4
Maintaining Charleville and Mackay as viable communities in which to live and work	na	na	✓	2

The second method used was semi-structured interviews, used exclusively for Mackay institutions, and their design was based on questions asked in the structured questionnaires referred to above.

Household and business participants were restricted to those affected by the 2008 floods in the case study regions; and institutions included those with members on the Local and District Disaster Committees and Community Service organisations, as well as representatives from Local, State and Commonwealth government institutions.

Table 4.2 below presents the total sample, non-contacts and response rates. It should be noted that the flood area in Charleville was restricted to a specific area close to Bradley's Gully, whereas the Mackay flood event was more widespread in geographic terms and a larger disaster event, thereby accounting for differences and greater complexities experienced in Mackay.

Table 4.2. Total sample, non-contacts and response rates

Sample Group	Charleville	Mackay	Total
Households			
Number contacted	65	400	465
Effective in-scope sample	55	87	142
Response rate	85%	22%	31%
Businesses			
Number contacted	15	142	157
Effective in-scope sample	13	47	70
Response rate	87%	33%	44%
Institutions			
Number contacted	30	38	68
Effective in-scope sample	23	12	35
Response rate	77%	32%	41%

4.1.3.1 Charleville Samples

Structured questionnaires were used for household, business and institutional sample groups in Charleville. Using a purposive sampling scheme, supported by information from the local SES Coordinator and Murweh Shire technical officer, the areas of interest were identified on the map and ground. Subsequently, households and businesses in the specific area of the flood event near Bradley's Gully were contacted. Households were door-knocked, and businesses phoned to make appointments for personal interviews. Local, State and Commonwealth Government and Community Service personnel and members of the Local and District Disaster Committees were contacted by phone to make appointments for personal interviews. Figure 4.1 shows the general spatial features of the sampling area. The locations of the samples are clustered near the Bradley Gully's where flooding occurred in that area and vicinities.

Figure 4.1. General spatial features of the Charleville sampling area. (Source: base from Google Earth)

The institutional questionnaire for Charleville contained the same questions as the householder and business surveys with additional questions related to the a) role of institutions during the flood and financial assistance they provided, b) issues that arose, c) what actions they took post the 1997 flood to better prepare for flood events, d) their future mitigation planning and 5-year plans to cope with future flood events, e) and how they would spend additional funding if available. Other questions related to what they thought the community and other institutions needed to do to better cope with flood events, and what needed to happen in the next 5 years to make Charleville a viable community in which to live and work. This sample was also asked whether there were any flood events that could have caused their organisations to consider moving to a different part of Charleville or leaving the town completely.

Personal interviews, using the structured questionnaires, were conducted with householders (55 respondents) and institutions personnel (23 respondents). A very small number of household surveys were dropped off and picked up to accommodate respondent's requests. Because a large proportion of the businesses contacted were in the retail sector and observed to be extremely busy when we visited, the decision was made to drop off and pick up these surveys, in order not to disrupt trading activities. A total of 13 responses from businesses were collected.

4.1.3.2 Mackay Samples

The same set of structured questionnaires were used in the Mackay case study region as used for Charleville, with the exception that semi-structured interviews were used for institutional representatives in Mackay.

The suburbs of Mackay recorded to be most affected by the floods were selected from post flood mapping according to the purposive framework. Out of a possible 4,000 households that could have been affected in Mackay, a purposive cluster random sampling method was used to identify the sample. The residential blocks within the suburbs were then allocated a number from 1-50, and a random selection of 6 residences was made based on an unbiased rule of selection. Questionnaires were then dropped off and picked up a few days later.

The flood's impact in Mackay was very widely distributed across the city of Mackay. Of the 400 household properties door-knocked in these regions, only around 22 % of residents were found to be home and living at the property at the time of the 2008 flood. Surveys were conducted between 3pm and 7pm to ensure that those who were working during the day were still able to be contacted however this may have been one contributor to the low response rate. However an estimated third of those surveyed were found to have moved in after the 2008 flood event which may either suggest a highly itinerant resident population in these areas or a pattern of migration following disaster events.

Figure 4.2 below highlights the properties affected by flood based on 100 year design flood event (GHD, 2009). These residential blocks were each allocated a number because they are priority areas. Residential blocks located in or adjacent to the areas affected by the peak flood elevation (mAHD) levels would then be targeted in order of hierarchy of the highlighted areas that were most flooded: (1) red, (2) orange, (3) yellow, (4) green, and (5) blue. These were numbered in order of residential blocks most affected by the flood event according to Figure 4.2. It should be noted that a snowballing method was used to identify the residences most affected by the floods. Households identified additional streets and the suburb of South Mackay that were not listed on Figure 4.2.

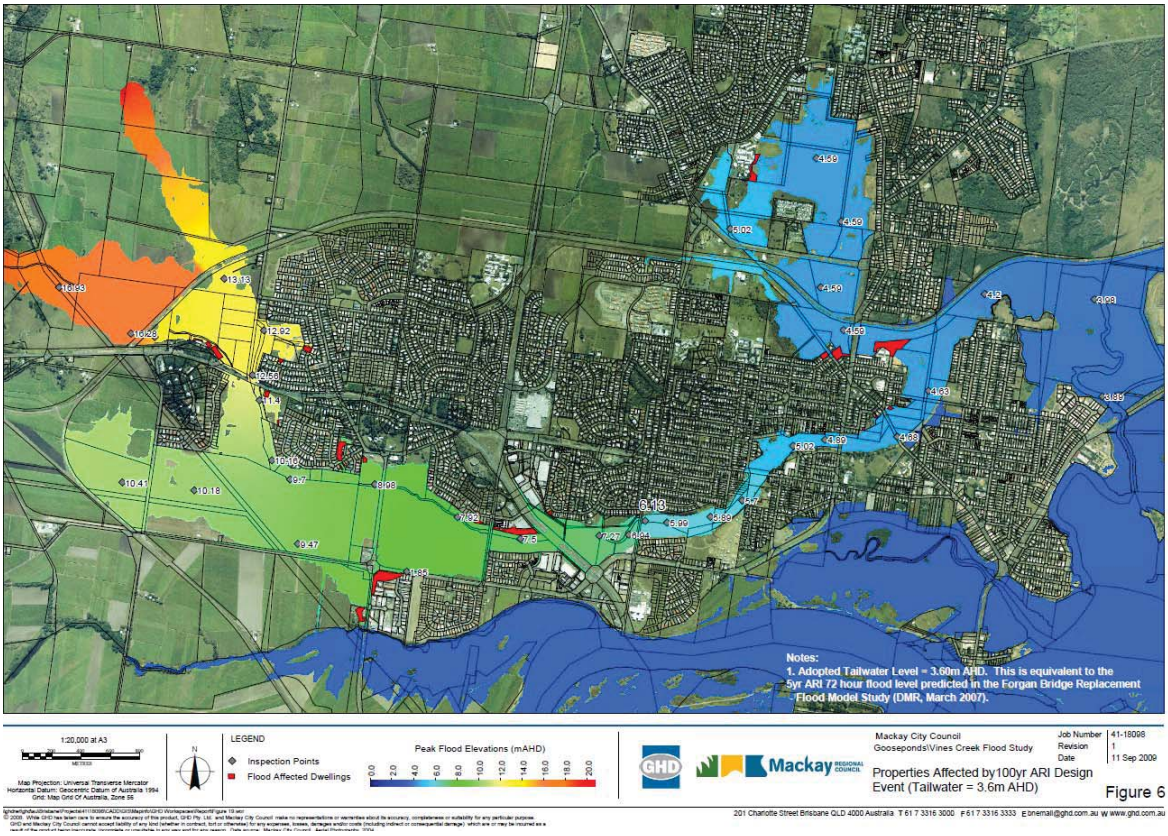

Figure 4.2. Flood affected dwellings in North Mackay based on 100 year design flood event (GHD, 2009)

The samples representing businesses were drawn from a range of commercial and industrial sectors from the Glenella Industrial Estate, Northpoint Shopping Centre and the Mackay airport that were physically located in the flood impacted area. Business enterprises located in the Glenella Industrial Estate were targeted initially for surveys and a snowball technique was then used to identify those business enterprises that were affected. It was found that there was a gradual slope upwards towards the road that led to the Fursden Creek where businesses were not affected by the flood event. Questionnaires were dropped off and picked up within a few days.

Semi-structured, face-to-face interviews, based on questions contained in the structured questionnaires, were conducted with stakeholder institutional representatives. Institutions were contacted the week prior to conducting interviews so that only those who were available on short notice were able to be interviewed. It should also be noted that given interviews were in the format of semi-structured face-to-face, that a full schedule was achieved of an average of 4 interviews per day over the 3 days spent in the field. There were additional institutions which would have been willing to participate in the study at a later date however due to study deadlines this was deemed not possible and adequate information had already been gleaned from the qualitative interviews.

Aspects of vulnerability, resilience and adaptive capacity were interpreted from the indicators included in the questionnaires. It should be noted, however, that some of the questions could arguably be an indicator of another category depending on the perspective addressed. For vulnerability, the following indicators were analysed:

- Awareness of flood warnings and information;
- Update of information and communication;
- Length of time living in the community and current home;

- Whether living alone or with other household members;
- Number of adults and children in household;
- Employment status;
- Ethnicity;
- Employment status; and
- Educational attainment.

In interpreting resilience, this study considered changes in awareness, procedure and management of flood-related issues by householders, business and institutions. The specific indicators used were:

- Previous experience of flooding;
- Adoption of flood mitigation measures since the last flood events;
- Changes in the awareness of people with regards to risk and preparedness (e.g. having household emergency plan, kits, evacuation routes, etc.);
- Length of time living in the community and current home; and
- Social network and sense of belongingness in the community.

The adaptive capacity of householders, businesses and institutions to adjust to potential damage or to cope with the consequences of flooding was interpreted using the same set of questionnaires. The key indicators used were the following: a) evacuation before and during flooding, b) taking flood insurance cover for property, c) specific actions to prepare for flooding, and d) migrating to another area (part of the town/city or outside of it).

4.2 Data Analysis

SPSS (Version 18) statistical software was used for the entry of data into a database, with respondent data from both towns ultimately being combined into two databases of households and businesses. This simplified the generation of comparative data. To facilitate the comparisons, a large number of cross-tabulation tables was generated with data standardised as percentages. Graphs were also generated for the same databases. By amalgamating the data and its results, a single case study of 2008 Queensland floods was presented, rather than jumping from one town to the other.

The results show fascinating similarities, as well the expected differences between each location. These simple cross-tabulations of qualitative data are clear statements of the impact, perceptions and attitudes towards each flood. Qualitative data were analysed by grouping responses by themes and associating them with the relevant project objectives.

5 Results and Discussion

5.1 Introduction

This section is organised into six parts: impacts of the 2008 floods; vulnerability; flood mitigation measures and State Planning Guideline 1/03; resilience and adaptive capacity. Under each part, results of the householder, business and institutional surveys are presented discussed. The summary tables of Surveys (Households and Businesses) for Mackay and Charleville are provided in Appendix 5.1.

In interpreting the results, it should be noted that in Charleville the single river gauge height monitoring station at Bradley's Gully was not working at the time of the flood, and that this gully was the main source of flood water. On the other hand, the Mackay flood was a flash flood resulting from a large scale synoptic event and a monsoonal low dropping large amounts of rainfall. It is not possible in these types of large scale synoptic events to make predictions as to local area effects.

Moreover, it is extremely difficult to obtain flood insurance in Charleville for household and businesses located in the floodplain making them more vulnerable to economic losses.

5.2 Impacts of the 2008 Floods

In the 2008 Charleville and Mackay floods, the populations were affected in the early hours of the morning. Due to the nature of the events, people in these regions were caught by surprise. Extensive damage occurred in both study areas during those floods (Figure 5.1).

(a) (b)

Figure 5.1. (a) Part of the Gooseponds and Barnes Creek Road, North Mackay, 15 February 2008, (Photo source: CQ Rescue), (b) Part of Warrego River and Charleville, 20 January 2008

5.2.1 Householders

In both Charleville and Mackay, the most common areas flooded were outside the home, in the block, garden, garage shed and outbuildings areas. A greater proportion of homes in Mackay had water enter their homes (85 %) as compared to just under half of Charleville residents. Most water entering Charleville homes reached up to 1000 mm. However, in Mackay, the water exceeded 1000 mm rising as high as 2000 mm for almost a quarter of residents.

Most residents in Charleville received a flood warning from Emergency Services and/or the Local Council. In Mackay, residents received flood warnings from the Bureau of Meteorology and the Local Council. In both towns, the most helpful forms of communication for keeping residents up to date on the floods were radio alerts. In Charleville additional sources were SES workers and family and friends.

Although the Mackay flood event was larger in terms of numbers of people and properties impacted than that experienced in Charleville, around 75 % of Charleville residents from the sample population were forced to leave home, as compared to just over a half in Mackay, depicting a major social impact of the flood. Most Charleville residents were able to return home in less than a month, while in Mackay, this period was more extended with 14 % of residents not able to return home for more than six months. This extension to more than six months before they could return home in Mackay may have been caused to a large extent by extensive delays experienced by residents in having insurance companies authorise repairs. Around 4,000 residents in Mackay were found to have damage to their house (EMA 2008) from around 160,000 residents living in the region (ABS 2006c).

Just over 75 % of resident homes in the case study regions were isolated by flood waters and, on average, 40 % incurred personal or business costs as a direct result of the floods not covered by insurance. Charleville residents (question exclusive to Charleville) reported financial costs as a direct result of the flood not covered by insurance as totalling $100,130. A higher proportion of residents in Charleville (35 %) as compared to Mackay (8 %) experienced a financial gain as a result of the flood. In Charleville, this was largely due to financial support provided by the government. As mentioned in section 3.4, selected families in Charleville were assisted through the *Natural Disaster Relief and Recovery Arrangements* (NDRRA) grants totalling over $446,000 in *Emergency Assistance and Essential Household Contents Grant* payments.

Additional comments made by householders about the flood events during interviews were listed in Appendix 5.2.

5.2.2 Businesses

All Charleville businesses interviewed suffered flood damage and flood water entered inside their business premises (Figure 5.2). In Mackay, 79 % suffered flood damage and 97 % had flood water enter inside their premises. The depth of water in most business premises in these towns was below 1000 mm but the majority of premises were isolated by flood waters, with around a third of business people forced to leave the premises.

Most Mackay businesses did not receive a warning of the flood event. However 15 % of businesses in Mackay were alerted by the Bureau of Meteorology but in Charleville the source of this warning was more widely distributed and included warnings from Local Council, Emergency Services, the Fire Service and Police.

Close to three-quarters of Charleville businesses were able to return to their premises within 1-3 days and the remaining within a week. All businesses in Mackay returned within 3 days of evacuating, with the exception of one business, which returned after 60 days. Compared to businesses, it was generally longer until residents in the two towns were able to return home.

Figure 5.2. Business premises flooded in Charleville (Photo source: Charleville Home Hardware and Chester Wilson)

Almost 60 % of businesses in Charleville were not covered by insurance and responses on the questionnaire indicate that it is virtually impossible to obtain insurance for flood for businesses in Charleville. A lot of these premises are situated in the flood plain area and thus the probability of flood occurrence is high. For Mackay, just over a third of businesses were not covered by flood insurance.

Almost all the Charleville businesses incurred business costs as a result of the flood not covered by insurance (92 % of the sample compared to 58 % in Mackay). In total, Charleville businesses estimated these costs were $375,000. This compares with a total of $342 million insurance payouts as recorded by the Insurance Council of Australia (Emergency Management Australia (EMA) 2008). Less than 8 % of businesses in the two towns reported receiving a financial gain as a direct result of the floods. However, as there was a large proportion of Mackay businesses related to home construction/homeware and that many residents received insurance to cover renovations, these businesses located in affected suburbs were likely to receive indirect benefits from the flood event.

Other comments made by businesses are presented in Appendix 5.3.

5.2.3 Institutions in Charleville

5.2.3.1 Institutional Roles during the 2008 Flood

Institutions in Charleville during the 2008 flood event were involved in a range of roles. These are summarised below, grouped by general theme. Other specific comments from institutions in Charleville are provided in Appendix 5.4.

a) Response and service delivery

- Response activities, responding to calls for help and other associated tasks;
- Transferring acute hospital patients to Roma, Brisbane and Toowoomba by air;
- Policing and paramedic services;
- Providing financial assistance and counselling referrals for the social and emotional well-being of the community;
- One Government department closed their offices for 10 days and all staff were assigned to provide casual labour to residents to help with sandbagging and other duties;
- Measuring water flows, pumping out low lying buildings that had water, carrying out a few minor rescues getting people out of bad situations;
- Hosing out and washing out houses affected with high pressure hoses, taking furniture to the dump;
- Low risk prisoners also helped with the flood event;
- Strategies to stop mosquito larvae breeding in stagnant water;
- Inspections of hospitality businesses, butchers, etc. in terms of any potential health issues; and
- Disconnecting power, where necessary, and monitoring people's assets and their safety

b) Coordination and support activities

- Attending Local and District Disaster Committee meetings and updates;
- Dealing with community issues, coordination efforts for different services;
- Disaster management coordination;
- Phoning insurance companies on behalf of residents overwhelmed by the event;
- Providing support to the local SES;
- Loans of vehicles and communications equipment to help with the event;
- Catering for evacuees and registration, helping people get where they needed to go; and
- Helping build the temporary levee.

5.2.3.2 Issues which Arose in Charleville during the 2008 Flood

One respondent expressed the view that the 2008 flood event was made easier to manage due to the good work of local government and their rapid response, and that the recovery processes by the Department of Communities were very well coordinated. Institutional personnel interviewed reported a number of issues which arose during the flood event. These are grouped below by general theme:

a) Response issues

- A temporary levee needed to be built in Charleville, and an emergency accommodation shelter established;
- Personnel numbers for initial response calling for SES volunteers were not sufficient. It was hard to gain and maintain those numbers. Initial response can be poor, and after that the whole community signs up and comes and helps; and
- SES volunteers are required to be inducted and some see this as a waste of time as they have life skills, such as how to use chainsaws which they have used all their life, and that this training has more value in cities where people are likely to have less life skills. Taking people through this formal safety training takes up resources to induct people.

b) Personnel/personal-related issues

- Specially trained swift-water rescue people had to be brought in;
- Difficulties with keeping children out of the water and floating downstream and there were a few snakes getting around and there was debris in the river;
- Sometimes people were reluctant to evacuate;
- "Rubberneckers" i.e. onlookers – there were problems with people getting in the way and some driving through flood waters and creating wakes, sometimes this could just be enough to force a breach and result in water entering a house;
- In events like this you see the best and worst of people. Individual's self-interest gets in the way of an efficient community response; and
- Positive outcomes were the way everyone worked together, that was a positive benefit

c) Operational and communication issues

- It was felt that the Local Hospital did not have all the facilities and set-up needed to be able to cope with nursing home patients;
- A number of institutions reported that staff fatigue was a problem because people did a lot of overtime during the flood;
- There were issues of access and logistics;
- Information provided to Queensland Health from outside the region did not reflect what was happening locally, and it was felt that a better synergy needed to happen between Emergency Management Queensland and Queensland Health;
- There is limited communication flow to rural properties, word of mouth in town is okay and communication to rural properties is usually via the police, radio and distance education (School of the Air Education), however the School of the Air were on holidays at the time;
- Resupply was needed for isolated properties and the community; and
- There was not enough food when the Red Cross team was feeding evacuees, they expected to feed 10 people and ended up feeding 40 evacuees. The local Red Cross was not informed as to exactly how many evacuees were needed to be fed.

d) Financial assistance issues

- Felt that handing out food or food vouchers may be better than handing out money straight away, and that this can sometimes be spent on alcohol instead of necessary items like food; and
- Subsidies are sometimes available for rebuilding where freight is paid for fencing equipment and in 2008 places near Bradley's Gully suffered greater damage than was experienced in the 1990 flood, however no-one claimed for subsidies for rural property fencing. The amount of paperwork involved may have dissuaded people.

e) Lack of local-decision-making

- Several institutions felt that some decisions made by staff in locations outside the local area would have been better made by local staff, and that the local people would be valuable for checking the validity of claims for funding in terms of being affected by floods.

f) Other issues

- Sandflies were a problem;
- Water quality was not such a problem as it is does not become contaminated like most flood water, Council continued to sample water during the flood period; and
- One organisation affected who did not have flood insurance incurred a lot of cost to rent temporary premises and this reportedly affected their ability to deliver a lot of their programs and services

5.2.3.3 Financial Assistance Provided by Charleville Institutions

Only two organisations surveyed were involved in providing financial assistance. Of these, one felt that a system that will enable "quietly checking" of recipients to see if there is a real need or not for financial assistance.

5.2.3.4 2008 Flood Experience for Charleville Institutions

Fourteen percent of respondents from institutions had never experienced flooding before 2008, while 81 % had experienced between one and three floods, and 5 % had experienced more than five floods. For most respondents, the 2008 flood event was not their worst flood. All those who responded indicated 1990 was the worst flood with one respondent also mentioning the 1997 flood. Figure 5.3 shows buildings of institutions flooded in Charleville.

The 2008 flood had very little impact on the premises of institutions surveyed, with only two affected. One organisation evacuated for 5 days and the other one was situated close to Bradley's Creek and underwent severe inundation and had to relocate to temporary premises for six months. This affected their ability to service their clients.

It was suggested that the main problem in the 2008 flood was that the one and only river height reader was not working on Bradley's Gully and therefore they had no idea what was coming in terms of water.

5.2.3.5 Flood Warning

The number of participants who received a warning from authorities included Emergency Services (7), followed by Local Council (6), Bureau of Meteorology (4), Police (3) and the Fire Service (2) (participants could select more than one authority in this question). Seventy-one percent rated the accuracy of flood warnings and information as being accurate most or all of the time, with 29 % indicating it is accurate some of the time.

Figure 5.3. Buildings of institutions flooded in Charleville (Photo source: Carol Finlay and Chester Wilson)

Eighty-five percent of institutions received a flood warning and responses to this warning included activities such as convening the Local District Management Group, carrying out river monitoring, placing the SES and Red Cross on stand-by, evacuating the office, activating the siren to warn the town, moving computers and colleagues' papers to higher ground, moving cars, and contacting management personnel. Of those who received the first warning, the time between receiving this first warning and being affected by the flood waters ranged from less than 1 hour (23 %) to 7-12 hours (8 %), 13-24 hours (15 %) and more than 24 hours (54 %).

5.2.3.6 Flood Damage

Only three institution premises in Charleville suffered flood damage, and areas flooded included floor coverings, the whole office, classroom and recreation rooms and affected office and clinical equipment. The depth of the flood waters inside these premises ranged from 130-1500 mm and two of these institutions were isolated by the flood waters and evacuated to temporary accommodation, one for five days and the other for six months. The council's response to the flood event was rated as moderately responsive and also as very responsive. Two of the respondents incurred financial costs not covered by insurance.

Figure 5.4 below shows that the most helpful form of communication for updating developments of the 2008 flood event were radio alerts, followed by the Bureau of Meteorology (BOM) website, SES workers and a message sent to their mobile by Murweh Shire Council.

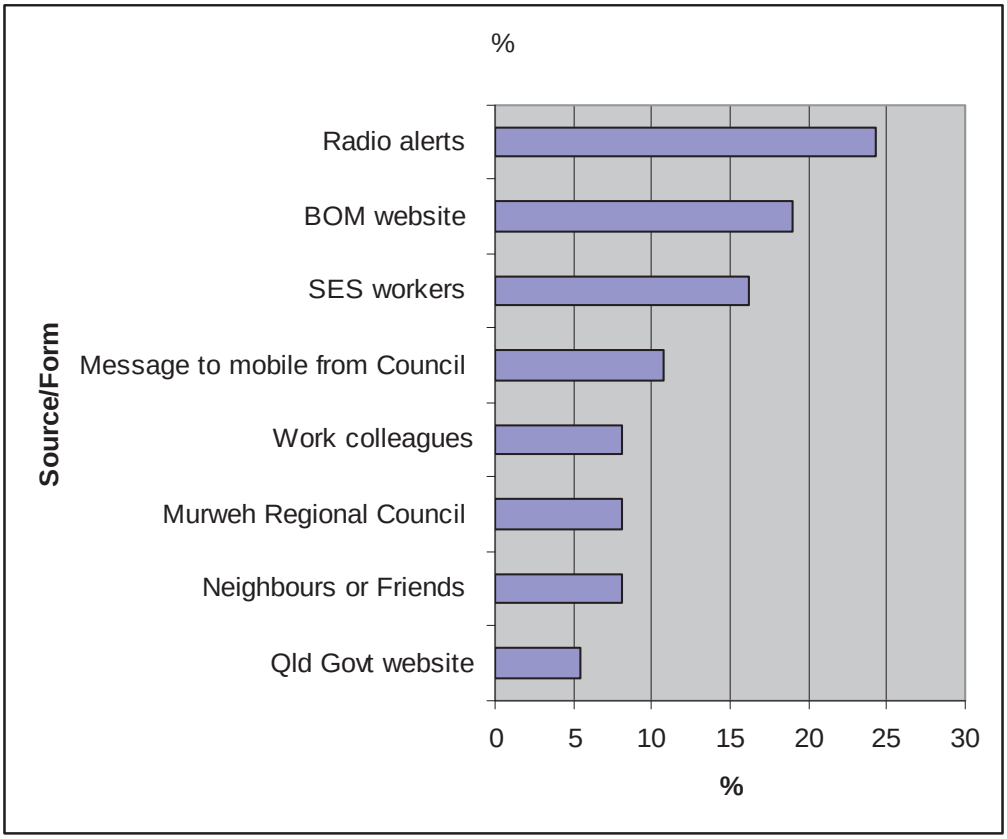

Figure 5.4. Source or form of communication rated as most helpful for institutions in updating developments of the 2008 flood in Charleville (could select more than one)

5.2.4 Institutions in Mackay

Only one institution from those surveyed in Mackay sustained flood damage, however many were cut off by flood water, limiting access to and from the building.

Comments made in personal interviews with Mackay institutions on the 2008 flood event are summarised below and included:

- The 2008 event was a "synoptic scale event" – a large scale event for which the science is not available for such localised weather events;
- Shortage of trades people in the region;
- Due to lack of availability of electricians some houses were without power for around 2 weeks;
- Clients in public housing were looked after but those in private rental accommodation had difficulties and were not treated well by landlords;
- Some cases of claustrophobia with clients in temporary accommodation;
- Some children experienced psychological effects of the floods;
- Water through the windows received, staff cars affected, telephone system went down, came into gutters;
- Needed a boat for evacuation but none available;
- Had to check on offers of food in case ABC was sued;

- Emotional and mental rebuilding did not go well;
- Businesses had less resilience than households;
- Cuts to roads from flooding hampered some rescue efforts;
- Insurance companies told many residents not to clean up till they had assessed the damage but this was causing health risks so the major intervened;
- Psychological issues, financial and infrastructure damage, particularly at the household level, some moved to other parts of Mackay, largely as a result of associated psychological issues;
- Some reports of theft;
- Corners were cut in the building trade;
- There was a housing shortage so people opened their homes people were housed quickly;
- Clients new to the area did not know how to prepare for the event;
- Clients new to the area were not aware of the natural hazards events such as floods and did not know how to prepare for the event;
- There was little warning of the severity of the flood event so little info to pass on to general Mackay community;
- Slow to be notified of the impending event;
- No warning of the severity of the flood;
- The event caught people by surprise;
- Some businesses laid off staff;
- Some banks suspended loan repayments at the time;
- Many insurance companies would not let rebuilding start until the building was dry sometimes this took 8 months to get dry;
- Different insurance companies took different approaches which created issues;
- Issues of staff fatigue due to overworking;
- Authorities did a good job at the time;
- Communications failed which means they were not receiving any helicopter rescue jobs: Mackay phone system was down and radios were down, mobile networks overloaded and only text messages could be sent;
- The storm surge evacuation plans confused people in the flood event;
- Staff had their own tragedies to deal with;
- Airport was closed and all flights cancelled;
- Significant economic activity was created due to repairs to homes, repairs averaged $140,000-$160,000; and
- The hospital was flooded and night staff had trouble leaving as there was restricted access, staff also had trouble getting to work re flood waters.

5.3 Vulnerability

5.3.1 Introduction

It is important to consider a community's characteristics in order to understand its relative vulnerability to human or natural hazards (Gazley *et al.,* 2009). In simple terms, vulnerability involves two aspects – *exposure* (how likely a hazardous event is) and *coping ability* (resilience and resistance) (Clark *et al.,* 1998).

People cope with hazards differently, and their vulnerability may relate to factors such as age, disability, family structure and social networks, housing, the built environment, income and material resources, lifelines (e.g. hospitals, emergency response), occupation, race and ethnicity. Many studies, for example, have shown that those aged over 75 years are considered a vulnerable sector of a population (Granger, 1995; Blaikie *et al.,* 1994), and people in full time employment who are educated have been found to be usually less vulnerable (Anderson-Berry and King, 2005).

Other factors that contribute to vulnerability can include poverty, poor management and leadership, lack of disaster preparedness and planning, and the nature of the buildings themselves which may not be constructed to cope with extreme events. Climate change can contribute to environmental vulnerability.

Vulnerability can also relate to low perceptions of risk, such as not considering there may be a risk in an area from flood events, as well as members of a community never having had experience with a natural disaster event and hence no memory upon which to draw experiences and approaches for coping and mitigating against the risks. New migrants face additional pressures and challenges, including language barriers and the need to build social networks.

Critical points of failure or vulnerability in communities can also relate to settlement patterns, building codes and the relationship between these two, and consequences that can lead to higher flood risk. These, together with other factors, can contribute to severe disaster event consequences and increase the vulnerability of a community.

5.3.2 Householders

Mackay residents could be considered a more vulnerable community as compared to Charleville residents based on a number of findings in this study. Their vulnerabilities generally related to a lack of information about floods, their perception of the accuracy of flood information, and responsibility for preparedness, whereas the vulnerability of the Charleville resident community relates especially to low levels of flood household insurance cover.

Mackay residents assigned a very low rating in terms of the response of their Local Council to the flood event (only 26 % rated it very or significantly responsive compared to 56 % in Charleville) and most residents (93 %) in Mackay did not receive any warning about the flood (42 % in Charleville). This may explain why only 5 % of Mackay residents considered themselves significantly or very prepared for the 2008 flood event (compared to 26 % in Charleville).

There were low levels of confidence amongst Mackay residents about flood warning information, with about half rating its accuracy very often not or never accurate (16 % in Charleville), which may have the potential to affect their future willingness to evacuate or prepare for flood events.

Charleville residents were more knowledgeable about where evacuation routes and centres were compared to Mackay (86 % and 28 % respectively), likely influenced by the fact that Charleville is a much smaller town in terms of area with tightly-knit community communication networks.

The main characteristic of vulnerability for Charleville was the low level of flood insurance cover taken out by residents (32 % compared to 68 % in Mackay). Residents in Charleville indicated that flood insurance is very difficult and expensive to obtain in Charleville hence these low levels of insurance make Charleville residents more vulnerable to economic losses in flood events. Moreover, some residents mistakenly believe that their household contents insurance covers them for flood damage, whereas this is frequently not the case.

A flash flood inundation of the type of event that occurred in Mackay would have been covered as storm damage, but if the Pioneer River had flooded households, it is possible that many more residents would have discovered that their household contents insurance did not cover them. It is likely that the implementation of additional mitigation and data monitoring mechanisms to measure river heights in Charleville for Bradley's Gully and other key strategic rivers may result in making it easier for residents to obtain household insurance for inundation floods.

5.3.2.1 Householder Concern about Flood Events

Concern about the risk of floods in Charleville and Mackay were similar. However, around a quarter of Mackay residents had a neutral attitude when it came to talking about floods and obtaining information about them.

Both communities had similar attitudes in terms of whether they thought about floods and sought information on the risk of flood to a similar degree. In terms of a flood posing a risk to personal safety, there was little difference between the groups. A slightly higher percentage in Charleville felt that the threat of floods could pose, quite a lot or a great deal, of threat to daily activities (work, leisure, etc.) (62 % versus 51 % in Mackay).

Close to half the resident samples believe a damaging flood is something that could occur in the future. About three-quarters in Charleville, and a third in Mackay, believe this is likely to occur during their lifetime.

5.3.2.2 Ethnicity of Householder Sample

The ethnic background of respondents in the two case study regions were similar, with the exception that in the Charleville sample, 14 % of respondents were of Aboriginal descent, compared to 4 % in Mackay. This reflects the higher percentage of indigenous people residing in Charleville estimated in the 2006 census as being 12.9 % (ABS 2006b). Other Australasian indigenous groups residing in these two towns were Torres Strait and Pacific Islanders. More than 80 % of respondents in both towns were non-indigenous.

5.3.2.3 Networks Sharing Flood Risk Information

Less than 15 % of members of resident households had participated in local community groups related to flood, or had written letters to authorities. However, a proportion of residents had attended meetings about flooding (Mackay 35 % and Charleville 22 %).

5.3.3 Businesses

A very large proportion of Mackay businesses did not receive any warning of the flood event (85 %, compared to 31 % in Charleville). The onset of the Mackay flood was very sudden and as previously mentioned was a large synoptic scale event with little opportunity for predictions to be made at the local scale.

Three-quarters of Charleville businesses perceived flood warnings and information as being accurate most or some of the time. In Mackay, close to half considered them accurate either all, most or some of the time. Two-thirds of Charleville businesses were aware of evacuation routes and centres compared to 41 % in Mackay. Charleville is a much smaller town in terms of area; hence this result could be expected.

Around a third of Charleville businesses rated their preparedness for the 2008 flood event as significantly or very prepared, compared to 8 % in Mackay. About two-thirds of Mackay businesses felt they were not prepared at all for the event (compared to 8 % in Charleville). Close to half the businesses in Charleville and almost a third in Mackay rated the response of their Local Council very or significantly responsive. The time between the first warning being received and being affected by the flood was between less than 1 and 24 hours in both towns.

Fifty-seven percent of Charleville businesses did not have flood insurance, compared to just over a third in Mackay. This is a major problem for those Charleville businesses which are situated close to Bradley's Gully and are unable to obtain flood insurance due to their location. Many of these businesses rely on easy access to the town for their custom; hence moving out of town would not be an attractive option for them economically. Implementation of mitigation activities and river height monitoring, together with development of documentation on these new flood prevention and mitigation strategies, are needed to persuade the insurance industry of the reduced risk. In this way, negotiations might be conducted with insurance companies to ensure Charleville businesses can be covered for inundation flood risk.

5.3.3.1 Concern of Businesses about Flood Events

Charleville businesses consider the risk of floods as a threat to business activities and they actively think about, talk about and source information on floods, and considered them a possible threat to personal safety (Figure 5.5). On the other hand Mackay businesses showed little concern for seeking information on floods and did not view them as possibly threatening to personal safety.

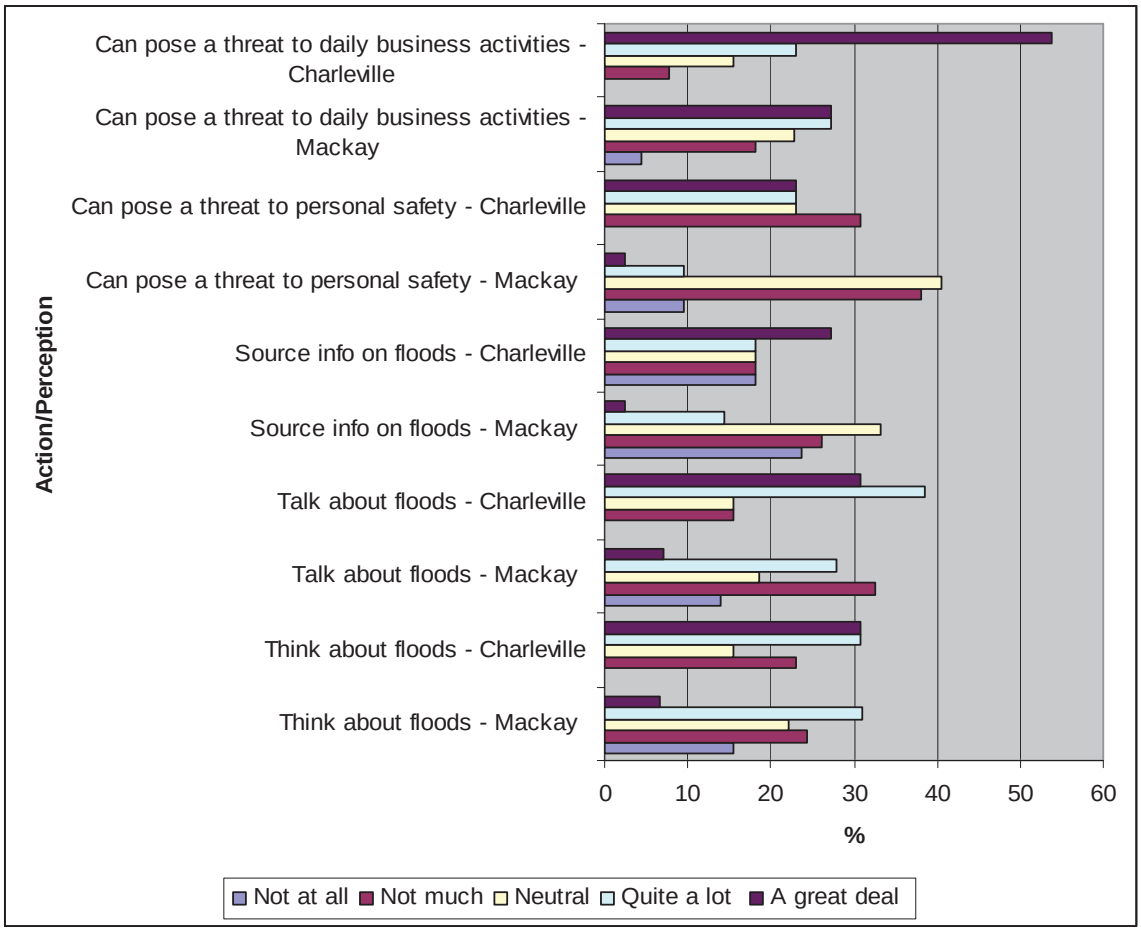

Figure 5.5. Businesses' concern about the risk of flood

Figure 5.6 clearly shows that almost 70 % of businesses in Charleville strongly believe that a damaging flood could occur in the future (compared to 21 % in Mackay) and 91 % believe it could happen in their lifetime, compared to just over a third in Mackay.

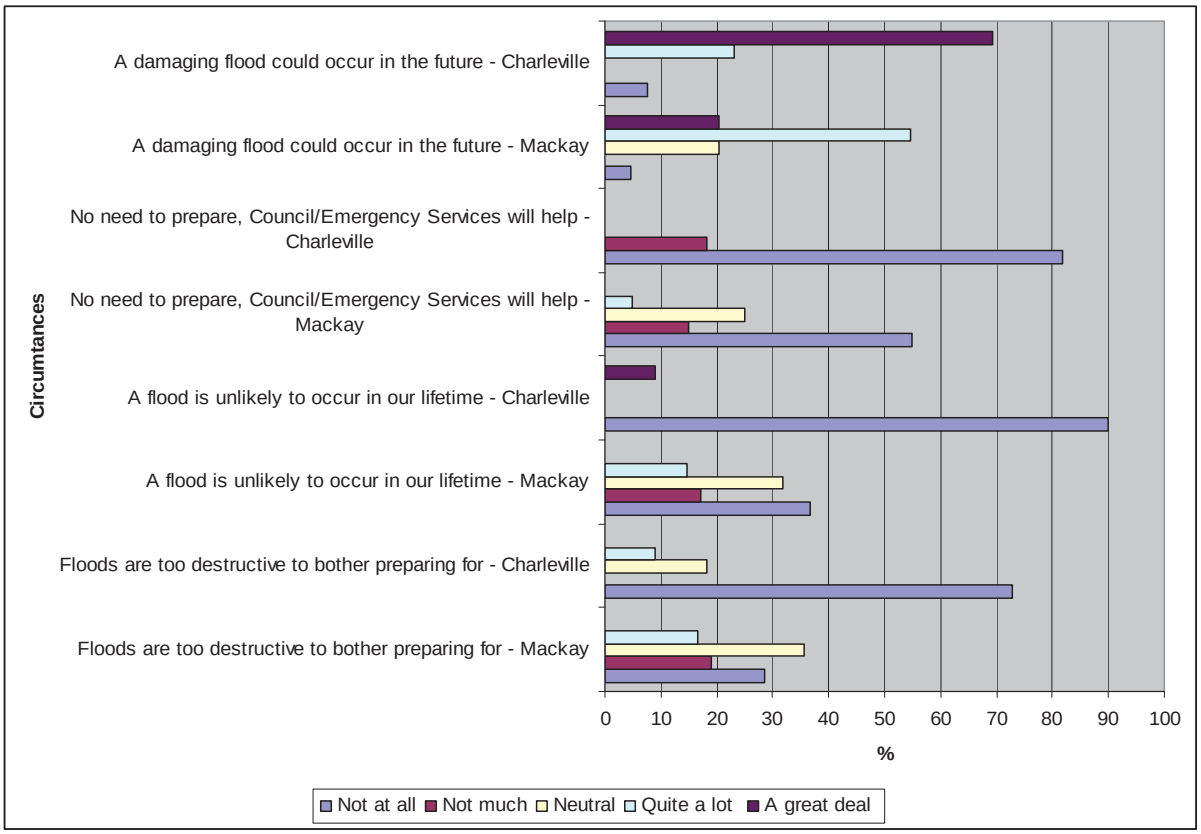

Figure 5.6. Extent to which businesses believe some circumstances about flood events

5.3.3.2 Respondents' Job Position, Gender and Ethnicity

Most business respondents were either Managers or Directors/Owners, a gender split of 62 % male and 38 % female in Mackay. In Charleville, the majority (70 %) of respondents were female. All respondents in Charleville and 96 % in Mackay were non-indigenous. The remaining respondents in Mackay were of Pacific Islander origin.

5.3.4 Institutions

5.4.4.1 Charleville

a) Profile of Charleville Institutional Personnel Interviewed

Personnel from 23 institutions in Charleville were interviewed using a structured questionnaire. These included representatives from Local, State and Commonwealth Governments and Community Service Agencies, and members of Local and District Disaster Committees. Seventy percent of respondents were male and 30 % female, 15 % were of Aboriginal or Aboriginal/Torres Strait Islander descent and 85 % were non-indigenous. Most respondents were tertiary qualified and organisations interviewed employed between 2-150 staff and have operated in Charleville for more than 10 years (67 %).

b) Flood Risk

Most Charleville institutions considered they were prepared for the 2008 flood event (70 %) (Figure 5.7) and almost all (93 %) were aware of the evacuation routes and centres.

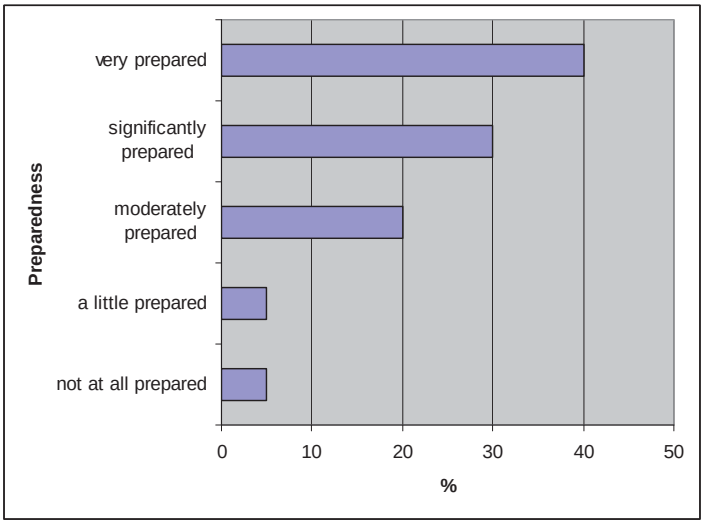

Figure 5.7. How prepared Charleville institutions consider their organisations were for the 2008 flood

Figure 5.8 below suggests that few institutions would leave Charleville if another flood occurred and affected their premises. Most believe that floods are likely to occur in their lifetime; there is a need to be prepared for floods, and that a damaging flood could occur in the future. There are high levels of commitment from Charleville institutions to remaining in this town.

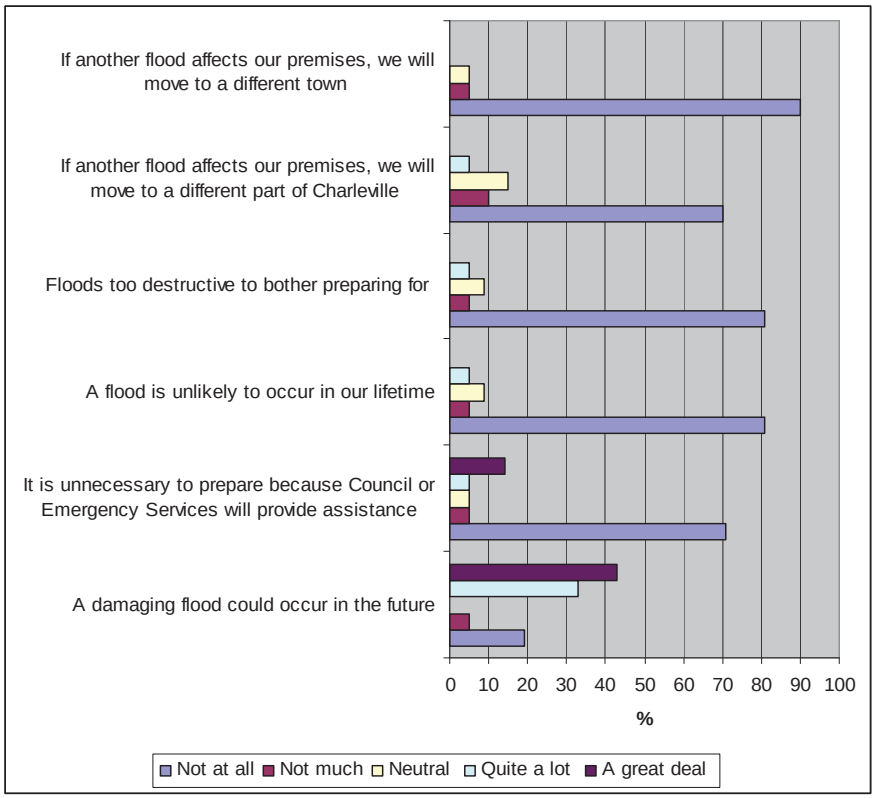

Figure 5.8. Perception of extent to which different events could affect institutions in Charleville

5.4 Flood Mitigation Measures and *State Planning Policy 1/03*

5.4.1 Introduction

One of the objectives of the research project was to understand the extent to which flood mitigation measures (including SPP 1/03) have been applied to reduce the vulnerability to flood events. It seeks to know how different mitigation measures work in the two different towns, as well as to provide gain insights on how *State Planning Policy 1/03: Mitigating the Adverse Impacts of Flood, Bushfire and Landslide* (SPP 1/03) could be improved.

The *State Planning Policy 1/03: Mitigating the Adverse Impacts of Flood, Bushfire and Landslide* (SPP 1/03) was introduced in 2003 as a statutory instrument under the former *Integrated Planning Act 1997* (current *Sustainable Planning Act 2009* (SPA)) and the *Statutory Instruments Act 1992*. The focus of this policy is to mitigate against the disaster impacts of natural hazards on communities and the environment and to effectively create more resilient communities including households and businesses.

The key themes of the SPP 1/03 are:

1. Natural hazards are to be identified in planning strategies and local planning schemes;
2. Incompatible development should be avoided, except for the following cases:
   a) proposed development is a development commitment;
   b) an overriding need for the development in the public interest with no other suitable site; and
3. Proposed infrastructure should be designed to function during and post the natural hazard event.

Prior to the SPP 1/03, there was no planning policy that imposed any restrictions to developments in natural hazard prone areas. It has resulted in mitigation measures being introduced in to local government planning schemes and strategic regional plans to prevent urban development in areas particularly vulnerable to natural hazards.

According to the SPP 1/03, the Queensland Government's position is: "*The appropriate flood event for determining a natural hazard management area (flood) is the 1 % Annual Exceedance Probability (AEP) flood.*" (Annex 3, A3.2).

5.4.2 Householder Mitigation Measures

Vehicles were the most common items moved to higher ground prior to the two flood events. Other items included washing machines, freezers and fridges. A small proportion of residents sampled raised the floor level of their house as a mitigation activity (around 1 % in Mackay and 9 % in Charleville). Close to half of respondents moved irreplaceable items above ground level, while close to three-quarters regularly carried out maintenance to ensure ditches and drains around their property were clean and free of debris.

More than half the residents in Charleville had copies of local flood plans of the area or were aware they are in a flood prone area. In Mackay, this was around 31 % of residents. On average, most residents in the case study regions did not have a household Emergency Plan (74 %), Emergency Kit (63 %) or Evacuation Plan (65 %).

In terms of insurance cover for flood, only around 32 % of residents in Charleville had insurance, compared to 68 % in Mackay. However, this type of insurance is very difficult to obtain in Charleville and very expensive, making these residents more vulnerable to economic losses in flood events.

5.4.3 Businesses Mitigation Measures

The most common mitigation activity in terms of moving items to higher ground in Mackay was the moving of outdoor equipment, followed by moving vehicles, computers, and chemicals and poisons. In Charleville, vehicles and outdoor equipment were the most common items moved, then fridges, freezers, chemicals and poisons.

Activities common to both sample groups when evacuating their business premises were turning off utilities, locking premises and raising furniture. Other activities in Charleville were emptying freezers, taking the evacuation route, putting sandbags in the bathroom and taking the Emergency Kit.

The proportion of businesses surveyed who took out insurance before the 2008 floods were 63 % in Mackay and 43 % in Charleville. However, it needs to be noted that the Mackay flood was a 'sky-flood' compared to Charleville's inundation flood, hence these are different types of flood events in terms of insurance cover.

Some businesses had raised their floor levels as a mitigation activity prior to the flood. Charleville businesses tended to be more vigilant in terms of maintaining ditches and drains around their property, keeping them clean and free of debris and in moving irreplaceable items above ground level (92 % and 84 %, respectively) compared to Mackay (54 % and 60 %, respectively).

Only 20 % of Mackay businesses had copies of local flood plans of the area or were aware they are in a flood prone area, compared to 58 % in Charleville. Most residents in Mackay had an Emergency Plan (81 %), Emergency Kit (70 %) or Evacuation Plan (60 %). Fewer businesses in Charleville had an Emergency Plan (36 %) and Evacuation Plan (55 %); however 82 % had an Emergency Kit.

5.4.4 Charleville Institutions

5.4.4.1 Actions Taken by Charleville Institutions since the 1997 Flood Event

About 90 % of Charleville institutions participated in the survey have taken action to prepare for floods since the 1997 flood event. Around a quarter of these institutions a) undertook training activities, b) reviewed or prepared emergency supplies, c) undertook desktop and mock exercises including the establishment of roles, d) attended formal and informal meetings, such as Local and District Disaster Committee Meetings, e) revisited their Disaster Management Plan, and f) conducted workshops. One institution translated information brochures for non- English speaking members of the community into Vietnamese and distributed these to Emergency Management Queensland and the Red Cross.

Other institutions shifted computers or equipment or a generator to higher ground, installed airconditioning in their operations room, bought desks with steel legs and carpet squares to

replace carpet (so the carpet is easy to move in a flood). Major work carried out since 1997 included the provision of a levee bank in Charleville, opening up development of flood free residential real estate areas, desilting and clearing the Warrego River, and installing permanent disaster communication lines. Risk management studies and a regional taskforce were also deployed for assistance.

Few institutions provided an estimate of the cost of these actions taken since the 1997 flood. Of the two who did, the total cost was estimated to be $30,000. Three organisations reported that they tested their mitigation efforts. Of these, only one indicated that they found it useful in coping with the 2008 flood event.

5.4.4.2 Mitigation Measures Undertaken by Charleville Institutions for the 2008 Flood

Prior to the 2008 flood event, two institutions moved vehicles to higher ground and one moved outdoor equipment, chemicals and poisons, freezers and fridges. Prior to evacuating, three organisations raised furniture, documents and other valuables onto tables and roof spaces. Two locked the organisation premises, took the emergency and evacuation kits. One organisation turned off the power, water and gas, while one emptied freezers and refrigerators leaving doors open.

A small number of organisations in Charleville had Emergency Plans (14 %), Emergency Kits (35 %) and Evacuation Plans (25 %) prior to the 2008 flood. It appears that some more work could be done in these areas to improve emergency planning tools.

Two institutions indicated that they had not taken out insurance against flooding and only one organisation intends to take out flood insurance in the future. Both said they had not raised the floor level of their organisation's premises nor did they intend to in the future. They had regularly maintained the ditches and drains around the property to ensure they were clean and free of debris and would continue this practice in the future.

5.4.4.3 Future Mitigation Measures Needed in Charleville

In terms of mitigation efforts needed in the future, respondents from institutions in Charleville suggested the following:

- More river height reading stations and other warning devices are needed on Bradley's Creek and the Warrego River and also on the Nieve River;
- Better data needs (e.g. flood mapping and risk assessment) to become available out of either manual or automatic systems;
- Desilting of Bradley's Gully needs to be carried out; and
- Delivering community education programs and training for SES volunteers.

A respondent estimated that the initial cost of implementing these mitigation activities is about $2 million, with a recurrent cost of $100,000.

One organisation said a review of laws with respect to electricity line clearance during emergencies, such as during flooding, is needed.

5.4.5 Murweh Shire Council and SPP 1/03

The Murweh Shire covers 43,905 km^2 and includes the towns of Augathella, Charleville, Cooladdi and Morven situated in the Great Artesian Basin. In Charleville, the Murweh Shire Council has a flood overlay as part of the town Plan. The industrial area in Charleville is outside the flood prone area, and new commercial premises in the flood area are required to have an upstairs area or an Evacuation Management Plan.

The Queensland Building Code requires that buildings be within or above the Queensland 1-in-100 event otherwise Council can be litigated against. The SPP was developed after the 1997 flood and is a guideline. Thus, Council has the opinion that they are not required to follow it because it is not legislation.

Habitable dwellings need to be at least 300 mm above the last known flood height (that is 300 mm above the 1997 flood height level) and the Council is using the Queensland 1-in-100 height. For example, the 1997 flood was considered a 1-in-80 flood event and the 1990 flood a 1-in-180 flood event.

Council has a social, moral and legal responsibility to care for its aged citizens, such that there would be concerns if, for example, their house had to be raised on stumps compromising accessibility for the elderly in having to use steps to enter the house. There is a concern as to how elderly residents will cope with the raised level of the house. A further concern has been the increased confidence amongst some residents in building on a concrete slab, since the construction of the levee. The levee may have contributed to a false sense of security that has eroded the willingness of people to construct high set houses.

Specific comments from respondents (businesses and institutions) as to how the SPP could be improved are given in Appendix 5.5.

Additional comments from respondents about SPP 1/03 are listed in Appendix 5.6.

5.4.6 Mackay Regional Council and SPP 1/03

The minimum building floor level, as specified in division 12 of the Flood and Inundation Management Overlay Code of the *Mackay City Planning Scheme 2006*, is 300 mm above the defined flood event (DFE; the flood event adopted by a local government for the management of development in a particular locality). This has resulted in the building of houses on slabs on the ground to reach this height (Planning and Development Team, Mackay Regional Council 03/02/10). Whilst the *Mackay City Planning Scheme 2006* requires that development applications are Code assessed for infill of more than 50 cubic metres, there is no calculation for the impact of the accumulated of infill across proposed developments (Department of Community Safety 05/05/10).

Consequently, this policy may be having the effect of contributing to the development of wetlands, storm surge and flood prone areas by effectively advocating infilling or reclamation of land to ensure that development is above the 1 % AEP (100 year Annual Recurrence Interval (ARI). A Mackay Regional Council worker highlighted that the previous Council enabled developments to be approved that were situated in floodplains including infill developments on land that was previously mangroves, such as a private school currently being constructed (Mackay Regional Council 03/02/10). It was further specified that the school was approved in a

flood plain but it had engaged professionals to conduct a flood study to ensure that the building met the code requirements (Mackay Regional Council 03/02/10).

It is cheaper to build houses on slabs as opposed to traditional methods that use houses built on stilts. This allows water to travel under houses and provides a means for water to be absorbed. Additionally, the Mackay Regional Council Planning and Development team found that builders had not constructed a house on stilts for 20 years and no longer knew how to do this because builders are trained these days to build to plans. Consequently, expertise in the building trade has been lost in constructing houses that have been found to be more resilient to natural hazards flooding (Planning and Development Team, Mackay Regional Council 03/02/10).

New infill development, such as the Glenfields Estate in Glenella, have been found to experience greater runoff onto pre-existing urban areas which has exacerbated the impact of flood events (interviews with Glenella residents, 9-10 December 2009; interviews with North Mackay residents 11 December 2009). The Mackay Regional Council reported that the Glenfields Estate in Glenella had completed flood assessments to a 1-in-100 ARI flood level, but the flood mitigation measures were to a certain level and that the 2008 flood event was greater than 1-in-500 ARI flood. Thus, the stormwater drainage was not able to cope with the disaster flood event (Department of Community Safety 05/05/10). Concrete can change hydrology flows.

It could be interpreted that the SPP 1/03 is able to be manipulated to suit the desired outcomes. The Mackay Regional Council allows extensions to dwelling houses as long as there is one "Habitable Room" at least 300 mm above the DFE or in fact the defined "Minimum Level" as a precaution for emergency management (Table 8-11 Assessment Categories and Relevant Assessment Criteria for the Flood Inundation Management Overlay – Making a Material Change of Use, Division 12 Assessment Tables for the Flood and Inundation Management Overlay, *Mackay City Planning Scheme 2006*). However, this means that there are buildings development being approved not only existing in flood plains but also below the high king tide mark in Mackay in addition to those already established (Mackay Regional Council 03/02/10). This subsequently shows the difficult task for the Mackay Regional Council of forward planning in a town built on historic planning decisions and restrictions for building above flood lines which were only introduced in the later part of the 20th century.

5.4.7 Implications of the *Sustainable Planning Act 2009*

New provisions have been introduced under the recently introduced *Sustainable Planning Act 2009* that affects State Planning Policies:

- Inconsistencies between local and state statutory documents have been clarified so that a state planning policy prevails over a local planning instrument (section 43);
- Power has been given to other Ministers so that state planning policies can be made in conjunction with the planning Minister if the state interest addressed by the policy is a matter relevant to the department administered by the eligible Minister (section 44(2) and 46(2));
- An expiry date of 10 years has been allocated to State planning policies (section 45); and
- Temporary state planning policies of up to one year may be made by the planning Minister if it has been deemed urgently required to protect or give effect to a state interest (sections 46 to 49).

The changes in state planning legislation will have the effect of overriding local government policies. This may result in increased destruction from natural disasters where state government

policy that aims to encourage development and economic activity overrides initiative by local governments for example in the case of Mackay where local government planners have been trying to influence state planning policy to introduce stronger measures to prevent development in areas susceptible to flooding (Planning and Development Team, Mackay Regional Council 03/02/10).

The introduction of an expiry date for all state planning policies could create havoc for the Integrated Development Assessment System (IDAS) in three years time when this policy is now due to expire in 2013.

As has been evidenced by these case studies, the impacts of disaster flood events on development in flood prone areas is costly at multiple levels from the household and business levels to the spheres of involvement of government agencies at the local, regional and state levels. A lack of statutory requirement to comply with a specific flood mitigation planning at the state level may result in the opportunity for development approvals in flood prone areas.

It is not a funding issue that has prevented the establishment of emergency shelters as specified under Annex 1 of the SPP 1/03, but governments have been too concerned about liability issues (Local government Emergency Management Coordinator, Mackay Regional Council 03/02/10).

Consequently, future recommendations are required to ensure that this aspect of the policy may be enacted. Darwin is an example of another jurisdiction in Australia where every gym is built to the cyclone code (ABC, 05/02/10).

5.5 Resilience

5.5.1 Introduction

Resilience is essentially concerned with people. Communities with long term residents, for example those who have lived in the community more than a decade or two are likely to be more resilient and the quality of the system for recovery higher. The building of resilience is also concerned with people accepting personal responsibility.

Social capital and its associated networks play a very important role in building and maintaining the resilience of a community. Networks can include personal and family networks and, coupled with volunteerism, are important indicators of social capital. Volunteerism may be formal where people join organisations as volunteers, or informal, such as people helping their neighbours. Networks can also involve institutions, as well as their levels of effectiveness and efficiency.

Changing risks associated with climate change are placing further strain on community systems and their capacity to recover from emergencies and disasters brought about by climate change. Hence questions may arise as to the processes, practices and strategies needed to promote or maintain community resilience in this changing climatic environment.

Resilience relates to the ability of a coherent society to recover from a catastrophic impact, such that sustainable integrated resources, core competencies and functions can be used to adapt to hazards and manage problems, to ensure safety, with mechanisms to ensure the ongoing availability of these resources and competencies (Paton, 2006). This can include building strong support networks which have learned lessons from past events.

Community members need to be involved in mitigation activities to reduce the impact of disaster events, and social and organisational links and supports are needed. Knowledge and awareness about natural hazards will also contribute to community resilience, as will high social capital.

5.5.2 Households

5.5.2.1 Period Living in Charleville, Employment and Education

More than 60 % of Charleville and Mackay respondents have lived in their community for more than 10 years. About 32 % and 42 % have lived more than 10 years in their current home in Mackay and Charleville, respectively.

A higher percentage (22 %) of residents live alone at home in Charleville, as compared to Mackay (8 %). In terms of other living situations, the two towns are similar in their proportions of families with children, without children or living with other people, not family.

Forty-six percent of the residents interviewed in Mackay are employed full-time. In Charleville, it is lower (20 %). Conversely, Charleville has a greater number of people who are not in paid employment (35 %), compared to Mackay's 29 %.

The split of tertiary and non-tertiary qualifications amongst householders is shown in Figure 5.9, with trade qualifications and levels of tertiary education tending to be somewhat higher in Mackay. In both towns, only around 10 % of the population had no school qualifications. More than 50 % of householders interviewed in Charleville had "school qualifications', i.e. any level from Year 1-12.

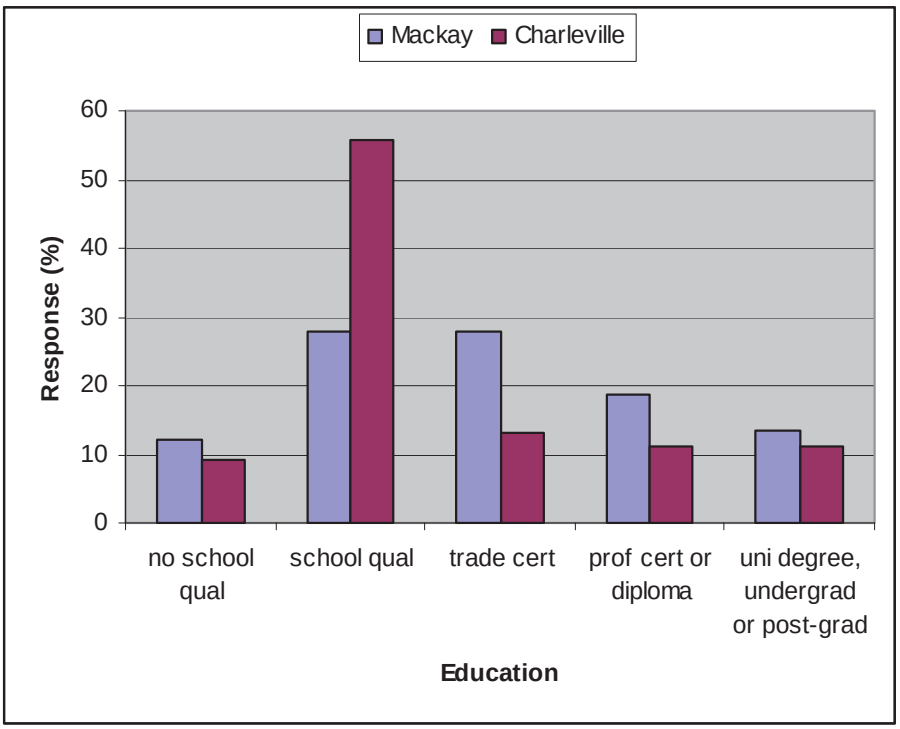

Figure 5.9. Householder educational qualifications

5.5.2.2 Where Householders Evacuated To

Charleville residents exhibited greater levels of resilience in terms of personal networks, with 77 % evacuating to family or friends compared to 51 % in Mackay. It was found that of the 400 household properties door-knocked in Mackay, only around 22 % of residents found at home were living at the property at the time of the 2008 flood. An estimated one-third of those surveyed had moved in after the 2008 flood event, suggesting a highly itinerant resident population in these areas or possibly a pattern of migration following disaster events.
The number of members of the household sick following the floods was less than a quarter (13 % for Charleville and 20 % for Mackay).

Knowledge and awareness about flooding is likely to be higher in Charleville with only 2 % of residents never having experienced flooding, compared to 51 % in Mackay. Almost all Mackay residents (96 %) considered the 2008 flood the worst flood they had experienced compared to 60 % in Charleville, likely influenced by the fact that a large number of residents in Mackay had not experienced floods there before.

5.5.2.3 Householder Understanding As to Who is Responsible to Protect Them From Floods

Mackay residents strongly believe that Local Council has a substantial responsibility for protecting them (64 % "*a great deal*" and 23 % "*quite a lot*") (Figure 5.10). However, in terms of whether residents themselves should prepare, there appears to be a mixed view. Charleville residents, on the other hand, assigned almost equal weighting to responsibility for protecting them from floods between householders and Local Council, with a slightly greater responsibility on the part of householders. About 70 % of Charleville respondents believe that there is a need to prepare for flood and that something can be done about it. In contrast, only 30 % of Mackay respondents shared the same view.

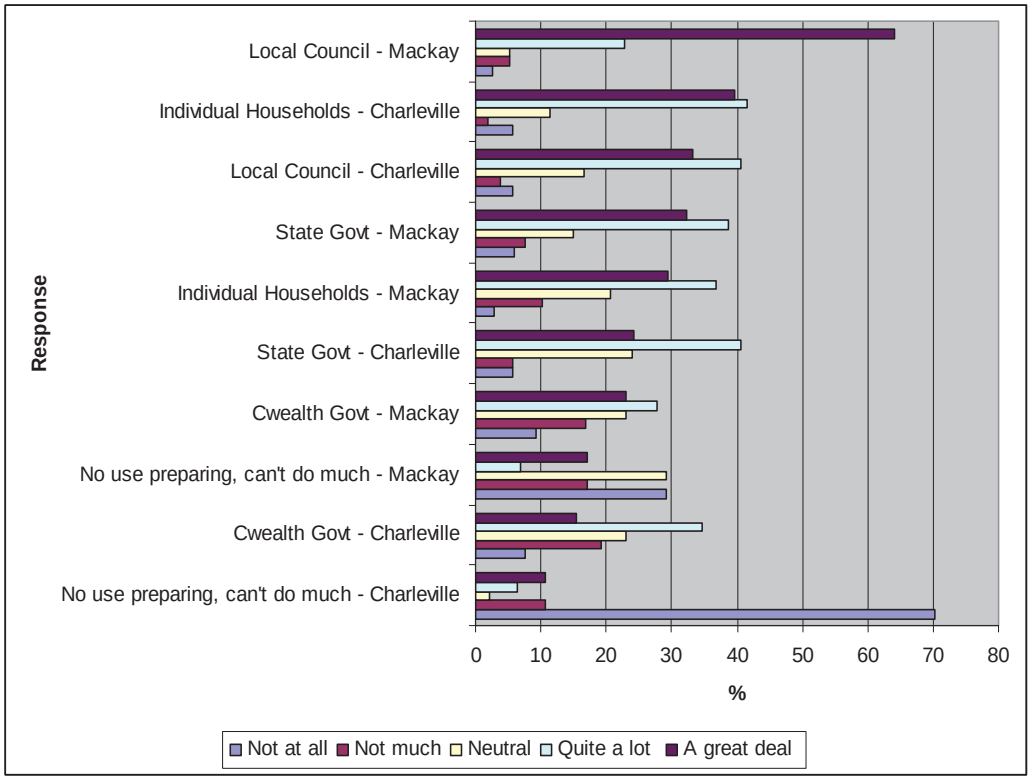

Figure 5.10. Householder understanding of levels of responsibility different groups have to protect them from floods

5.5.2.4 Volunteerism

Formal volunteer rates of household respondents were low in both regions, with 85 % in Mackay and 80 % of residents in Charleville not participating in formal volunteer organisations. However, this does not mean these communities do not have informal volunteering, such as helping neighbours, family and friends.

Neighbourhoods were found to assist each other in Mackay. For example, in both Glenella and North Mackay suburbs where the highest flood water levels in homes were recorded, neighbours in higher ground (usually up the road), opened their homes for evacuees to shelter till the flood waters subsided. Dry towels were contributed from nearby neighbours. There were neighbours, community groups and even some businesses such as hotels that provided hot meals in the evening for households affected by the floods.

In both Glenella and North Mackay, there were women who were home alone that got trapped in their homes with floodwaters around two m high. In both cases the floodwaters came suddenly and with force and in both cases sons from a neighbouring family, who were aware that they were home alone, came specifically to check on them. They were both required to break into the house to rescue the women and both women were thankful. In one case this also required escaping a crocodile in the front garden and in the other case, this required navigating through sewage. One man in the North Mackay suburb went around checking on the neighbours at the time.

Following the floods, a neighbourhood group was formed in relation to the flooding event in Bradman Drive, Glenella. This street is involved now in the Mackay Christmas lights each year as a remembrance of how the event affected their street. An Italian lady who lives in Ingham but owns a house in Glenella let the next door neighbours who had recently moved from India, stay in their home whilst theirs was being rebuilt.

Many staff at the ABC radio worked over time to ensure that communications between the Mackay community were facilitated. In addition to becoming an important forum for discussion, the ABC became a "match-making" service where goods and services volunteered were provided to those in need. They received many thanks, for example from the Country Women's Association (CWA) who played a role in the flood recovery process in Mackay (ABC interview).

The SES, which comprises volunteers, played a large role both during a following the flood event, by assisting residents. The Auxilary Queensland Fire and Rescue Service, likewise played a significant role in the post recovery phase (QFRS interview).

Mackay has a range of volunteer organisations with a range of environmental community groups listed on the MRC website. Thus, perhaps the residents surveyed in this study were not active members because they had spent a large proportion of their time recovering from the flood event.

5.5.2.5 Social Networks

Figures 5.11 and 5.12 below depict householders' feelings about community and social networks. It can be seen from Figure 5.12 that Charleville residents rated more highly than Mackay residents in terms of:

- Knowing their neighbours and other community members (strongly agree: 80 % in Charleville, 38 % in Mackay);
- Having the same values and beliefs as their neighbours (strongly agree: 53 % in Charleville, 31 % in Mackay); and
- Being satisfied with, and feeling at home, in their community (strongly agree: 78 % in Charleville, 63 % in Mackay).

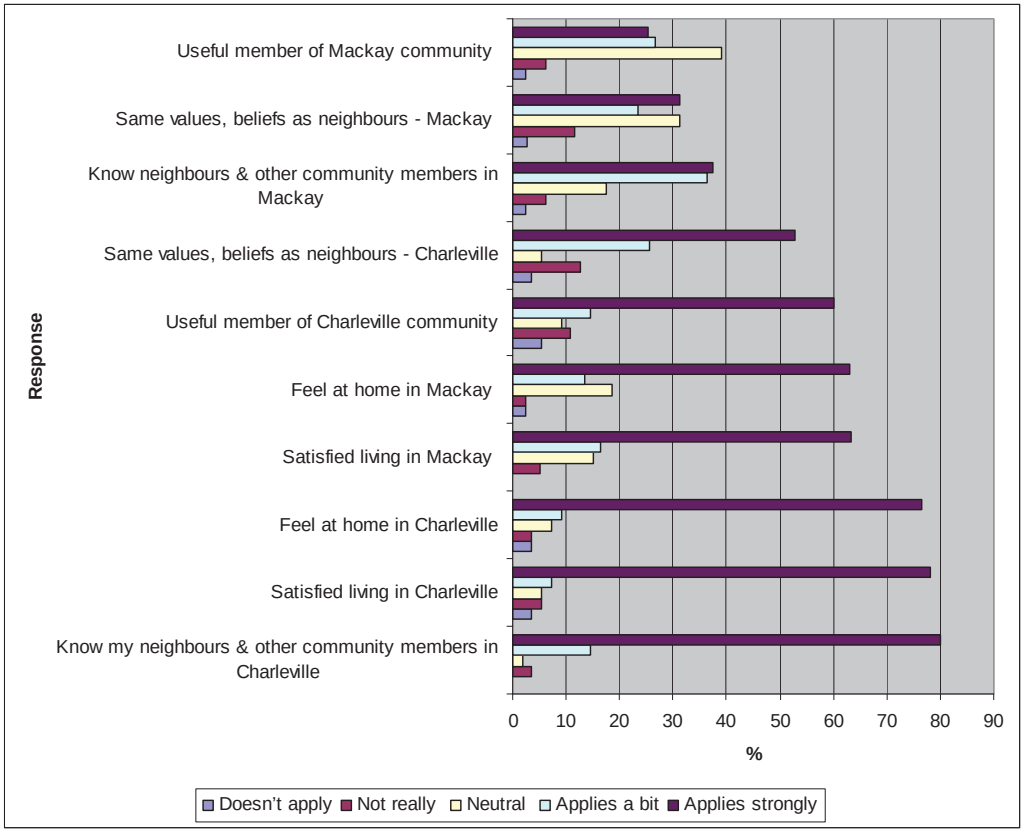

Figure 5.11. How householders feel about living in their community

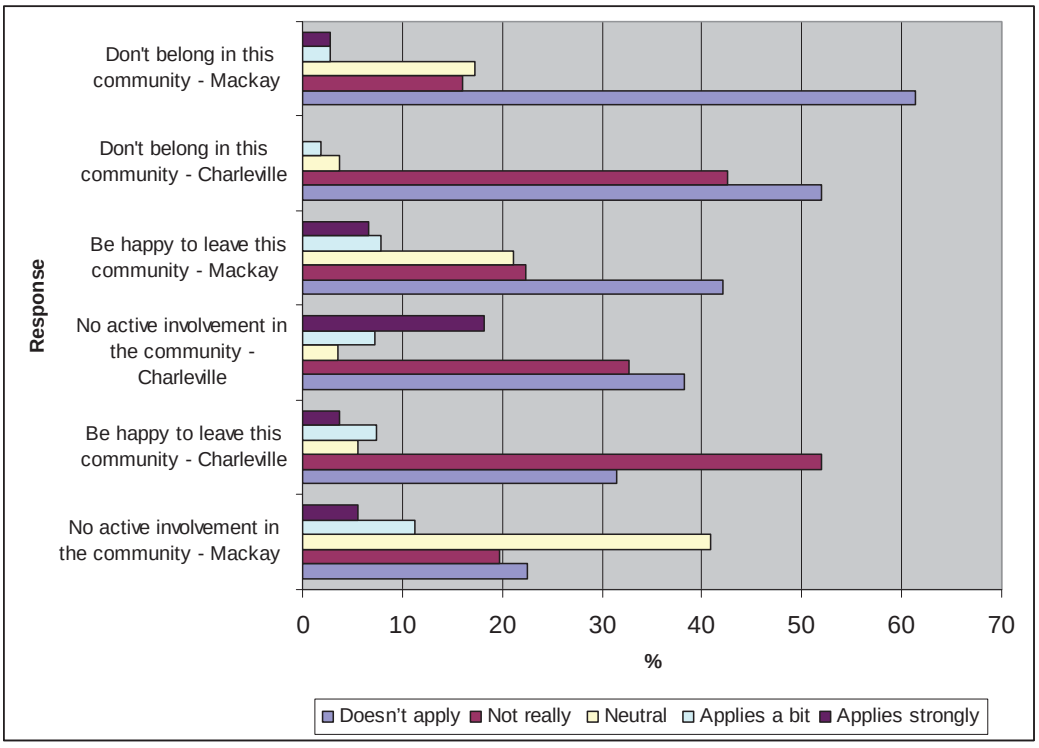

Figure 5.12. How residents feel about their community

Ratings by Mackay householders were more mixed in terms of feeling a useful member of the community (25 % strongly agree), and about having the same beliefs and values as neighbours (31 %) and knowing their neighbours and other community members (38 %) (In Charleville, the same items recorded 60 %, 52 %, and 80 %, respectively.) What it means to be a useful member of a community may be a lesser understood concept in Mackay than Charleville, as Mackay has more of a city culture. Mackay residents may be also more time-poor than Charleville residents because they are living in a faster pace, city-like environments, with stresses on their time, such as commuting to and from work and other pressures and activities.

Mixed results may also relate to the state of affairs in the community almost 2 years on from the flood event. For example, one resident in Mackay who was rescued by a neighbour has since had the house renovated. The renovated house now looks better than before and the same neighbours have now stopped talking to them for some reason. Communities appeared to have become closer during the flood, however, issues over insurance pay outs appears to have caused tensions in some communities as neighbourhoods struggled to rebuild their homes. For instance, in one street, two different houses had the same insurance packages but received different pay outs due to different evaluators.

Figure 5.12 shows that there is a strong sense of belonging on the part of residents to their communities, with Mackay having a slightly higher sense of belonging. However, views were mixed in Mackay as to whether they would be happy to leave their community with a leaning toward preferring to stay, whereas Charleville residents preferred to stay and had active involvement in the community. Mackay had a strong leaning toward a neutral view on whether they considered they had active involvement in the community. Figure 5.13 shows an example of some people in the community who helped during the construction of temporary levee during the 2008 flood in Charleville.

Figure 5.13. Some people in the community who helped during the construction of temporary levee during the 2008 flood in Charleville (Photo source: Chester Wilson)

5.5.3 Businesses

5.5.3.1 Types of Businesses Surveyed and Period Operated

Most businesses surveyed in Charleville were retail (77 %) and skilled trades (23 %), with similarly high proportions in the same industries in Mackay (60 % and 29 %, respectively). Other industries in Mackay included financial institution, estate agent, residential aged care and airport.

Over 50 % of businesses interviewed in Charleville had operated more than 10 years. In Mackay, about 42 % were in business a shorter period of time (1 to 5 years) (Figure 5.14).

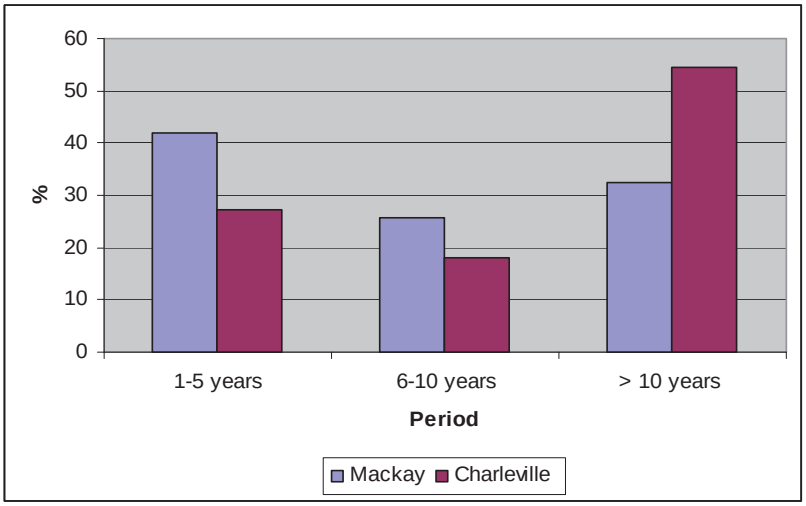

Figure 5.14. Duration of business operation

5.5.3.2 Educational Qualifications of Business Respondents

No respondents in Charleville were without school qualifications and they had a higher percentage of respondents with school, trade certificates or university degrees than the Mackay sample (Figure 5.15).

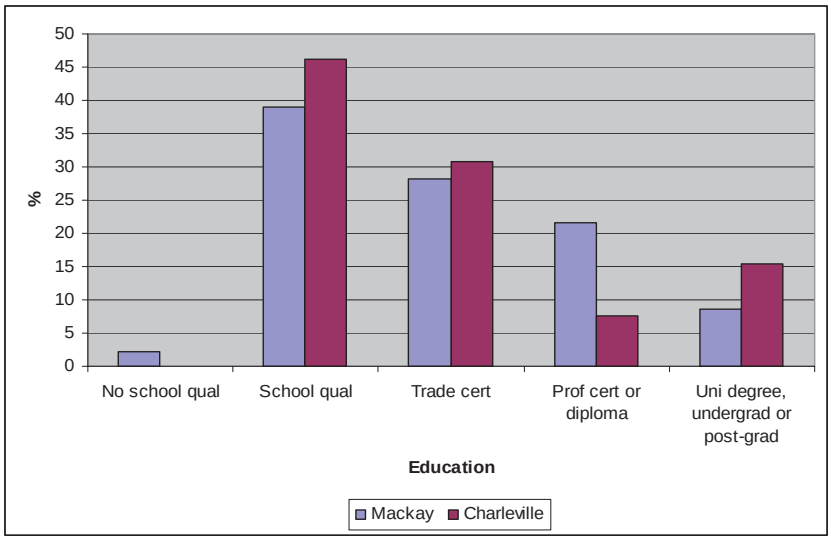

Figure 5.15. Educational qualifications of business respondents

5.5.3.3 Where Business People Evacuated To

In all cases, Charleville business people evacuated to home, as did 80 % of Mackay business people. More business people were sick following the flood with a high proportion in Charleville of 39 % compared to 6 % in Mackay. The reason for this higher level in Charleville is not known.

Almost three-quarters of Charleville businesses had experienced flooding (between 1-4 floods, with just over a third having experienced two flood events), compared to 67 % of Mackay businesses who had never experienced flooding. For all Mackay businesses the 2008 flood was the worst flooding experienced and for Charleville businesses this was the case for 64 %.

5.5.3.4 Understanding of Businesses as To Who is Responsible To Protect Them From Floods

The majority of business respondents believe that governments (federal, state and local council) have a great level of responsibility for protecting them from floods (Figure 5.16). More than half of the respondents (62 % for Charleville and 52 % for Mackay) considered that the local council has the greatest responsibility.

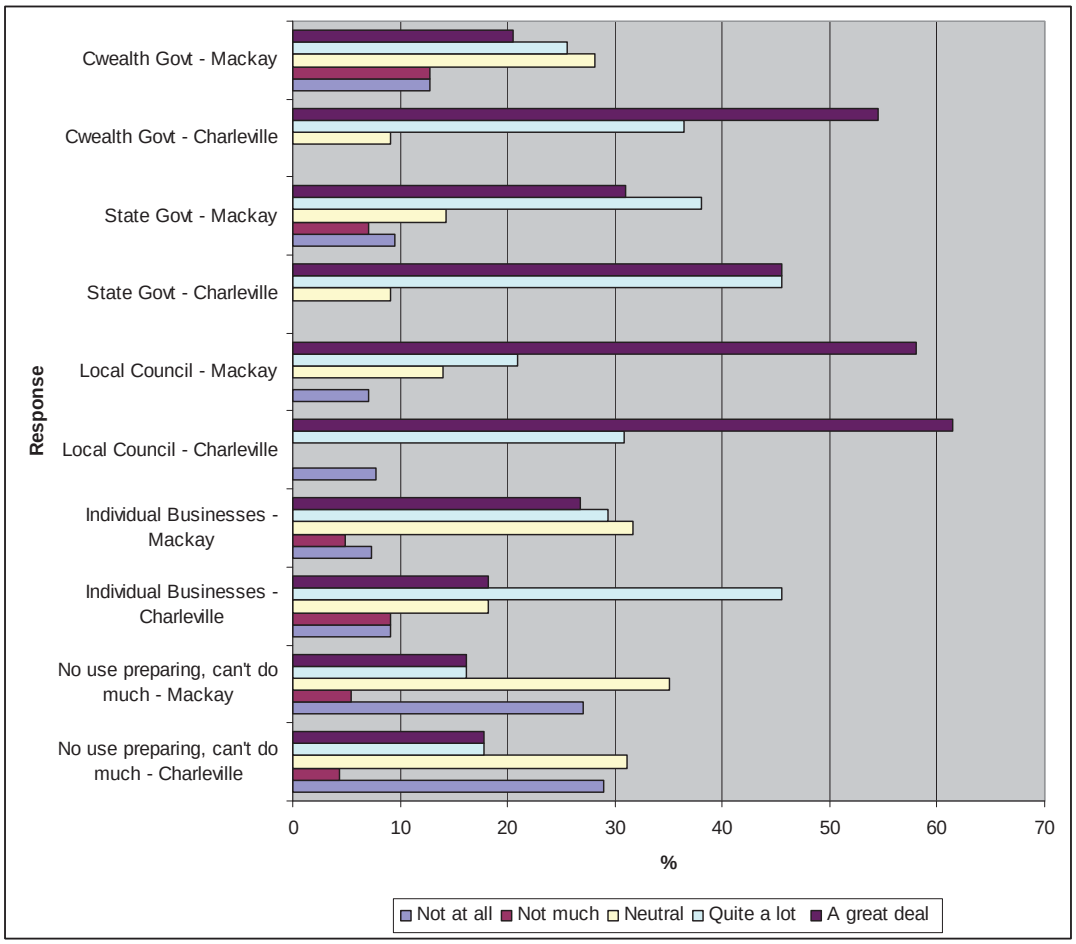

Figure 5.16 Businesses' understanding as to the levels of responsibility different groups have to protect them from floods

5.5.3.5 Volunteerism Levels Amongst Business Personnel

Formal volunteer rates of businesses in Mackay were only 23 % compared to 54 % in Charleville. The SES was the most common group volunteered for in Mackay (9 %). In Charleville, it was the volunteer fire brigade (31 %) and Rotary (15 %).

5.5.4 Charleville Institutions

Figure 5.17 below suggests that institutions think the risk of floods is real and could pose a threat to organisation's activities and personal safety, and that floods are a regular risk that is talked about, taken into account and about which they source information.

The Charleville community was rated the lowest (36 %) in terms of being prepared.

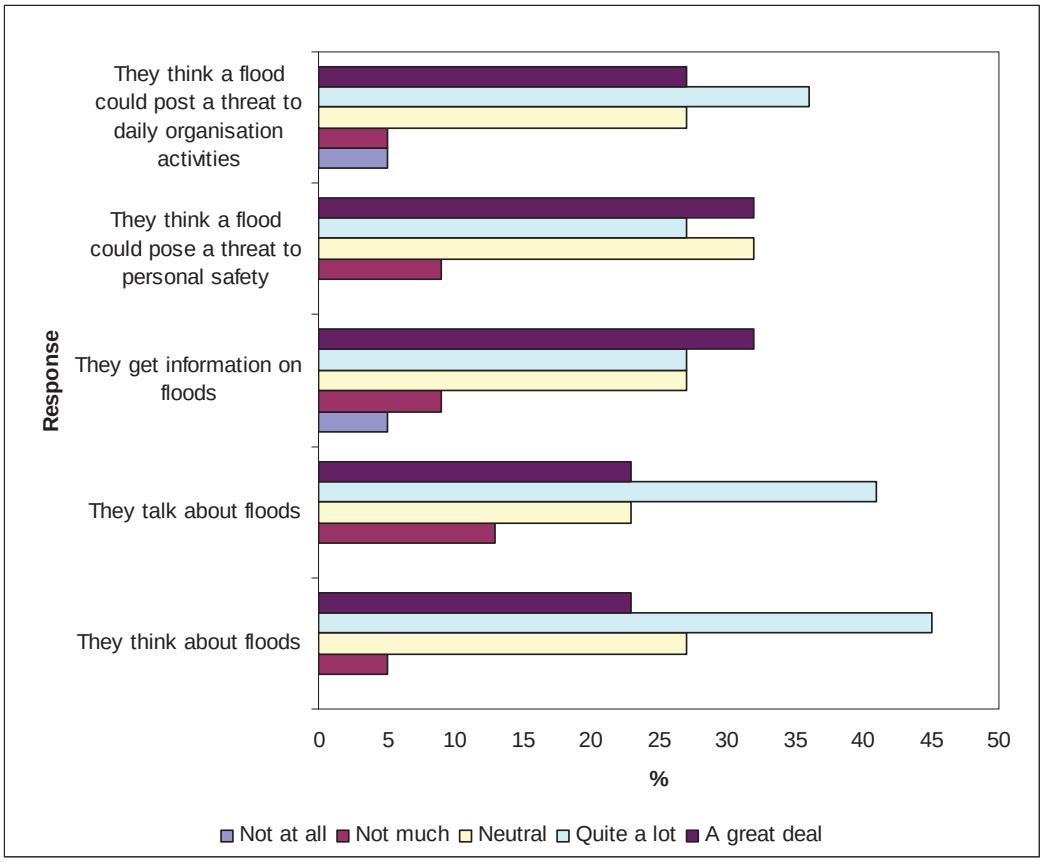

Figure 5.17. Levels of institutional concern in Charleville about the risk of floods

Figure 5.18 presents the most common organisations that institutional staff volunteers for, i.e., the Fire Brigade and the SES. In 25 % of the respondents from the institutions, none of their staff act as volunteers.

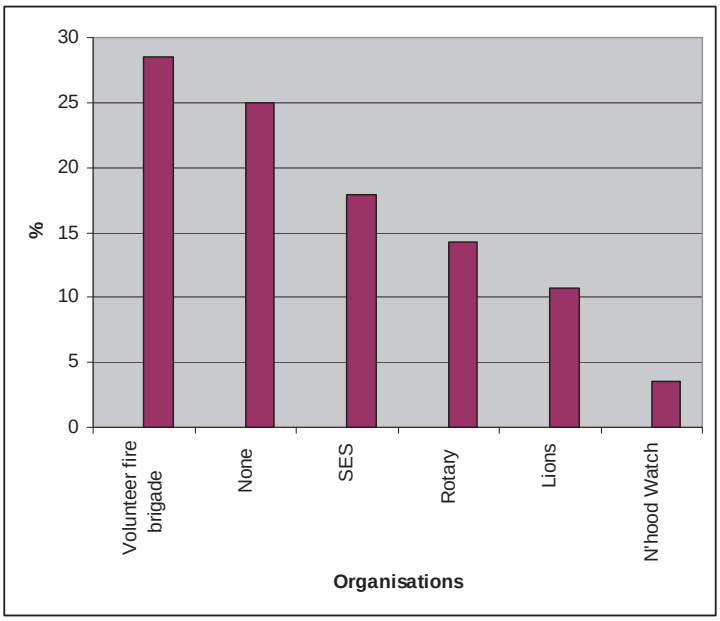

Figure 5.18. Volunteer organisations institutional staff in Charleville are involved in

In terms of preparedness for future floods, the respondents from institutions rated different organisations and entities in Charleville (Figure 5.19). The top three organisations rated as "*very prepared*" were:

- State government (86 %);
- Bureau of Meteorology (82 %); and
- Local Government (77 %).

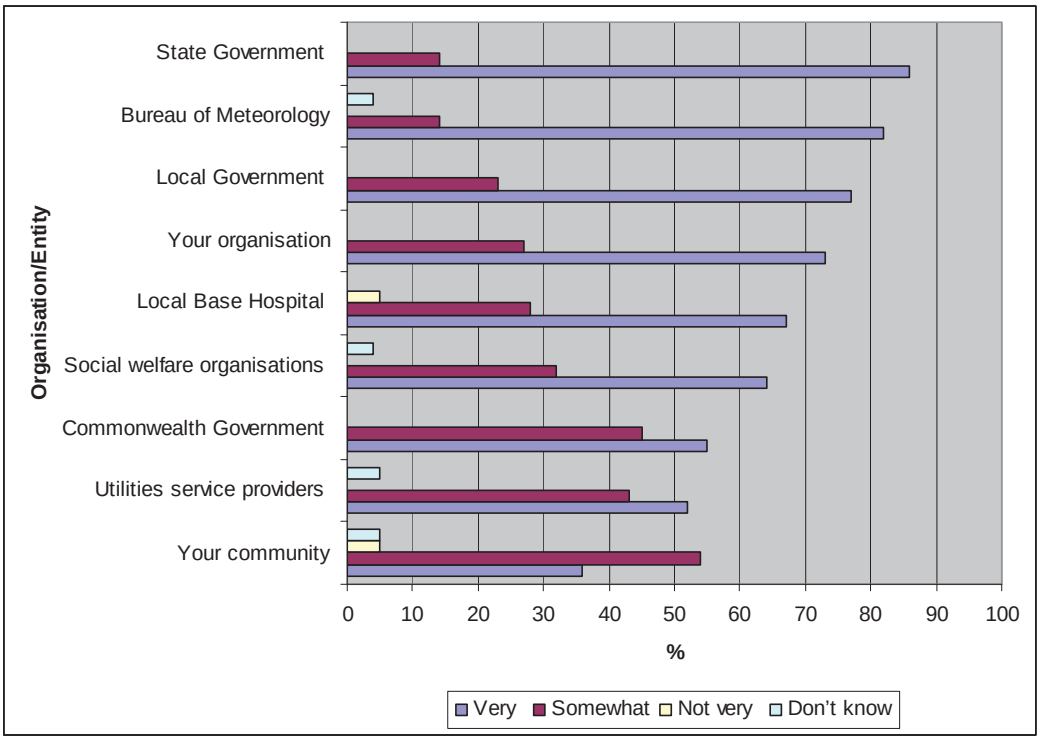

Figure 5.19 How prepared Charleville institutions feel these organisations are for future flooding events

The majority of respondents from institutions viewed that the Local Councils have the major responsibility for protecting people from floods (a total of 99 % indicated "*quite a lot*" and "*a great deal*") (Figure 5.20). It was followed by State Government and individual households. An additional comment made by a respondent was that everyone should have a plan in place.

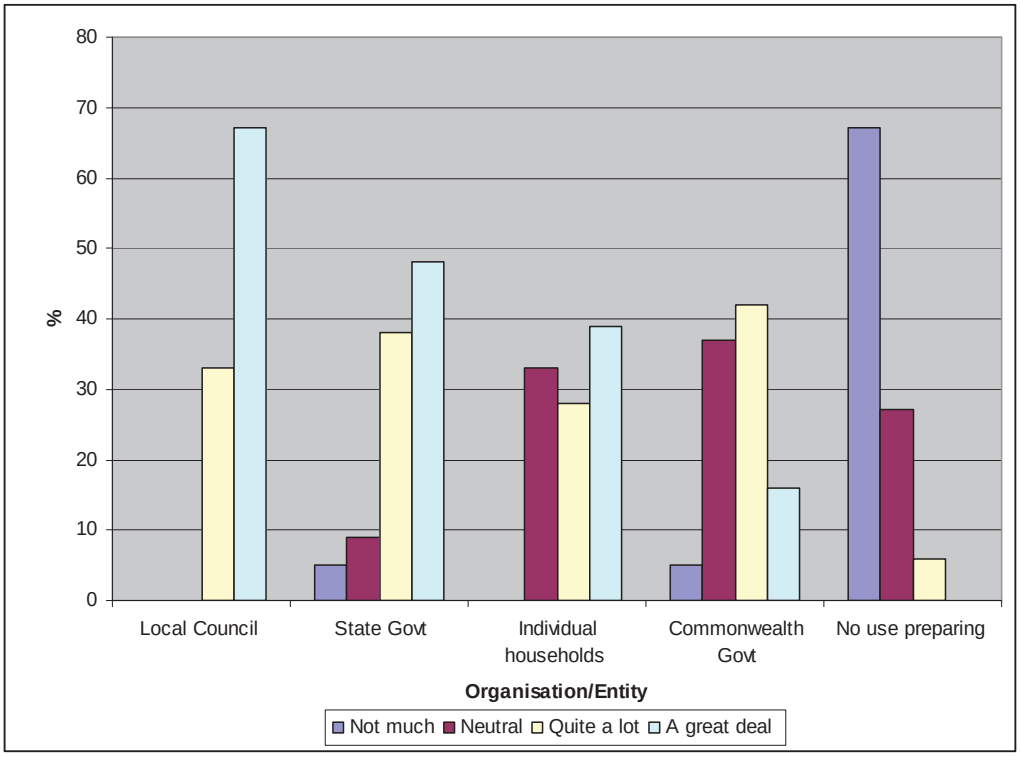

Figure 5.20. Scale of responsibility Charleville institutions believe should protect the community from floods

5.6 Adaptive Capacity

5.6.1 Introduction

Adaptive capacity is "*The ability of a system to adjust to climate change … to moderate potential damages, to take advantage of opportunities, or to cope with the consequences*" (IPCC, 2001, p. 982). Building adaptive capacity can include creating standards and legislation, institutional change, undertaking research and management, developing policies, strategies, plans and partnerships (Sivell *et al.,* 2008).

Questions may arise as to whether current emergency relief and other economic support enhance the choices of householders and businesses in terms of their adaptive capacity. Insurance markets and the design of insurance products have the potential to support adaptive behaviour, as do beneficial policies, statutory or governance arrangements. Community systems ideally need to be able to cope with damage related to climate variability and extremes, and adaptation may be planned or reactive.

5.6.2 Householders

Householders in the two towns appear to be heeding advice issued by authorities on floods, with 60 % and 69 % of residents having their electrical appliances checked before use, as compared with 15 % and 40 % who boiled their tap water before using it (Charleville and Mackay samples, respectively). The quality of river water in Mackay is likely to be more murky and susceptible to

secondary health problems after a flood (as 90 % of the tap water comes from the Dumbleton Weir on the Pioneer River not far upstream from Mackay), compared to Charleville town water which is bore water and suffers less effect in terms of quality during flood events.

5.6.2.1 Actions Planned by Residents Following the 2008 Flood Event

Following the flood event, an additional 11 % of residents in Mackay and 3 % in Charleville intend to take out household insurance against flooding. The difficulty of obtaining flood insurance in Charleville needs to be looked at and some action taken in terms of insurance companies designing new products or being given evidence, once the Gully is fixed, so people can be insured. The adaptive capacity of Charleville may be improved by review of the role of insurance markets and the possible design of insurance products to achieve these objectives.

About 3-4 % percent of residents intend to raise the floor levels of their houses. Around 79 % and 87 % of Mackay and Charleville residents, respectively, will continue to carry out maintenance ensuring ditches and drains around their properties remain free and clear of debris. A much higher proportion will move irreplaceable items off the ground floor – 74 % and 69 % (Mackay and Charleville, respectively).

Adaptation actions planned by residents as a result of the 2008 floods are depicted in Figure 5.21 below. This Figure shows that neither groups are likely to raise the floor levels of their houses. Charleville residents are less likely to seek information on flood risk or how to prepare for possible floods, join local groups or increase levels of insurances. As previously mentioned, insurance is very difficult to obtain in Charleville.

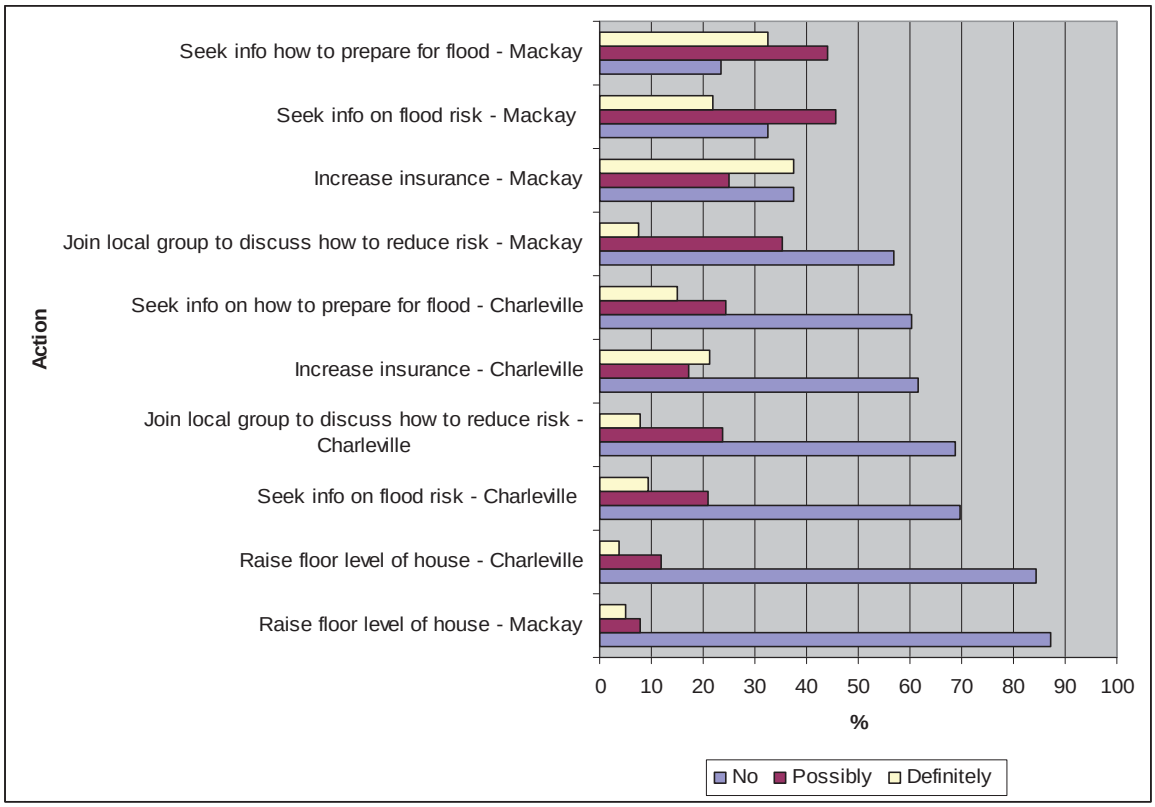

Figure 5.21. Adaptation activities residents in Mackay and Charleville intend to undertake as a result of the 2008 floods

5.6.2.2 How Residents View the Preparedness of Government and Community Groups

Figure 5.22 below shows the degree to which residents in the case study regions believe certain groups are prepared for future floods affecting their communities. In examining the results in the individual towns, in Charleville a greater percentage of residents rated these groups as being very prepared more highly than Mackay residents, suggesting a strong level of capacity within these organisational groups.

Major differences were found between the ratings by the two groups for some institutions. For example, Charleville residents rated more highly than Mackay residents the preparedness of the following groups for future flood events, the State Government, Utilities providers and the Local Hospital (78 %, 59 % and 49 %, compared to Mackay 37 %, 11 % and 22 % respectively). In most other ratings the two groups were not substantially different.

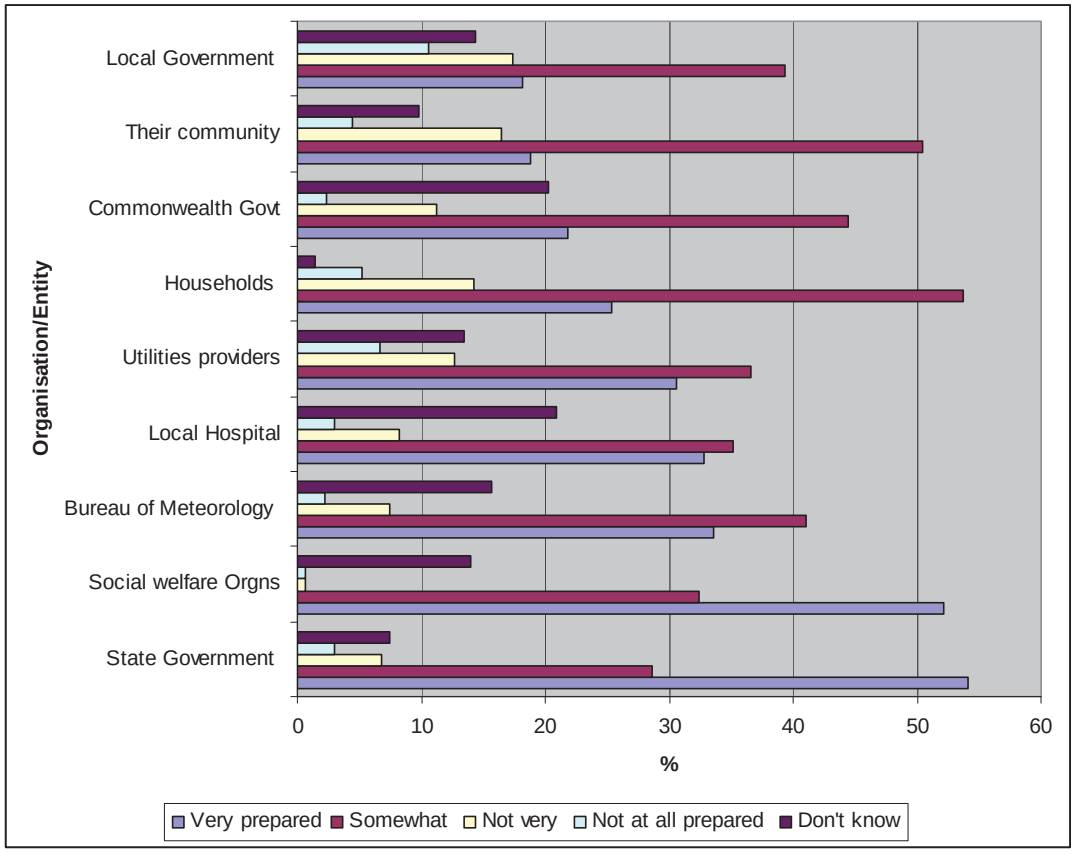

Figure 5.22. On average, how prepared Charleville and Mackay residents believe these groups are for future floods affecting their community

5.6.2.3 Possible Barrier to Adaptive Capacity for Householders

Participants were asked about a number of factors which may prevent them from preparing for flood event. It can be seen from Figure 5.23 that Charleville householders generally consider skills and the need for cooperation less of an impediment in preparing for floods than Mackay, and also that floods are something they think about. This could suggest that Charleville residents believe they have the adaptive capacity to cope with future flood events in terms of resources. However, cost was indicated as a main factor for close to half of Charleville residents.

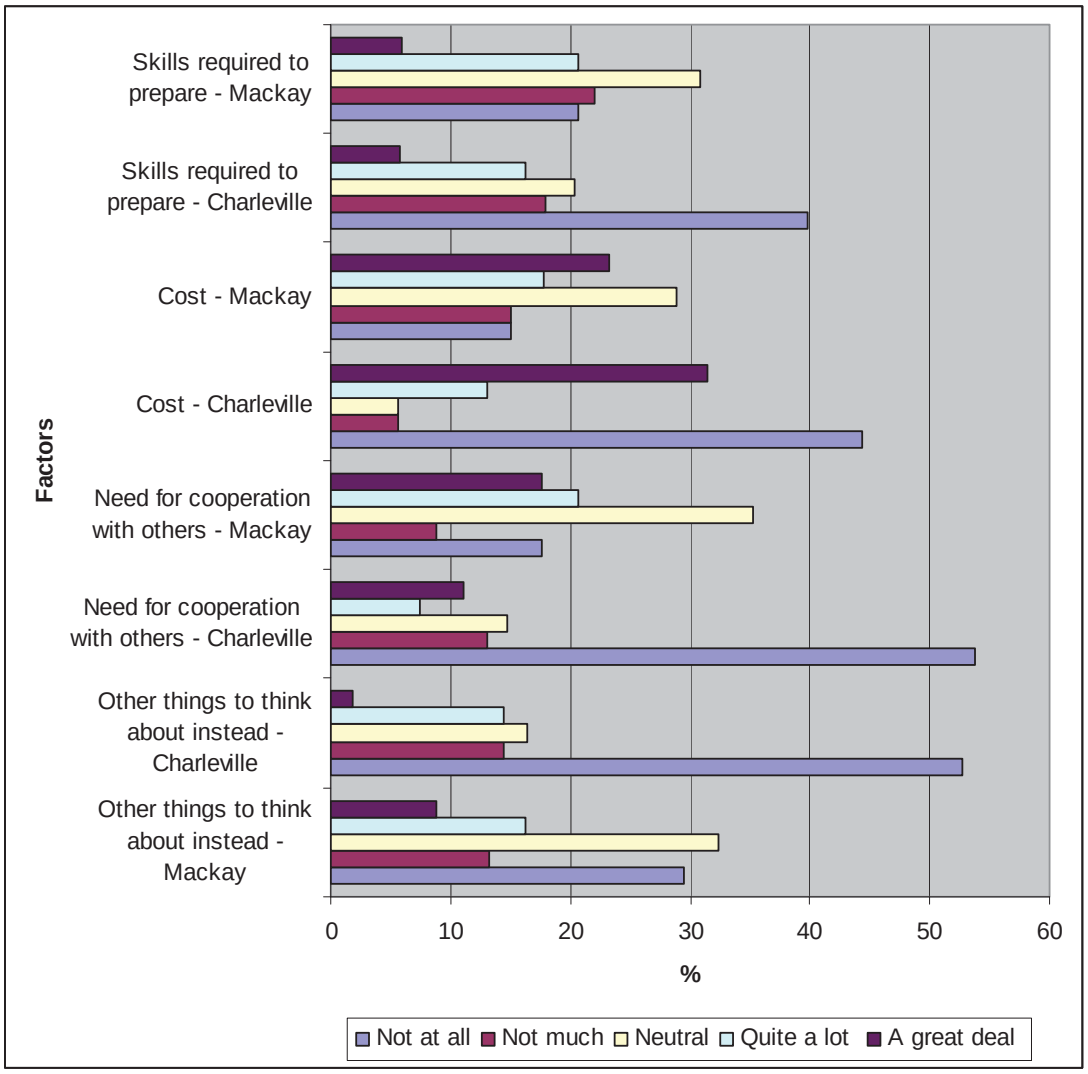

Figure 5.23. Factors which may prevent householders from preparing for floods

Thinking about floods could also be related to the fact that Charleville residents have experienced more flood events over the past 10 years than Mackay, or that floods had more severe consequences for their community. This raises the question: which city/town is more vulnerable to flooding? They are both located on flood plains so consequently they are both prone to flooding although Mackay received fewer flood events over the past 10 years than Charleville. The need for cooperation with others is a greater indicator for adaptive capacity to cope with future flood events.

Whilst "*thinking about floods"* may relate to preparedness, it could also be an indicator of a lack of adaptive capacity in that they have suffered emotional distress (post traumatic stress disorder) from flood events. Emotional and mental distress was noted on the Charleville household survey but not by institutions whereas it was distinct in the Mackay community. This may be an indicator of a lack of adaptive capacity.

5.6.2.4 What householders may do if another flood affects their home

Figure 5.24 shows that a large percentage of residents in both Mackay and Charleville would neither move to another part of their town (43 % and 46 %, respectively), nor relocate to a new town (55 % and 63 %, respectively) if another flood were to affect their home. It also shows that Mackay residents would be slightly more likely to move to another town than residents in Charleville. Moreover, a larger percentage of Charleville residents would relocate to another part of the town, as compared to Mackay.

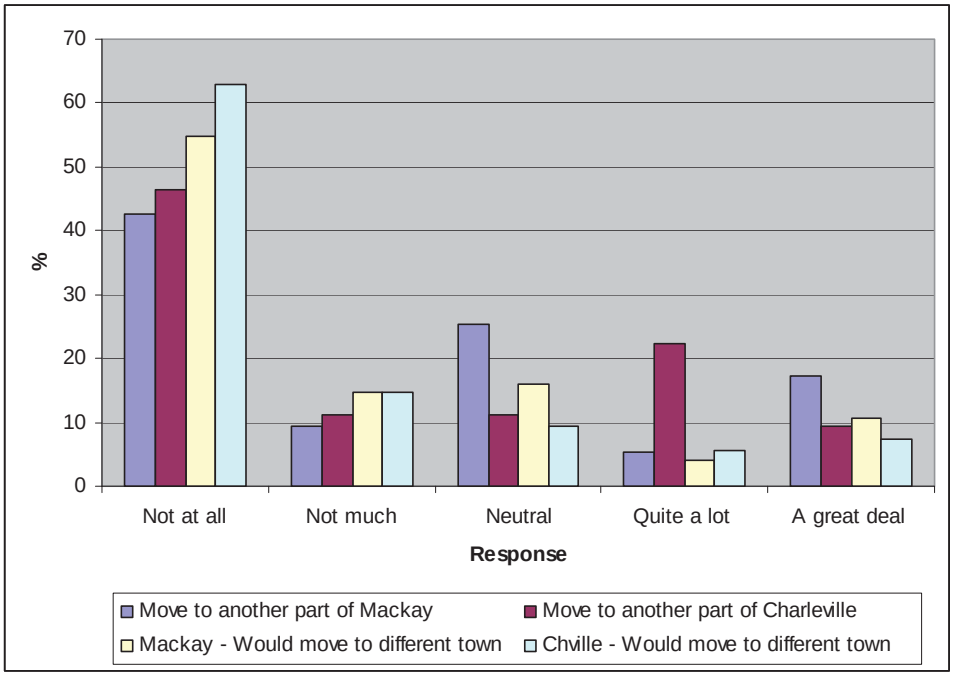

Figure 5.24. Decision to move to another part of town or different town if a flood occurs

5.6.3 Businesses

Similar to householders, a large proportion of businesses in both regions checked their electrical appliances before use (around 80 %) and about a quarter boiled tap water before use.

5.6.3.1 Actions Planned by Businesses Following the 2008 Flood Event

Following the 2008 flood event more than half the businesses in Mackay and Charleville intend to or may increase their level of insurance.

Few Mackay businesses indicated that they will be raising the floor level (3 %), while 18 % in Charleville may. Following the 2008 flood, 17 % additional Mackay businesses indicated that they will be attending to maintenance of ditches and drains around properties. There was no change in the number of businesses in Charleville undertaking this mitigation strategy: it remained at 92 %.

There was a 40 % increase in the number of Mackay businesses that intend to place irreplaceable items above ground level since the 2008 flood, with little amongst change in Charleville businesses.

Adaptation actions planned by businesses as a result of the 2008 floods are depicted in Figure 5.25 below. In both Charleville and Mackay, it shows that few businesses (82 % and 91 %, respectively) intend raising floor levels of their business premises. Mackay businesses appear less interested in joining local groups to discuss how to reduce flood risk than those in Charleville.

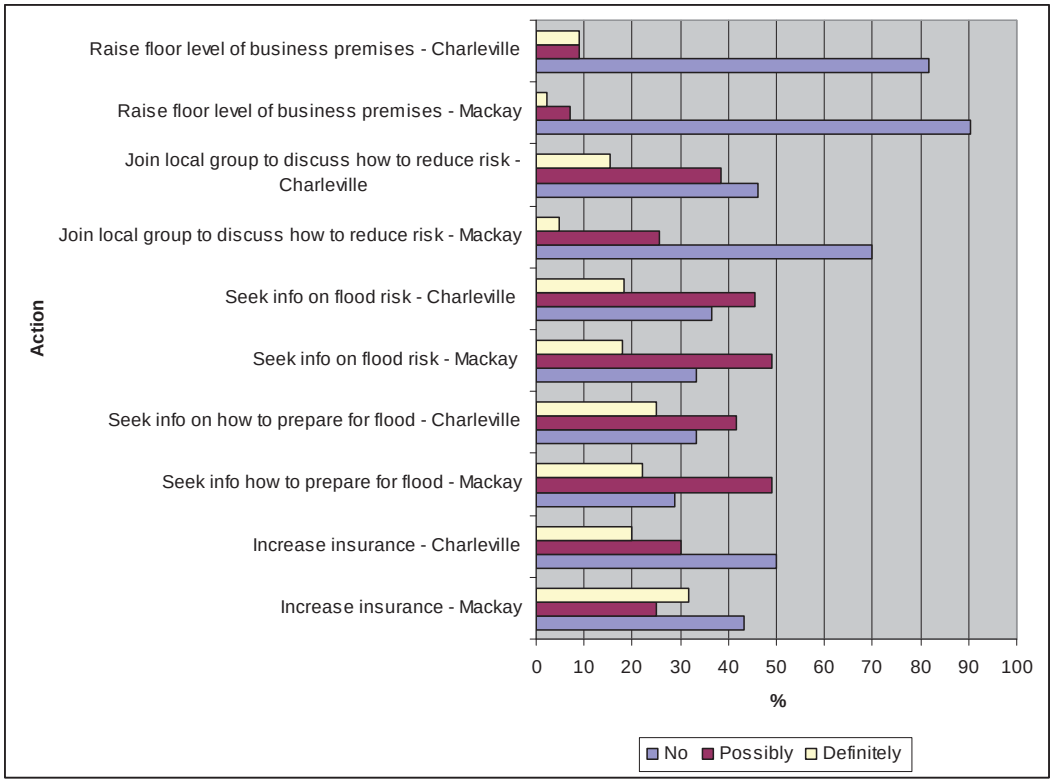

Figure 5.25. Adaptation activities businesses in Charleville in Mackay intend to undertake as a result of the 2008 flood

5.6.3.2 How Businesses View the Preparedness of Government and Community Groups

How prepared businesses rated the preparedness of different groups for future floods are shown in Figures 5.26 and 5.27 below. In all cases shown in Figure 5.26, a number of businesses selected 'don't know' (around 10-25 % of respondents).

Figure 5.27 below shows that Charleville businesses *did not* rate their Local Hospital, community, their business or utility providers lowly, as 'not at all prepared' for future flood events affecting their community. Conversely none of these businesses rated their community as being 'very prepared', suggesting that improvements could be made in preparations by the Charleville community. The Local Hospital in Charleville was rated the most highly in terms of preparedness.

Mackay businesses, on the other hand, rated each of these groups as being 'not at all prepared' (around 10-20 % of the sample) indicating they have concerns about their level of preparedness.

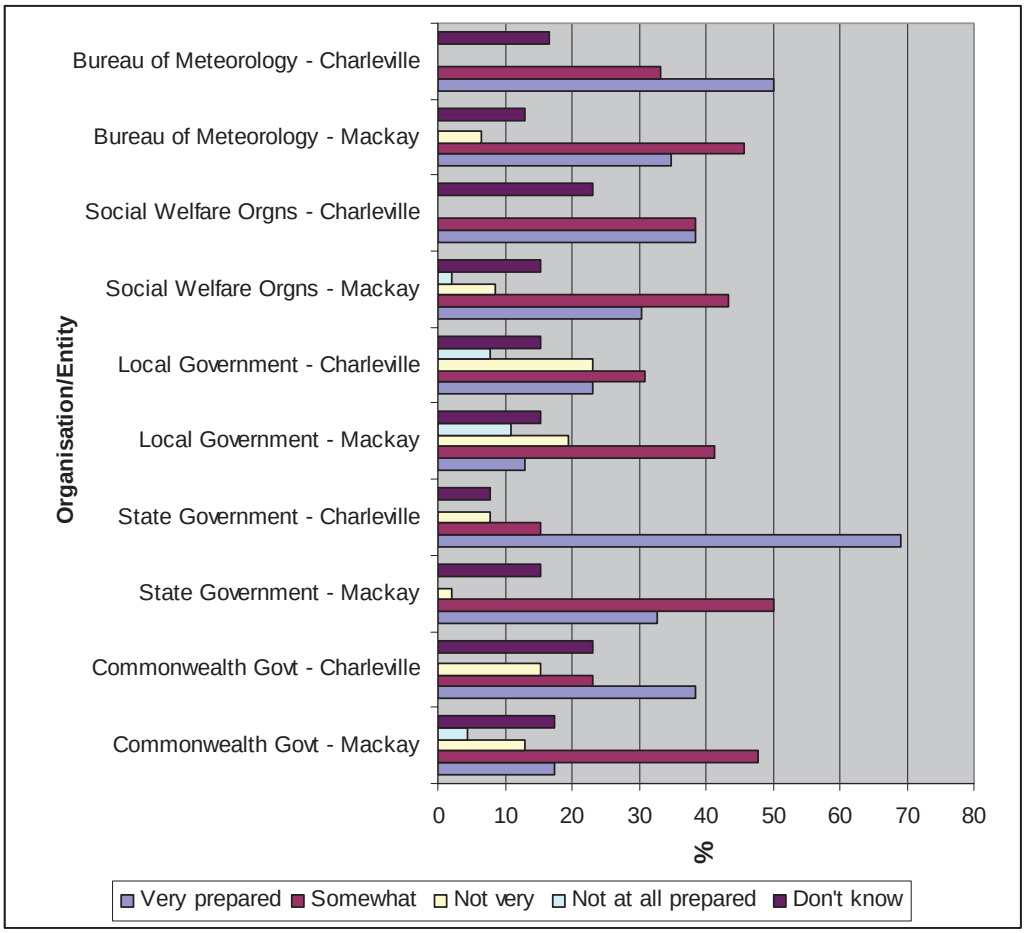

Figure 5.26. How prepared businesses believe these groups are for future floods affecting their communities

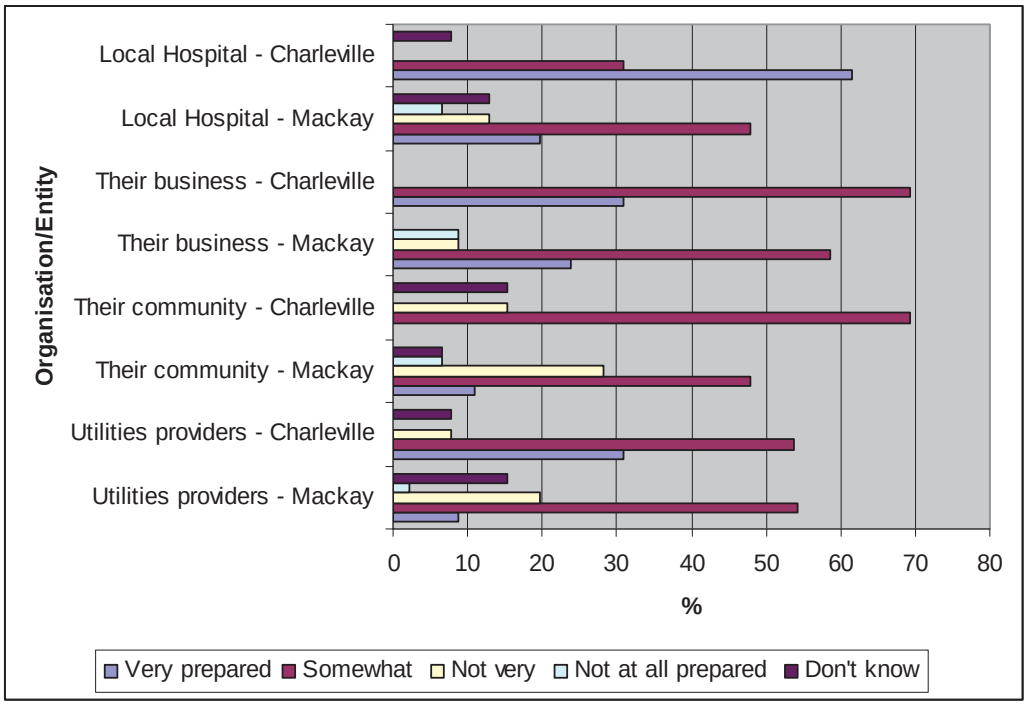

Figure 5.27. How prepared businesses believe these groups are for future floods affecting their communities

5.6.3.3 Possible Barriers to Adaptive Capacity for Businesses

Factors which may prevent businesses from preparing for flood events are shown in Figure 5.28.

For Charleville businesses, the need for cooperation with others was not considered a major issue, however, cost was. They also have other things to think about rather than floods. Mackay businesses seemed to be unsure whether skills are a barrier to their preparedness or not, and a large number are neutral in terms of their need for cooperation with others. These latter two findings may reflect an attitude by Mackay businesses that the responsibility for skills and cooperation with others is not theirs, but government and other agencies.

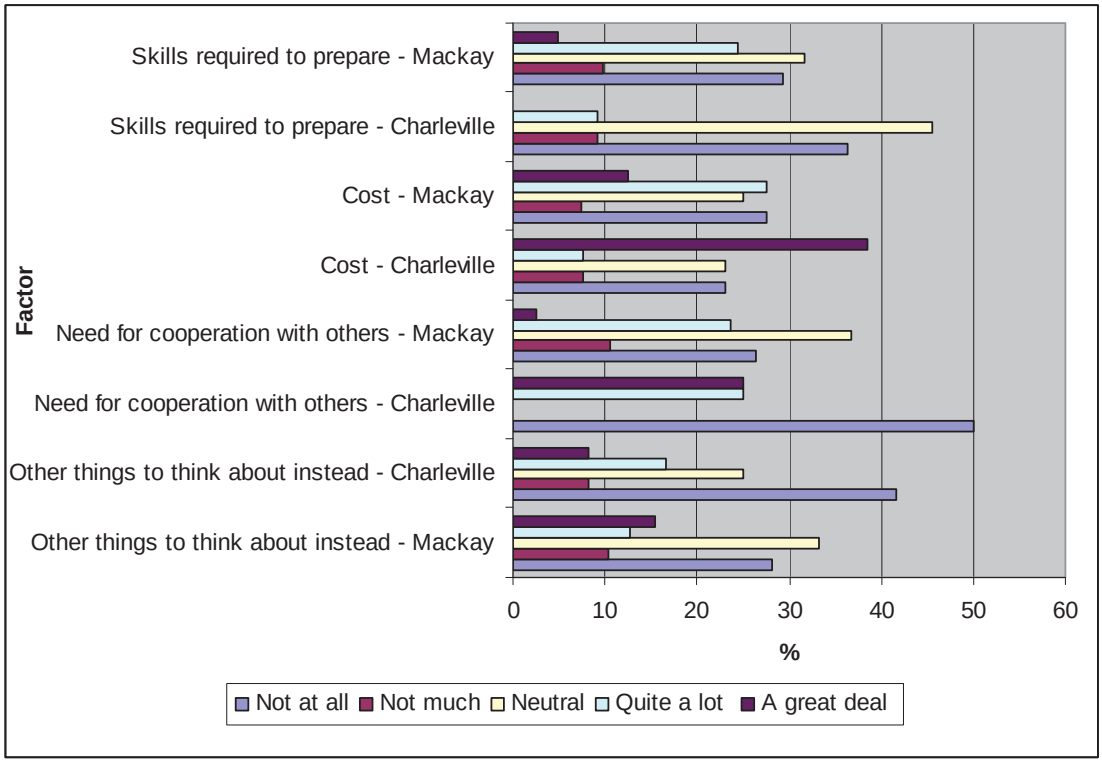

Figure 5.28. Factors which may prevent businesses from preparing for floods

5.6.3.4 What Businesses May Do if Another Flood Affects their Business

Figure 5.29 shows that only a small percentage (9 %) of Charleville businesses may move to another part of town if a flood affects them. On the other hand, around 21 % of Mackay businesses would move to a different part of Mackay if another flood affected their business. However, more than 80 % of respondents in either Charleville or Mackay would not consider moving out of their present area into different town.

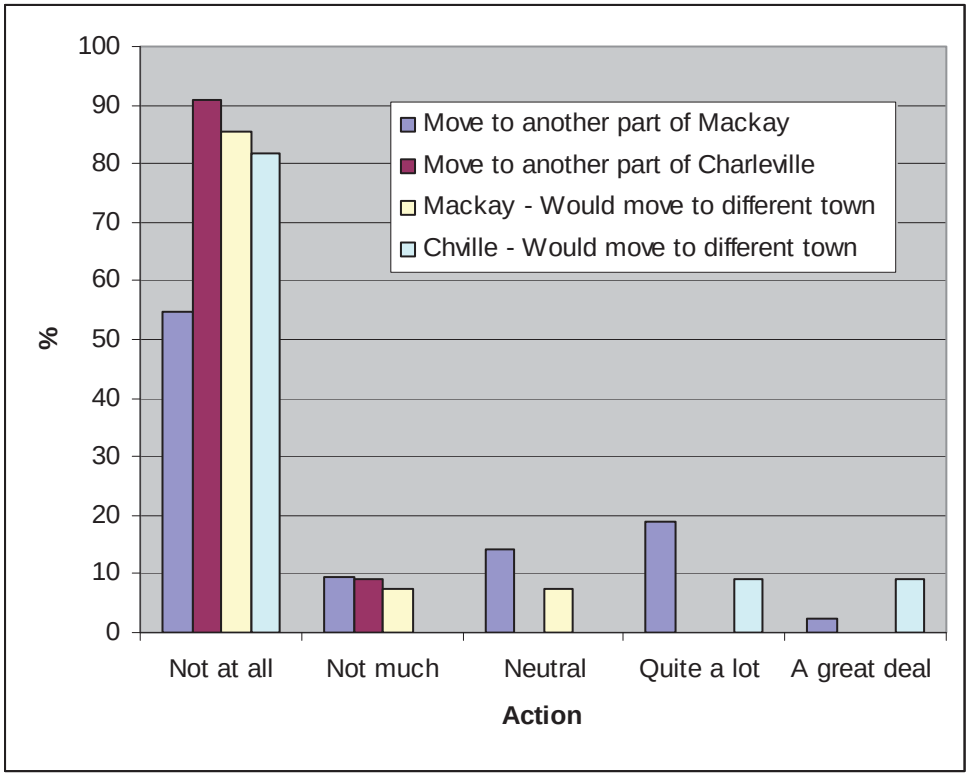

Figure 5.29. Actions businesses may take if another flood affects their business

5.6.4 Charleville Institutions

5.6.4.1 Institutions Would Do if They Had Access to Additional Funding

The study found that close to a third of institutions interviewed, if given additional funding, would not undertake any other actions to prepare for flood events, as they said that they are financially well-resourced. This may indicate that they also consider themselves well-prepared. Actions to take for those who would use additional funding are detailed below.

What some Charleville institutions would do if they had access to additional funding:

- Bring in additional staff from outside Charleville (e.g. nurses, police and other professional staff) and this would allow them more money for overtime and would help with fatigue management. Some staff had to defend their homes during the 2008 flood and they also needed to work a lot of overtime;
- Have more translators in Charleville;
- Continue working with the non-English speaking community;
- Relocate their business premises to a flood-free area on higher ground;
- Support local government with the processes in development of their disaster management capacity, e.g. provide some IT infrastructure to the SES, and enhance SES management;
- Develop and deliver community warning devices and education and SES training
- Continue clearing and desilting the Warrego River and Bradley's Gully; and
- Partner with Council to have a larger animal enclosure to save animals in a flood situation, so they can separate, for example, different types of dogs, house cattle, etc., so there are fewer deaths of animals.

Two respondents provided estimates for the cost of these activities, which were $5,000-$6,000 for swift water training, or an ongoing annual cost of $5,000 for 10 people; and the cost to raise the height of a building estimated at $100,000. Other respondents did not provide any information on the estimated financial cost of these strategies.

There appears to be a very strong commitment from institutions interviewed to stay in Charleville no matter what flood event conditions occur. Institutions appear very resilient and very committed to remaining in Charleville. Most institutions indicated that they were very well resourced and hence cost (and other factors shown above) appeared not be to be limiting factors in preparing for floods.

5.6.4.2 Flood Events That May Cause Members of the Charleville Community to Leave

The major concern of institutions in terms of flood events that could result in the community considering relocating out of Charleville would be another flood event similar to 1990.

However, opinions were fairly equally divided. Just over half the respondents felt people in Charleville would leave if they experienced another 1990 flood event, and the remainder felt they would remain in Charleville irrespective of any flood events.

Some of the flood events Charleville institutions think may make people leave included:

- If they experienced another flood that like in 1990, and people would not rebuild their businesses;
- Not so much a gully event, but if a flood came into the town like the 1997 flood;
- Not sure people trust the design of the levee;
- If continual flooding had continued to happen they may leave; and
- Some might move away from Bradley's Gully to another area, new people might leave. Government workers are a very transient population.

Other institutional personnel in Charleville who felt people would not leave could be due to the following reasons:

- There is a bit more confidence with the levee;
- People are used to floods. The town is prepared for floods. People are worried the levee is going to cause Charleville to become a dam. The community is very resilient, they won't leave the town;
- Floods have made the community stronger and Charleville thrives. Most of the locals are pretty good at coping. They have the resilience to recover. All the business people are related to each other and everyone will help each other;
- None really. People always come back after floods. The town has started to expand a lot, blocks are being approved at the Movern Road. There has been a bit more of a shift toward moving out of town; and
- Not now. There is confidence in the work that has been done. Happy with the intervention through to recovery. Price of houses with the levee bank has skyrocketed.

The following additional comments were raised by respondents:

- It was commented on how hard it is to get flood insurance for cars and vehicles. With Bradley's Gully now as it is, the point was made that it should be easier now to get insurance. This can require getting a lot of paperwork from Council;
- Some businesses closed after the 2008 flood but the respondent was unsure why they closed;
- Some people may move, but it comes down to money as to what option they choose.
- May be affected by loss of industry, availability of housing, and unemployment can be a problem in these situations, i.e. during flood events, if people are unemployed then these people will leave; and
- Continual flooding can cause mental and financial hardship.

5.6.4.3. Flood-Related Events That May Cause Institutions to Consider Leaving Charleville

Seventy-eight percent of institutions interviewed would not leave Charleville and were committed to remaining and operating from Charleville. Eleven percent may move if they experienced an event similar to 1990.

Others commented that there is confidence in the work that has been done and happy with intervention through to recovery.

Few groups will be raising the floor level of their premises or increasing insurance. This may be related to the fact that many may already have sufficient insurance or be in a low risk area in terms of potential inundation. About half of the respondents indicated that they will join a local group to discuss how flood risk can be reduced and close to half will seek information on flood risk and how to prepare for possible floods. Other actions indicated were that some respondents will continue to build partnerships with agencies and are currently looking into development of flood plan management.

5.6.4.4 Lessons learned and Future Actions by Charleville Institutions

Some of the lessons learned from the 2008 flood event, and suggestions made by Charleville institutions to help the community better prepare and cope made by respondents are outlined below in this section.

a) Information and campaigns Charleville institutions believe could help their community cope better in flood events

Seventy-seven percent of institutions thought that information or campaigns could help Charleville better prepare, respond to and cope with flooding. The following suggestions were raised, including the timing and likely costs:

- Translating information into different languages for the non-English speaking community (*six monthly*);
- Repetition of information. Occasional newspaper or radio, tips and reminders. Put this information on both local and ABC radio stations;
- Continual message campaigns about the services available and what to do in a disaster

- Put a flyer in letterboxes and articles in the newspaper. Remind people what they might need to do in a flood situation;
- There could be more education packages for people. Quite a few people did not experience the previous floods (*annually*);
- EMQ could prepare a flood kit, similar to the Cyclone Kit (*yearly at the start of the wet season*), radio and print advertising (*annually, at rating time*) (approx. cost $15,000);
- For basic preparedness for a flood or potential flood, could put together a warning document, e.g. (*annually*) and regularly over the season. Prepare a list of things that could happen and advise how people they can prepare (e.g. *when x water holes fill up, do y action, etc.*) (*regularly throughout the year*); and
- Local Government could advertise information in the media, television and in the Western Times (*weekly*) (approx. $100 per ad).

b) Warning information and alerts

- Better warning system and alerts are needed;
- Provide information on gully water height measurements;
- In the storm season, maybe Council could put some messages on the radio and a thing in the newspaper saying make sure you have batteries, etc. and telling people who they can phone; and
- Make sure people can hear the siren throughout the town. Some people were not able to hear the siren and they were not able to be contacted by police either.

5.6.4.5 What Institutions Believe Other Organisations and the Community Need to Do to Better Cope With Floods

About two-thirds of the respondents indicated that organisations and the community could do something to better cope with floods. Suggestions are shown in Table 5.1.

Table 5.1. What institutions believe could be done in Charleville to better cope with flood events

Who was suggested to implement the action	***Action suggested***
Local Council	Dig Bradley's gully. Cement the gully, make an upside down culvert, get the water flowing faster
Local Council	Produce a booklet for the community, a preparation booklet advising what to do.
Not stated	Provide interpreters to help non-English speaking members of the public.
Not stated	Better communication between agencies in the flood
Local Govt/Council	Develop an awareness package should be sent to everyone on flood evacuations and flood evacuation plans eg., give to new people who come to town.
Local and District Disaster Committees.	Evacuation point signs should be put up eg., Evacuation Point 1, so people know where to meet.

5.6.4.6 Actions That Could Be Done In The Next 5 Years To Make Charleville Viable

Almost 75 % of respondents believed that actions were needed in the next five years to make Charleville a viable community in which to live and work.

These included:

- Improving flood modelling and warning systems;
- Being more targeted in evacuations;
- Localising decision-making;
- Maintaining regular information in the media, particularly on what needs to be done and what different people's roles are;
- Providing people with accurate information, better warning system;
- Implementing specific mitigation measures;
- Greater commitment from insurance companies;
- Cooperation between departments is needed;
- Managing onlookers during flood events;
- Have available more apprentice plumbers; and
- Promote rail as a service option.

5.6.4.7 Actions Planned By Charleville Institutions In The Next 5 Years To Better Cope With Flood Events

Close to two-thirds of respondents had actions planned in the next 5 years to better cope with flood events.

a) Operational planning

- Carrying out mock exercises and updating their recovery plan every 12 months
- Annual, and continuous training, including of new staff;
- Planning for major events, detailing the chain of command, reviewing what worked well and what did not;
- Reviewing all the major training eg., flood boat training for 3 levels - flood and fast moving water;
- Allocating staff to support local government and help the SES and work with the local people;
- Reinstalling the community alarm system;
- Applying under the NDRP to provide mapping of river and vulnerabilities;
- Provision of additional mitigation strategies;
- Providing information and advice and review risk treatments related to prevention, preparedness, response and recovery; and
- Taking a more active role in the Disaster and Community Recovery Committees.

b) Response recommendations

- Making recommendations that people not throw out furniture but use furniture until they get some new furniture, and suggesting that sometimes whitegoods can be repaired;
- People need to be dissuaded from sending clothes to the Charleville railway station, as during the 2008 flood around 30 crates of donated clothes arrived there that were not needed and they did not have the people to handle all those clothes. Such clothing donations need to be sent through to an organised group; and
- It was recommended that financial handouts be discontinued.

5.6.5 Mackay Institutions

Comments made by Mackay institutions with respect to adaptive capacity are summarised below:

- People do not want to move from Mackay regardless of the natural hazards risks
- Promotion of sirens would be useful;
- Animal welfare issues need to be considered domestic and rural, especially moving domestic animals during a flood; and
- Lesson learnt – have a broadcaster situated near decision makers so info quickly reaches the public.

6 Synthesis

6.1 Resilience: Social Networks

6.1.1 Objective and Hypothesis

Objective 1: To understand how societies that are regularly flooded operate and the characteristics of their resilience or low resilience.

Hypothesis 1: That those households established in areas that are vulnerable to regular flooding, that have greater connections within the community, display more resilience in the event of a disaster flood event.

Sub-Hypothesis 1: That community members with greater connections within the community were more likely to find accommodation with family and friends following flood damage to their homes.

6.1.2 Discussion

When comparing the Mackay community to that in Charleville, it was found that Charleville had high levels of social capital, and strong social networks, which were cohesive and supportive. From those surveyed, around three-quarters of Charleville residents were forced to leave home during the flood event, compared to just over a half in Mackay. Most Charleville residents were able to return home in less than a month, but in Mackay this period was more extended with 14 % of residents not able to return home for more than six months.

Charleville residents exhibited greater levels of resilience in terms of personal networks, with 77 % evacuating to family or friends compared to 51 % in Mackay, regardless of the time that they had lived in the community. This finding demonstrates the important role that community networks play in disaster events. Other locations of evacuation included the following places: rented, family and temporary accommodation and state schools. In Mackay, state schools were established as official evacuation centres during the disaster event. It should be noted that temporary accommodation also included living in other parts of the flood damaged house such as the garage.

In addition to the shortage of housing supply in Mackay, there was a shortage of tradespeople in the region at the time of the 2008 flood as a result of the economic boom in this year (Department of Employment and Economic Development, 04/02/10). This meant that those requiring repairs on their homes were required to wait some time for work to be completed, with the added demand for tradespeople in the region. This may explain the length of time, which spanned over six months in many cases, that some householders were required to evacuate their residences for.

The households surveyed in Mackay that were required to evacuate largely comprised families. The longer the household had lived in the community, the more time it took to return to their residence. This may be because those who had lived in the community for longer had greater access to stronger community ties and networks which allowed them the luxury of evacuating for longer periods of time, resulting in greater resilience in the post-disaster recovery phase.

The only significant relationship that was found for the above household survey data was between length of time living in the community and location of evacuation.

There is a housing crisis in Mackay which is evidenced by the public housing which is full and the emergency housing that is lived in permanently (Women's Domestic Violence, 05/03/10). Prior to 2008, the median sale price rose steadily at 20 percent growth per annum from December 2002 to reach $386,000 in June 2008 (Collins International, 2008). Similarly, unit prices have also risen over the period with the median sale price reaching $310,000 in June 2008.

Mackay's local economy includes supporting the surrounding mining industry which produces 85 % of Queensland's coal and those employed by the mining industry in the Mackay Local Government Area increased by half as much again from 2001 (8 %) to 2006 (12 %). Research by Collins International (2008) found that the growing demand for units in Mackay represents a lifestyle choice for the mobile labour force employed in the neighbouring mines. Those new to the area, such as those who had moved to earn money in the mines, were not aware of the natural hazard events such as floods and how to prepare for such events (Women's Domestic Violence, 05/02/10).

An evacuation centre was established by the Mackay Regional Council. Sixty-five people sheltered there on the first night, many of whom were homeless prior to the floods but had heard about the service being offered (Mackay Regional Council, 03/03/10). There were only around 15 people at the centre the next night with none the following night (Mackay Regional Council, 03/03/10). This demonstrates that Mackay households affected by the disaster flood event were able to seek shelter in more appealing circumstances elsewhere.

As an emergency management response to the floods facing a town with a housing shortage, the ports were approached regarding making vacant land available to create a donga city in the interim whilst people's houses were being repaired. However this did not eventuate because people were able to find accommodation either provided by insurance agencies or by staying with friends or family whilst their houses were being repaired (Mackay Ports Limited, 05/03/10). This demonstrates the existence of strong social networks in Mackay.

In Charleville, many have resided in the town for over 10 years and the research conducted found that personal networks were strong and participation rates in community activities generally high. A strong sense of community, family and belongingness was evidenced by large numbers of residents evacuating to family and friends, and other findings which support this. Additionally, they reported that they knew their neighbours and other community members, and were generally satisfied with, and felt at home in, their community.

In Mackay, business premises that had been established for longer within the community were less likely to have experienced flood damage. This link may be related to trends in development and economic expansion where businesses which have been established for greater periods of time were constructed prior to economic growth in the town and the consequent building of new business hubs. This may reflect an era in town planning schemes that allowed these developments to be constructed in flood prone areas.

In Mackay, the study found no strong correlation between involvement in volunteer organisations or feelings about living in the community and length of time spent living in the community for both the household and business sectors.

Differences found between Charleville and Mackay institutional sample responses related to psychological issues and effects of the floods and problems with insurance claims. Three Mackay institutions commented on the psychological issues and effects of the 2008 flood on adults and children, and the fact that emotional and mental rebuilding did not go well. Some people in Mackay reportedly moved to other areas of Mackay, largely as a result of associated psychological issues. This may suggest that the Charleville community could be more resilient than Mackay in terms of emotional coping mechanisms, where there may be more of an expectation and dependence on Government services, rather than on their own and neighbour and family network resources, to deal with emergency situations.

6.1.3 Conclusion

The study found that those established in areas that are vulnerable to regular flooding, who had greater connections within the community, displayed more resilience in the event of a disaster flood event.

Thus, the Charleville community was found to be *staunchly resilient*, with high levels of sense of belongingness and commitment on the part of residents, businesses and institutions to remain in the community irrespective of future flood events. In comparison, low participation rates in the community, low formal volunteerism rates in Mackay and the belief that they have a limited personal responsibility to prepare for floods and mixed views on the question of belongingness, indicates *weaker levels of resilience* in Mackay.

In Mackay, the length of time a business had been established was linked to flood impacts indicating a complacency to flood events at some point as evidenced by the expansion approved for the development of industrial estates and retail outlets in lower lying areas of Mackay.

The Mackay community could be considered a *less resilient community* as compared to Charleville in terms of *social capacity* but Charleville was considered to be a *less resilient community* in terms of *economic capacity*.

6.2 Vulnerability: Resilience and Adaptive Capacity

6.2.1 Objective and Hypothesis

Objective 2: The characteristics of communities that are 'on the edge', where flooding might push them into non-viability.

Hypothesis 2: That social groups with special needs such as the elderly are less resilient to a disaster flooding event than other members of a community

6.2.2 Discussion

Research by Tapsell and Tunstall (2006) found that there was a significant correlation between persons aged 65 and the likelihood of experiencing health impacts as a result of flood events. Morrow (1999) and Buckle *et al. (*2000) are cited by Tapsell and Tunstall (2006) as other studies which also found the elderly are vulnerable group within societies to flood events.

Vulnerable populations in Charleville included nursing home residents due to there being limited suitable accommodation with special facilities during the evacuation, businesses and residents who cannot obtain flood insurance, as well as new migrants. New migrants can experience problems such as language barriers, lack of social networks and other challenges. Rural populations have to deal with the problem of distance and limited channels for accessing information, with some needing to rely on School of the Air radio channels, for example. Rural and domestic stock can also be considered a vulnerable population. There are no special facilities available to house, for example, domestic pets during flood events, or in Charleville rural stock as well.

The main characteristic of vulnerability in Charleville is the difficulty involved in obtaining flood insurance, which economically marginalises these groups and exposes them to greater levels of financial risk than residents in Mackay who may be covered by flood insurance. More than half the Charleville businesses surveyed were not covered by flood insurance and incurred business costs as a result of the flood of around $375,000 which were not covered by insurance. Only around a third of Charleville residents were insured whereas a total of $342 million was covered by insurance in Mackay for the 2008 flood event (Insurance Council of Australia, 2008).

A large proportion of the Mackay resident population could be considered vulnerable in that they appear to be somewhat indifferent to the risk of flood events and do not have high confidence in flood warning information. This may relate to the fact that few had previous experience of floods, but it could affect future actions in terms of preparation and willingness to evacuate. The Mackay Regional Council has attempted to specifically identify those who are vulnerable in the event of a natural disaster and currently has 85 people listed on a Special Needs Register but it is estimated that figures are more likely around 115 on the register (Mackay Regional Council, 03/03/10). This demonstrates an effort by council to reduce the vulnerability for these groups by identifying those that need particular attention in evacuation procedures and mitigation plans.

The Mater Hospital in Mackay had spare beds and offered to take people in and offered the service to the public, particularly to the elderly because they were aware that they are a vulnerable group and may have no one to look after them, but no one took them up (Mackay Regional Council, 03/03/10). Additionally, the Mater Hospital was well prepared for emergency or disaster events and had reserves such as a lot of cooked and chilled food (Mater Hospital, 05/02/10). The Mater Hospital heard on the news on the television at around 10am that the Good Shepherd Lodge had been flooded and offered to take any of the elderly and received two people but the rest of the elderly went home to families (Mater Hospital, 05/02/10). There were 116 residents in total that were evacuated from the Good Shepherd Lodge which is located in South Mackay (Good Shepherd Lodge, 11/12/09). The one death recorded for the disaster flood event was an elderly person from North Mackay who died of a heart attack.

In both case study regions, it was suggested by respondents that businesses were less resilient than householders and that animal welfare issues during floods were flagged as requiring consideration, e.g. rural and domestic animals, and housing these animals in flood events, particularly domestic animals. Respondents in both study regions made similar comments concerning new people to the regions who were unsure how to prepare for the event and the fact that the event caught people by surprise. Both groups commented on issues of staff overworking and staff fatigue, as well as staff having their own flood-related problems to deal with at home. A current shortage of tradespeople was found to be common to both towns.

The impact of the flood showed that in Mackay it was the elderly who required mass evacuation, were admitted to hospital and accounted for the only death. The vulnerability of the elderly was increased in Charleville. Outside of the nursing home, where during the evacuation there was a lack of suitable accommodation with the required special facilities and barriers, issues of receiving care were exacerbated due to the distance between towns and major cities and the limited channels for accessing to information. Consequently this shows the vulnerability of this social group and decreased resilience to a disaster event. These results however focus on physical vulnerability to a disaster event as opposed to mental vulnerability.

As a coastal urban city, Mackay residents that consist of a large itinerant population were less likely than the residents of the rural town Charleville to have experienced a flood event. Psychological impacts of the flood on the Mackay community members were found to be a key issues in contrast to the residents of Charleville. This may reflect the coping capacity of communities and subsequent resilience to disaster events. Charleville residents are used to experiencing disaster events caused by natural hazards, whether drought or flood events and consequently have established more mental resilience for coping with such events.

The Flood Hazard Research Centre based in the United Kingdom has conducted several studies that have investigated those social groups in the community that are most vulnerable to suffering psychological health problems as a result of flooding events (Flood Haward Research Centre, 2005). Post-disaster evaluations by Mackay councillors commented that the physical rebuilding of the city went well but not emotional and mental rebuilding (Councillor for Community Services, 03/02/10).

As a result of the flood event in Mackay, Lifeline recorded 2,151 calls with 75 % requesting additional counselling support (EMQ, 2008). Lifeline is a telephone line service established by the Methodist Central Mission and run by volunteers for the purpose of providing assistance to the community in the event of a crisis. Counselling for some cases initiated by the disaster flood event were still current two years following the event. It is possible that these clients may have been suffering Post-traumatic Stress Disorder which has been found to occur following disaster flooding events and researched in previous flood studies (Auger *et al.,* 2000; Waelde *et al.,* 2001; McMillen *et al.,* 2002; Norris *et al.,* 2002).

In the case of the 2008 floods in Charleville and Mackay, communities' experiences particularly consisted of: contact with floodwater; increased exposure to toxins, pathogens and other biological risks; disruption of livelihood, assets and property; displacement; some residents also experienced prolonged disruption of water supply and even the risk of drowning (data from surveys and interviews with residents and businesses of Mackay 2009; in particular Mail Service 09/12/09 and Bradman Drive, Glenella 11/12/09).

Children in Mackay were found to experience psychological effects resulting from the floods with regression occurring, for instance not wanting to go to the toilet anymore (Women's Domestic Violence, 05/02/10). Veenema and Schrodeder-Bruce (2002) found that regressive symptoms in children aged 4-6 (stage 3) are common reactions to trauma.

One Mackay resident from the suburb of Glenella described the effects of the flood event on her six year old daughter as so distressing that they are now moving from the house which they built 16 years ago despite one of the original builders returning at the age of 70 to oversee the rebuilding of their home (household interview 10/12/09). Despite not being scared at the time of the event, the six year old can't sleep when it rains. Veenema and Schrodeder-Bruce (2002) found that this was a common reaction to trauma by children from 6 years old to puberty.

In Mackay, the council found that there was a lot of confusion during the disaster which resulted in long term impacts for rebuilding the community (Councillor for Community Services, 03/02/10). The Mackay Regional Council funded the following post disaster recovery efforts to address the psychological rebuilding of the Mackay city:

- Crossroads Art documentary (*Daily Mercury*, 2008); and
- Artspace Mackay workshops and exhibition (*Daily Mercury*, 2009).

The significant ongoing mental health impact on the Mackay community resulting from the disaster flood event may have been exacerbated by the onset of the global financial crisis as households and businesses were in recovery phases.

Both towns had many residents who have resided in the town for over 10 years, but in Mackay around half had never experienced a flood event before, which means they may have a limited memory upon which to draw coping and mitigation measure strategy information.

6.2.3 Conclusions

Whilst this study found the elderly was a social group vulnerable to disaster flood events, it particularly highlighted the psychological impacts of the flood on the community. The research of the Mackay 2008 flood indicated that lack of prior exposure to disaster events was a critical factor contributing to mental health and reducing the resilience of communities in the post-disaster phase. Consequently, it is recommended that mental health be included as a component of in the consequences phase in addition to the 'macro-economic' impacts that may in turn increase the vulnerability of a population.

6.3 Resilience: Flood Mitigation Measures

6.3.1 Objective and Hypothesis

Objective 3: The extent to which flood mitigation measures have been applied to reduce the vulnerability to flood events.

Hypothesis 3: That those who had applied flood mitigation measures were more resilient to disaster flooding events.

6.3.2 Discussion

In terms of its attitude toward, and perception of, levels of flood risk and low levels of motivation for obtaining information on flood risk; Mackay was found to be a more *vulnerable community* than Charleville.

In Charleville, the community rated highly their Local Council's response to the flood event, and they were generally confident about the accuracy of flood warning information in Charleville. In contrast, the Mackay community demonstrated low levels of confidence about the accuracy of flood warning information, which may have the potential to affect their future willingness to evacuate or prepare for a flood. Levels of preparedness were also low, which could have been influenced by the suddenness of the event and the fact that few received a warning. In

Charleville, the community was generally of the belief that they have a personal responsibility for preparing for floods, in conjunction with their Local Council.

In Charleville, cost was seen as a barrier to preparing for future floods, as was the fact that they have other things to think about apart from floods. This latter attitude is common to all communities. The local hospital was rated highly in terms of preparedness, but it was felt that local residents could be better prepared. Like Mackay, few business people in Charleville were interested in joining clubs to discuss flood risk and a number of Charleville businesses were unsure how prepared different community and government groups are for future floods.

Most Mackay residents did not receive any flood warning, two-thirds did not know where the evacuation routes and centres were and they did not consider their Local Council was highly responsive to the flood event. The ability of some residents to return quickly to their homes after the flood appears to have been influenced by procedures required by insurance companies with respect to damage claims, extending their time away from their residences.

The Mackay community's *adaptive capacity* is considered somewhat impeded by the large number of residents who had not experienced a flood before. Quite a number had a neutral attitude as to whether they are limited by issues such as cost and skills in preparing for floods, which may be influenced by the limited responsibility they believe they have to prepare for floods. Few Mackay businesses were interested in joining groups to discuss flood risk and many were unsure how prepared different government and community groups are for future flood events, they also expressed concern about the level of preparedness of local residents and other members of the community in Mackay.

State Planning Policy 1/03: Mitigating the Adverse Impacts of Flood, Bushfire and Landslide (SPP 1/03) has been discussed in the previous section, but it should be reiterated that this is a statutory mitigation instrument that drives some land use planning decisions. The fact that the policy is limited and vulnerable to misinterpretation or misuse does not entirely negate its role as a mitigation strategy. Clearly the next phase of the policy needs strengthening, as planners are not intentionally misusing or ignoring the policy, but rather they are caught between the vagueness of some of its requirements and pressures from developers. An example is the compromise that has been adopted in Mackay.

The minimum building floor level, as specified in division 12 of the Flood and Inundation Management Overlay Code of the *Mackay City Planning Scheme 2006*, is 300 mm above the defined flood event (DFE; the flood event adopted by a local government for the management of development in a particular locality). This has resulted in the building of houses on slabs on the ground to reach this height (Planning and Development Team, Mackay Regional Council, 03/02/10). Consequently, this policy may be having the effect of contributing to the development of wetlands, storm surge and flood prone areas by effectively advocating infilling or reclamation of land to ensure that development is above the 1 % AEP (100 year Annual Recurrence Interval (ARI)) A Mackay Regional Council worker highlighted that the previous Council enabled developments to be approved that were situated in floodplains including infill developments on land that was previously mangroves such as a private school currently being constructed (Mackay Regional Council 03/02/10).

Mitigation planning in Charleville

One characteristic of *vulnerability* that was found in Charleville related to development and the settlement pattern near Bradley's Gully, where a lot of buildings are mainly low set and hence more susceptible to inundation and subsequent flood damage. Current level for buildings of 300 mm above the 1997 flood level as sufficient to cope with future flood events, particularly for buildings situated close to Bradley's Gully, has been assessed as a development characteristic of vulnerability in Charleville.

Mitigation planning in Mackay

The findings of those households and businesses surveyed who had applied flood mitigation measures were that these premises still received water in their homes and flood damage. However it is theorised that this may also be a reflection of the study design where participants were selected specifically from areas that received the greatest flood damage from the 2008 disaster event in Mackay. Therefore, those premises that had implemented mitigation measures and avoided damage from the 2008 flood event in Mackay despite being in the suburbs that were most affected, were not included in the survey. This meant that qualitative information was subsequently used to assess the value of specific flood mitigation measures.

It was noticeable in particular in the suburb of North Mackay that older buildings which had been built on stilts were less likely to have received flood impacts (resident surveys 10-11/12/09). These households that were not flooded were not included in the survey because the targeted sample was from those households that had received flood damage. Subsequently, this may account for the low numbers of households that had implemented specific flood mitigation measures related to housing design. It may therefore be implied that housing design is an important component of flood damage mitigation for communities.

Building design, to some degree, had an impact on those that were flooded and those that weren't in the 2008 Mackay flood event. For example, those that had built their slabs up higher were often found to have avoided flood damage. This was the case for a resident in Windmill Crescent, Glenella who was one of few houses in the street that didn't receive flood waters. A resident in Davey St, North Mackay had built the slab up two stairs and consequently only the shed was flooded (household interviews 11/12/09).

Mitigation actions taken by the Mackay Regional Council following the flood event

The Mackay Regional Council has taken the following actions since the 2008 flood event which are aimed at increasing the city's resilience to future disaster events:

- Created flood maps for the Gooseponds area (Mackay Regional Council, 2009a);
- The Council is in the process of creating an online mapping service so that residents are able to identify their property and whether it is located in a flood prone area and types of risks associated with their location;
- Re-designed a new subdivision in the Glenella area aimed at lowering road levels to facilitate an improved outlet along the road to Jane Creek;
- Installed an additional 900 mm diameter pipe downstream of Angelina Avenue, Glenella to Fursden Creek;

- Cleared vegetation along the edge of Jane Creek tributary to improve the future flow along the creek;
- Repaired numerous storm water drainage systems damaged by the flood;
- Repaired roads saturated by floodwaters; and
- Provided a wet season checklist to assist residence to mitigate against flood damages.

Additionally, the Mackay Regional Council funded a flood study on the Goosepond and Vines Creek. GHD Pty Ltd (GHD) conducted the study and made the following recommendations to enhance the cities' resilience to the impacts of a 1-in-100 year ARI design flood event:

- Upgrade existing waterway crossings with significant blockages to flow;
- Property Resumptions;
- Construction of levees; and
- Construct eight 1800 mm x 1500 mm Reinforced Concrete Box Culverts and a 50 m wide trapezoid channel with a 17m wide base and a ratio of 1:6 side slopes aimed at diverting storm water from the Glenella industrial estate (GHD, 2009).

6.3.3 Recommendations

Charleville

The study revealed that mitigation activities that could have been implemented to better prepare for floods in Charleville might have cost circa $600,000, and could have included de-silting Bradley's Gully (estimated cost $500,000) and installing more river height reading stations on Bradley's Creek and the Warrego River and also on the Nieve River (estimated cost of $50,000-$100,000).

Potential improvements to mitigation measures for Charleville included suggestions that more warning devices be installed upstream in Warrego River, better flood mapping including GIS data is needed, delivery of community education programs and training for SES volunteers, and regular monitoring, clearing and de-silting of the river and Bradley's Gully. The initial cost of implementing these mitigation activities is estimated at $2 million, with a recurrent cost of $100,000.

It is considered that the adaptive capacity of the community could be vastly improved by enabling Charleville residents and businesses access to flood insurance. However, this is probably not a viable recommendation in light of events over the last 2 years: increasing natural disaster events and insurance pay outs plus a financial crisis. The government cannot afford to support the continuation of building in areas subject to natural hazards

Charleville institutions suggested that a number of information and campaigns could be used to help Charleville cope better in flood events and commented on what they believe the community and other institutions can do to help the community cope with future floods. They also articulated what actions could be taken in the next five years to make Charleville a more viable place to live and work. These included improving flood modelling in the catchment and improving planning; better warning systems; implementing specific mitigation measures and best practice catchment management; localizing decision-making; ongoing publishing of information and education; greater departmental cooperation; managing onlookers; more commitment from insurance companies; putting on more apprentice plumbers and promoting rail as a service option.

Mackay

A gradient overlay in the local government planning scheme was proposed by the former CEO of the Mackay Regional Council (Mackay Ports Limited, 05/03/10).

The 2008 Mackay flood event caught people by surprise so mitigation measures such as emergency or evacuation plans were not implemented because there was no time or right personnel available to implement them (Mackay Ports Limited 05/02/10). For example, the airport general manager rang the Chief Executive Officer of the airport at 5:00am to notify him that the airport was closed, and the general manager of the airport was unable to get to the airport (Mackay Ports Limited, 05/02/10).

Emergency plans are written according to a known competency of the people to enact the plan. However in the case of the 2008 Mackay flood event, they were not able to get the staff to the airport or port to enact the plan and often the staff had their own tragedies to deal with (Mackay Ports Limited 05/02/10). So in the case of the 2008 Mackay disaster floods, many emergency plans weren't able to be enacted. The Mackay Ports Limited proposed that "plans need to be developed and tested so that if you can't get the key actors in you can 'call in a different cast to stage the production"' (Mackay Ports Limited 05/02/10). There could therefore be two types of plans - one written for those with the expertise and another written in case those people aren't able to be present so that raw recruits may be able to understand and implement them.

6.3.4 Conclusion

The research conducted did not show any direct correlation between implementing mitigation measures and avoidance of flood impacts in Mackay. However, due to the purposive methodology used in the research design where those households and businesses that received flood damage were selected, this may subsequently indicate that those who were not impacted by the floods had implemented a greater number of mitigation measures which provided greater resilience to the flood event. Planning and development was found to play a critical role in the resilience of communities to disaster events such as flooding.

6.4 Adaptive Capacity: Migration as an Option

6.4.1 Objective and Hypothesis

Objective 4: The characteristics of vulnerability, resilience and adaptive capacity of households and businesses.

Hypothesis 4: That those who have more adaptive capacity, move from areas that are vulnerable to regular flooding, achieving increased resilience.

6.4.2 Discussion

In both case study regions there is evidence that the communities are heeding advice given following flood events such as checking electrical appliances, boiling tap water before use, keeping drains and ditches clean and free around buildings. This shows an adaptive capacity enabled by resilience actions promoted by local councils.

Numerous definitions of vulnerability, resilience, mitigation and adaptive capacity can be found in the literature. A new definition of adaptation capacity is required for the EMA glossary. Nelson *et al. (*2007) have written a literature review on the definitions of the climate change discourse including a comparison of definitions of resilience and adaptive capacity. In their paper, they define adaptation as "*a process of deliberate change in anticipation of or in reaction to external stimuli and stress*" (Nelson et al, 2007). According to them, resilience is focused on the functioning of the social-ecological system as a whole whereas the literature on adaptation to climate change is focused on the actors.

Relocation within a city or town

Following the 1958 flood event in Mackay, a policy of relocation was implemented for the devastated suburb of Foulden where all houses were destroyed including three houses washed out to sea. A multi-hazard risk assessment by Geoscience Australia (2000) of community risk in Mackay, argues that flood mitigation planning policy either needs to regulate the renovation or 'retrofit' codes for existing building; or advocate a policy of relocation which may include the compulsory acquisition of properties with an unacceptably high degree of exposure (Geoscience Australia, 2000). Geoscience Australia cautions that policies of compulsory acquisition or relocation are usually marked by controversy, but are clearly effective in reducing risk.

It should be noted that houses in the former suburb of Foulden were also flooded in the Mackay 2008 disaster flood event with one man who received an award for his efforts in rescuing people in a boat in the 1958 floods was still living in the area and also witnessed the 2008 flood event (Geoscience Australia, 2000). It is interesting to note that other significant developments were also located close to the former Foulden suburb such as the Valetta Gardens estate and the two primary business districts that were impacted: the Glenella industrial estate and the Northpoint Retail shopping complex.

A new settlement has been established in Charleville outside the flood prone areas but it is reportedly not being used currently. There is some thought that it may become popular into the future with younger couples wanting to purchase affordable housing.

Little evidence was found of willingness to move within Charleville despite the availability of a new settlement provided for the key aim of reducing destruction to residences. This shows a lack of *adaptive capacity* amongst the Charleville community to change what may be entrenched patterns of living despite the significant risk of increased flooding events resulting from climate change.

Similar responses were given by institutions in the two case study regions to a number of questions, including that these communities have a strong commitment to remaining in their town, irrespective of a natural hazard risk, such as a flood. The exception was that if there were another flood similar to that experienced in 1990 in Charleville, members of this community may rethink that point of view.

It was found that few residents in both towns would consider leaving if another flood affects their home, business or institution, and a small proportion may consider moving to other areas within the town. If there was another flood like that experienced in 1990 by the Charleville community (for some like that experienced in 1997), the majority of the community maintains that they would continue to stay in the town under such circumstances, although it was suggested that some businesses may not rebuild.

In Charleville, institutions, being primarily government agencies, were found to be well-resourced financially and there are high levels of commitment amongst these organisations to remain in Charleville. Most community members have experienced a number of flood events which can contribute to their knowledge in terms of preparedness, and coping and adaptive strategies. This community is knowledgeable about, and aware of, the risks and likelihood of flood events in their region. A particular indicator of adaptive capacity in Charleville is that prisoners are now seen as a resource, due to their helping during the flood event.

The research conducted in Mackay found that households and businesses affected by the disaster flood events were willing to increase their resilience to future flood events with the intent to increase their flood mitigation actions following a disaster flood event (Table 6.1).

Table 6.1. Comparison of Mackay flood mitigation measures implemented prior to the disaster flood event and intentions following the event

Flood mitigation action	Response after experiencing a disaster flood event	
	Household Survey Results	Business Survey Results
Take out insurance against flooding	↑	↑
Raise floor level	↑	↓
Keep drains and ditches around the property clean and free of debris	↑	↑
Avoid keeping irreplaceable items or valuable goods on the ground floor level of the premises	↑	↑

It has been theorised that those with greater adaptive capacity were more likely to move to other towns to seek opportunities following a natural disaster event in a particular geographical location. The data from the research found the both residents and businesses may consider moving to another part of Mackay but the majority indicated that they would not move to another town. This highlights the attraction of Mackay as a place to live and work. However in the case of the survey of residents, it should be noted that around a quarter of residents door knocked, had in fact moved into the neighbourhood following the disaster flood event. This high number of new occupants to the community may characterise the itinerent nature of the city or in fact point to a population that had already relocated as a direct result of the flood event. However, the results indicate and the Mackay Regional Council Planning and Development Team (03/02/10) have discovered that people largely do not want to move from Mackay regardless of the natural hazard risks. Consequently, the Council sees their role as reducing risks which inevitably can not be avoided and preparing for the Emergency Management role required (Mackay Regional Council Planning and Development Team 03/02/10).It is also difficult to assess the economic impacts of the flood on Mackay and subsequent changes in Real Estate market because it coincided with onset of the global economic crisis (Collins International, 2008).

Indicators of the economic downturn in Mackay in early 2008 can be seen in the reduction in industrial sales by 37.2 % from December 2007 to December 2008 (Coorporation, 2008). Consequently specific reductions in industrial and housing sales may be directly attributed to the disaster flood event.

It should be noted that in the survey sample size, there were many households who had not been present during the flood indicating that there were many households that did not in fact return following the disaster flood event (survey of Mackay residents 2009).

Measures taken by the Mackay Regional Council to address adaptive capacity following the flood event

Following the 2008 disaster flood event, the Mackay Regional Council introduced a Disaster Response Levy of $10 per annum against all rateable assessments from the season of 2009/10 (Mackay Regional Council, 2009b). This is to assist Council to have the capacity to meet the demands associated with natural disasters and funds areas, such as:

- Operating costs for SES and Emergency Management Section;
- Improvements to SES facilities;
- Purchase of capital equipment essential to maintaining a Disaster Coordination Centre in the Administration Building;
- Covering the trigger point costs for actual emergencies not funded by other government support; and
- Development and implementation of an Emergency Risk Plan for the area.

The levy and the services that it aims to provide, seeks to enhance the adaptive capacity of Mackay residents to future natural disaster events.

6.4.3 Recommendations

That Charleville residents should relocate within their town to embrace the new estate on higher ground provided for by government institutions.

Mackay City Council should re-consider the approval of new developments, particularly estates, in flood prone areas that may result in greater costs incurred to the council and subsequently Mackay rate paying residents. New developments incorporate adequate measures so that they are built off the group but allow for water passage on ground levels. Flood mitigation measures may also incorporate greater drainage infrastructure.

6.4.4 Conclusions

This research indicates a significant increase by households and businesses affected by the disaster flood event to implement flood mitigation actions. Data from the research found both residents and businesses may consider moving to other parts of Mackay but the majority indicated that they would not move to another town which highlighted the preference to live in the urban coastal city despite its vulnerability to natural disaster events such as flooding. However, there may be some scope to recognise that households affected by natural disasters move to another suburb or town as a means to increasing their adaptive capacity. Businesses in Charleville had no alternative location to move to and few of their residents contemplated relocation.

7 Conclusions and Recommendations

7.1 Conclusions

The study concludes that those established in areas that are vulnerable to regular flooding, who had greater connections within the community, displayed more resilience in the event of a disaster flood event. Thus, the Charleville community was found to be *staunchly resilient*, with high levels of sense of belongingness and commitment on the part of residents, businesses and institutions to remain in the community irrespective of future flood events. In comparison, low participation rates in the community, low formal volunteerism rates in Mackay and the belief that they have a limited personal responsibility to prepare for floods and mixed views on the question of belongingness, indicates *weaker levels of resilience* in Mackay.

In Mackay, the length of time a business had been established was linked to flood impacts indicating a complacency to flood events at some point as evidenced by the expansion approved for the development of industrial estates and retail outlets in lower lying areas of Mackay. The Mackay community could be considered a *less resilient community* as compared to Charleville in terms of *social capacity* but Charleville was considered to be a *less resilient community* in terms of *economic capacity*.

Whilst this study found the elderly was a social group vulnerable to disaster flood events, it particularly highlighted the psychological impacts of the flood on the community. The research of the Mackay 2008 flood indicated that lack of prior exposure to disaster events was a critical factor contributing to mental health and reducing the resilience of communities in the post-disaster phase. Consequently, it is recommended that mental health be included as a component of in the consequences phase in addition to the 'macro-economic' impacts that may in turn increase the vulnerability of a population.

The research conducted did not show any direct correlation between implementing mitigation measures and avoidance of flood impacts in Mackay. However, due to the purposive methodology used in the research design where those households and businesses that received flood damage were selected, this may subsequently indicate that those who were not impacted by the floods had implemented a greater number of mitigation measures which provided greater resilience to the flood event. Planning and development was found to play a critical role in the resilience of communities to disaster events such as flooding.

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7.2 Recommendations

The following recommendations below are proposed.

7.2.1 Specific Projects or Actions

- A project to approach the insurance industry to develop new products and determine the level of evidence needed of improved mitigation and reduced risk and timing, etc.;
- Engineering assessment of Bradley's Gully in Charleville and impact of upstream catchment practices;
- Investigate the viability of having areas set aside for use in floods to house domestic and rural stock, situation, so different types of dogs, house cattle, etc., can be separated to reduce animals deaths;
- A project to cost the range of specific mitigation measures for householders and likely effectiveness of these measures, and consult with relevant institutional personnel;
- Investigate the usefulness of having e.g., Evacuation Point 1, etc., signs for residents so they know where to go, or similar for Mackay;
- Prepare preparation booklets that include what an Emergency Plan and Evacuation Plan are, and who they call if they need help developing and putting one of these together;
- Be more targeted in evacuations with plans showing vulnerable people, etc.;
- Improving flood modelling and warning systems;
- Maintaining regular information in the media, particularly on what needs to be done and what different people's roles are; ensure one person is the key contact for all flood information;
- '*Managing for Flood Workshops*' – people can attend and learn about the science issues, climate change and flood modelling, the roles of different agencies, good catchment management practices, what they should do to prepare themselves, etc.;
- Put on *YouTube* videos of how to prepare for floods;
- Ask vulnerable groups, particularly the elderly, how they would prefer to receive flood warning information;
- Put on-line examples of Emergency Plans, Emergency Kits, Evacuation Plans, etc., so people know what to do;
- Real estate agencies in Mackay or in electricity bills – produce flyers on what to do to prepare for floods for new people to the town;
- Vulnerability mapping of flood prone areas – e.g. those aged over 65 years and over 75 years and other attributes;
- Appoint a *Flood Specialist* in each town Council to help with contact information for insurance, to coordinate who responsible for what, give advice on how to modify their houses etc.;
- Promote importance of self-protective behaviour;
- Exploratory study on what will people do in ongoing extreme events;
- For each town, establish exactly what the vulnerable characteristics of the people, property and other attributes are to make a register of the vulnerable; and
- Australian Tax Office or Council rebates to residents and businesses in flood-prone area which carry out mitigation works to buildings, e.g., appropriate modifications, and help get insurance.

7.2.2 Specific to Charleville

- Regular monitoring, clearing and desilting of the river and Bradley's Gully;
- Consider desilting Bradley's Gully and installing more river height reading stations on Bradleys Creek and the Warrego River and also on the Nieve River;
- More warning devices upstream in the Warrego River;
- Flood mapping project with GIS, and including socio-economic and vulnerability indicators (e.g., people aged over 65 years, disabled, identified groups – indigenous etc., as mentioned above) and put together a register;
- Regular community education programs and training for SES volunteers including in swift-water rescue procedures;
- Cost financial resources needed to obtain additional staff e.g., nurses, police and key professionals to help during flood events to manage overtime and staff fatigue and how to fund this resource (mid-term);
- Continue with non-English speaking translation of materials and investigate viability of having more translators;
- Develop an improved warning system that can be heard all throughout the town, supplement with door knocking and consider sending SMS messages for flood warnings.
- Focus particularly on the type of technology that vulnerable, identified groups would like flood warning information delivered by.
- Review all the major training e.g., flood boat training for 3 levels - flood and fast moving water;
- Ensure Queensland Ambulance is in the loop and receiving info on roads cut from all authorities to help as they do not have helicopters to get to sites;
- Carry out mock exercises and updating their recovery plan (every 12 months);
- Annual, and continuous training, including of new staff;
- Planning for major events, detailing the chain of command, reviewing what worked well and what did not;
- Allocating staff to support local government and help the SES and work with the local people;
- Reinstall the community alarm system and note that in some areas of Charleville it can not be heard, so supplement these areas with door knock;
- Apply under the NDRP to provide mapping of river and vulnerabilities;
- Provision of additional mitigation strategies;
- Providing information and advice and review risk treatments related to prevention, preparedness, response and recovery;
- Making recommendations that people not throw out furniture but use furniture until they get some new furniture, and suggesting that sometimes whitegoods can be repaired;
- People need to be dissuaded from sending clothes to the Charleville railway station, as during the 2008 flood around 30 crates of donated clothes arrived there that were not needed and they did not have the people to handle all those clothes. Such clothing donations need to be sent through to an organised group; and
- It was recommended that financial handouts be discontinued; food vouchers, etc. instead.

7.2.3 Specific to Mackay

a) Resilience

Technological/engineering solutions

- Increased drainage, particularly along the railway line in Glenella.

Local Council Maintenance

- Ensure drainage systems are cleared prior to the wet season.

b) Adaptive Capacity

Town planning

- Create building spaces below new developments so that water can flow over land; and
- Create a gradient overlay that identifies low lying areas inland in addition to the existing storm surge and riverine inundations overlays.

Community Awareness campaign

- Awareness of the responsibilities of households and businesses to prepare for floods;
- Awareness of various insurance covers and what is and is not covered; and
- Explain to people in Mackay why they did not receive a warning – i.e. the nature of the flood is different (large scale synoptic), and reinforce that they have a personal responsibility to prepare for floods too as sometimes the modelling cannot predict these events.

c) Emergency Management

- Create emergency management plans that are easily interpreted by those found on the scene; and
- Create policy at the national levels which aim to increase incentives for volunteerism. For example, a scheme where HECS debts may be paid off through volunteer hours worked. This would attract a younger demographic to an aging volunteer work force.

Acknowledgements

First, we would like to thank the *National Climate Change Adaptation Research Facility* (NCCARF) for funding this work.

We would like to extend our appreciation to all the householders, businesses and personnel from institutions in Charleville and Mackay who were so generous with their time, and for providing us with valuable insights and information on the 2008 floods. In particular, we thank Allan Pemberton (Murweh Shire Council) for his valuable help.

We would also like to acknowledge the assistance of Ernest Dunwoody and David Liddell in data collection in Charleville, and Daniel Girling for the processing of data, tables and graphs for the Mackay and combined data.

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Appendix 4.1

Appendices

SURVEY OF HOUSEHOLDERS - CHARLEVILLE

Australian Centre for Sustainable Catchments, Toowoomba

We are conducting a survey of householders who were affected by the floods in Charleville during January and February 2008, last year. This study is part of a national series of case studies of recent natural disasters from which we and governments hope to learn of ways in which future events can be managed. All information will be completely confidential and will be stored at the Australian Centre for Sustainable Catchments office at the University of Southern Queensland, under the responsibility of Associate Professor Armando Apan, who can be contacted on 07 46311386 or email apana@usq.edu.au . The Australian Centre for Sustainable Catchments is conducting a number of studies related to climatic events, including flood events, which can be found on its website at http://www.usq.edu.au/acsc.

Name: _____ Address: _____ USQ Code: _____ Interviewer initials: _____ Date interviewed: _____

Section 1. The 2008 Flood							
1. Did your home or its contents suffer from flood damage during January and/or February 2008?		Yes		No			
2. If your answer was no to question 1, please go to question 20.							
3. If your answer to question 1 was yes, what parts of your property were flooded?		House and contents					
Garage		Block and garden					
Car, caravan or boat		Sheds and outbuildings					
Other – please describe							
4. Did flood water enter your home?		Yes		No			
5. If flood water entered your home how deep were the flood waters inside the house?		Millimetres		or metres			
6. Was your home isolated by the flood waters?		Yes		No			
7. Did you or your business bear any financial costs as a direct result of these floods, that were not covered by insurance (excluding loss of earnings, if any)? If yes, total cost incurred $ _____		Yes		No			
8. Did you or your business experience any financial gain as a direct result of these floods?		Yes		No			
9. Were you or anyone in your household forced to leave your home during or after the flood?		Yes		No			
10.a. If the answer to 9 above was yes, where did you go to when you evacuated?							
10.b. After evacuating how long was it before you returned to your home? Please specify hours or days.							
11. Please tick any of the following items which you moved to a higher location.	vehicles	outdoor equipment	garbage	chemicals and poisons	freezers	fridges	Other - please describe

12. Please tick any of the following actions you completed when evacuating your house	Turn off power, water and gas	Put sandbags in the toilet bowl and over all laundry/bathroom drain holes to prevent sewage back-flow		Took evacuation route	Other - please describe
Emptied freezers and refrigerators, leaving doors open	Locked home	Raised furniture, clothing and valuables onto beds, tables and into roof spaces		Took emergency kit	Took evacuation kit

13. How effective do you think council responses were to the 2008 flood event?	Not at all responsive	A little responsive	Moderately responsive	Very responsive	Significantly responsive

Section 2. Recovery After the Flood.

14. Did you boil all tap water until supplies were declared safe?	Yes		No	
15. Did you have electrical appliances checked for safety prior to continued use?	Yes		No	
16. Were any of the members of your household sick immediately following the flooding event?	Yes		No	

Section 3. Precautions taken before the flood.

17. Had you undertaken any of these flood mitigation measures before these floods?

Taken out household insurance against flooding	Yes	No
Raised the floor level of your house	Yes	No
Regular maintenance to ensure the ditches and drains around the property are clean and free of debris	Yes	No
Avoided keeping irreplaceable items or goods of sentimental value on ground floor of your home	Yes	No

18. Has your household undertaken (or do you intend to undertake) any of these flood prevention measures after the 2008 flood?

Taken out household insurance against flooding	Yes	No
Raised the floor level of your house	Yes	No
Regular maintenance to ensure the ditches and drains around the property are clean and free of debris	Yes	No
Avoided keeping irreplaceable items or goods of sentimental value on ground floor of your home	Yes	No

19. Have members of your household ever done any of these things?

Been a member of a local community group related to flooding	Yes		No	
Written letters to relevant authorities about flooding	Yes		No	
Attended meetings related to flooding	Yes		No	
None of these	Yes		No	

Section 4. Previous Experience of Flooding

20. How many times have you experienced flooding that has caused some disruption to your usual routines while living at this address?

Never been flooded	One	Two	Three	Four	Five	More than five times

21.a. Were these floods the worst (i.e. biggest impact) that you have experienced at this address?	Yes		No	
21.b. If not, when was your worst flooding experienced?				
21.c. What flood-related events do you consider may cause you to consider leaving and moving out of Charleville completely?				

Section 5. Warnings of the February 2008 Flood.												
22.a. Were you aware of flood warnings issued by anyone before the flood?								Yes		No		
22.b. If your answer was yes did you take any special actions in response to the warning? If your answer was no, go on to question 26.												
23. How long before you were actually affected by the flood waters did you receive the first warning?												
I did not receive any warning		Less than 1 hour		1-6 hours		7-12 hours		13-24 hours		More than 24 hours		
24. From which authority did you receive warning(s)? Tick any box which applies.												
I did not receive any warning	Local Council	Emergency Services	Bureau of Meteorology	Police	Fire Service	I can't remember	Another weather service - please specify	Other – please specify				
25. Which forms of communications were helpful in updating you of the developments of the 2008 flooding event? (please tick more than one box if applicable)												
Murweh Regional Council website		Email received from council		Message received from council to mobile phone		Television advertisements						
Radio alerts		Newspaper alerts		Queensland Government website		SES workers						
Bureau of Meteorology website		neighbours		friends and family		work colleagues						
Other - please describe:												
26. How accurate do you think that the warnings and flood information for these floods was? Tick one box.												
Accurate all of the time		Accurate most of the time		Accurate some of the time		Very often not accurate		Never accurate				
Section 6. Preparations Before the Flood												
27. How prepared do you think your household was for the 2008 flood event? Tick one box.												
Not at all prepared		A little prepared		Moderately prepared		Significantly prepared		Very prepared				
28. Did you have copies of local flood plans of the area or were your aware if your house is located in a flood prone area prior to the 2008 floods?								Yes		No		
29. Did you have a Household Emergency Plan prior to the disaster floods and if so did you use this during the 2008 floods? Tick one box.												
	Did not have a Household Emergency Plan prior to the 2008 floods											
	Had a Household Emergency Plan but no it was not used during the floods											
	Had a Household Emergency Plan and yes it was used during the floods											
30. Did you have an Emergency Kit prior to the disaster floods and if so did you use this during the 2008 floods? Tick one box. Equipment usually included in an emergency kit for flood prone areas: emergency phone numbers, portable radio, torch, spare batteries, first aid kit, strong plastic bags for clothing, plastic sheets, timber strips, hammers and nails for temporary repairs.												
	Did not have an Emergency Kit prior to the 2008 floods											
	Had an Emergency Kit but no it was not used during the floods											
	Had an Emergency Kit and yes it was used during the floods											

31. Did you have a Household Evacuation Plan prior to the disaster floods and if so did you use this during the 2008 floods?					
	Did not have a Household Evacuation Plan prior to the 2008 floods				
	Had a Household Evacuation Plan but no it was not used during the floods				
	Had a Household Evacuation Plan and yes it was used during the floods				
32. Were you aware of evacuation routes and centres for your area before the 2008 floods?		Yes		No	
Section 7. Thoughts About Floods. This helps with planning for public education campaigns					
33. How concerned are you about the risk of floods? Tick the box which is closest to your level of concern.					
	Not at all	Not much	Neutral	Quite a lot	A great deal
I think about floods					
I talk about floods					
I get information on floods					
I think a flood could pose a threat to my personal safety					
I think a flood could pose a threat to my daily activities (work, leisure etc)					
34. How prepared do you believe the following groups are for future floods affecting your community? Tick the box which is closest to your understanding.					
	Very prepared	Somewhat prepared	Not very prepared	Not at all prepared	Don't Know
Your household					
Your community					
Local Government					
Local Base Hospital					
State Government – Emergency Services etc					
Commonwealth government — Emergency Management, Health, Social Security etc)					
Bureau of Meteorology					
Utilities service providers – including roads, electricity, telecommunications etc					
Social welfare organizations – Red Cross, Salvation Army, Lifeline etc					
35. As a result of these floods do you intend to? Tick the box which fits your intentions.					
			No	Possibly	Definitely
Seek information on flood risk in your community					
Seek information on things to do to prepare for a possible flood					
Increase level of insurance					
Raise the floor level of our house					
Become involved with a local group to discuss how to reduce flood risk in your community					

36. Please indicate on the scale whose responsibility you believe it is to protect us from floods. Tick the box which is closest to your level of understanding.

	Not at all	Not much	Neutral	Quite a lot	A great deal
Commonwealth government					
State government					
Local council					
Individual households					
There is no use preparing as we can't do much anyway					

37. Which, if any, volunteer organisations are you or anyone in your household involved in? Tick any box.

	State Emergency Service (SES)
	Neighbourhood watch
	Volunteer fire brigade
	Rotary
	Lions
	None
	Other(s) Organisations (Please specify)

38. Below is a list of statements on how you feel about living in your community. Please use the scale on the right to show how much each statement applies to you, or doesn't apply to you.

	Doesn’t apply	Not really	Neutral	Applies a bit	Applies strongly
I feel ‘at home' in this community					
I am satisfied living in this community					
I am a useful member of this community					
I have the same values and beliefs as my neighbours					
I feel I don't ‘belong' in this community					
I am interested in knowing what goes on in this community					
I would be happy to leave this community					
I know my neighbours and/or other community members					
I have no active involvement in this community					

39. To what extent might each of the following prevent you from preparing for floods? Tick the box that applies.

	Not at all	Not much	Neutral	Quite a lot	A great deal
Cost					
Skills required to prepare					
Other things to think about instead					
Need for cooperation with others					

40. To what extent do you think that – tick the box that applies to you -

	Not at all	Not much	Neutral	Quite a lot	A great deal
Floods are too destructive to bother preparing for					
A flood is unlikely to occur during our lifetime					
It is unnecessary to prepare for floods as assistance will be provided by the Council and/or emergency services					
A damaging flood is something that could occur in the future					
I will move to a different part of Charleville if another flood affects my home					
I will move to a different town if another flood affects my home					

Section 8. Basic Demographic Information about you and your Household. It allows us to test that our survey sample is representative and to some extent lets us know a bit about how various groups of people deal with floods.

41. How long have you lived in this community?						years	
42. How long have you lived in this current home?						years	
43. Which best describes the situation you are living in now ?					Family with children		
Family without children		Alone			With other people, not family		
Other (Please specify)							
44. Please list how many adults and children under 18 years live in this household.							
		Male			Female		
Number of Adults							
Number of children under 18 years							
45. Are you?	Aboriginal		Torres Strait Islander		Pacific Islander Origin		
Aboriginal and Torres Strait Islander					None of these		
46. Are you?	Employed full-time				Employed part-time		
Self-employed full-time		Self-employed part-time			Not in paid employment		
47. What is your highest educational qualification? Tick one box							
No school qualifications		School qualifications			Trade certificate		
professional certificate or diploma		University undergraduate degree (e.g. university diploma or bachelor's degree) or university postgraduate degree (e.g. Master's, Ph.D.)					
48. Would you be interested in taking part in a focus group which will discuss issues raised in our community interviews about the 2008 flood?		Yes		No		Maybe	
49. Would you like to receive a copy of the survey results? If yes please provide an address below.			Yes		No		
Your Mail Address:			Your email address:				
50. Are there any other comments you would like to make?							

Thank you very much for your participation in this survey.

Information you have provided will be stored at the University of Southern Queensland and will remain completely confidential.

SURVEY OF BUSINESSES - CHARLEVILLE

Australian Centre for Sustainable Catchments, Toowoomba

We are conducting a survey of businesses that were affected by the floods in Charleville during January and February 2008, last year. This study is part of a national series of case studies of recent natural disasters from which we and governments hope to learn of ways in which future events can be managed. All information will be completely confidential and will be stored at the Australian Centre for Sustainable Catchments office at the University of Southern Queensland, under the responsibility of Associate Professor Armando Apan, who can be contacted on 07 46311386 or email apana@usq.edu.au . The Australian Centre for Sustainable Catchments is conducting a number of studies related to climatic events, including flood events, which can be found on its website at http://www.usq.edu.au/acsc.

Business Name: _____ Person interviewed: _____

Business Address: _____ USQ Code: _____ Interviewer initials: _____ Date interviewed: _____

Section 1. The 2008 Flood							
1. Did your business premises and its contents suffer from flood damage during January and/or February 2008?	Yes		No				
2. If your answer was no to question 1, please go to question 19.							
3. If your answer to question 1 was yes, What parts of your business property/properties were flooded?							
4. Did flood water enter inside your business premises ?	Yes		No				
5. If yes, how deep were the flood waters inside the business premises?	Millimetres		or metres				
6. Was your business premises isolated by the flood waters?	Yes		No				
7. Did your business bear any financial costs as a direct result of these floods, that were not covered by insurance (excluding loss of earnings, if any)? If yes, total cost incurred $ _____	Yes		No				
8. Did your business experience any financial gain as a direct result of these floods?	Yes		No				
9. Were any people in the business premises forced to leave during or after the flood?	Yes		No				
10.a. If the answer to 9 above was yes, where did they go when they evacuated?							
10.b. After evacuating how long was it before they returned to the business premises? Please specify hours or days.							
11. Please tick any of the following items which were moved to a higher location.	vehicles	outdoor equipment	garbage	chemicals and poisons	freezers	fridges	Other - please describe

12. Please tick any of the following actions you completed when evacuating your business premises	Turn off power, water and gas	Put sandbags in the toilet bowl and over all laundry/bathroom drain holes to prevent sewage back-flow		Took evacuation route	Other - please describe
Emptied freezers and refrigerators, leaving doors open	Locked business premises	Raised furniture, documents and other valuables onto tables and into roof spaces		Took emergency kit	Took evacuation kit
13. How effective do you think Council responses were to the 2008 flood event?	Not at all responsive	A little responsive	Moderately responsive	Very responsive	Significantly responsive

Section 2. Recovery After the Flood.

14. Did your staff boil all tap water until supplies were declared safe?	Yes		No	
15. Did your company have electrical appliances checked for safety prior to continued use?	Yes		No	
16. Were any of the members of your staff sick immediately following the flooding event?	Yes		No	

Section 3. Precautions taken before the flood.

17. Had you undertaken any of these flood mitigation measures before these floods?

Taken out business insurance against flooding	Yes		No	
Raised the floor level of your business premises	Yes		No	
Regular maintenance to ensure the ditches and drains around the property are clean and free of debris	Yes		No	
Avoided keeping irreplaceable items or valuable goods on the ground floor level of your business premises	Yes		No	

18. Has your business undertaken (or do you intend to undertake) any of these flood prevention measures after the 2008 flood?

Take out business insurance against flooding	Yes		No	
Raise the floor level of your business premises	Yes		No	
Regular maintenance to ensure the ditches and drains around the property are clean and free of debris	Yes		No	
Avoid keeping irreplaceable items or valuable goods on the ground floor level of your premises	Yes		No	

Other measures: Please describe these:

Section 4. Previous Experience of Flooding

19. How many times has your business experienced flooding that has caused some disruption to your usual business operations since operating at your current premises?

Never been flooded	One	Two	Three	Four	Five	More than five times

Yes		No	

20.a. Were the 2008 floods the worst (i.e. biggest impact) that you have experienced at this address?								
20.b. If not, when was your worst flooding experienced?								
20.c. What flood-related events does your organisation consider may cause your organisation to consider leaving and moving out of Charleville completely?								
Section 5. Warnings of the January and February 2008 Floods.								
21.a. Was your company aware of flood warnings issued by anyone before the flood?		Yes			No			
21.b. If your answer was yes did your company take any special actions in response to the warning?If your answer was no, go on to question 25.								
22. How long before you were actually affected by the flood waters did you receive the first warning?								
I did not receive any warning	Less than 1 hour	1-6 hours	7-12 hours	13-24 hours	More than 24 hours			
23. From which authority did you receive warning(s)? Tick any box which applies.								
I did not receive any warning	Local Council	Emergency Services	Bureau of Meteorology	Police	Fire Service	I can't remember	Another weather service - please specify	Other – please specify
24.a. Which forms of communications were helpful in updating you of the developments of the 2008 flooding event? (please tick more than one box if applicable)								
Murweh Regional Council website		Email received from council		Message received from council to mobile phone		Television advertisements		
Radio alerts		Newspaper alerts		Queensland Government website		SES workers		
Bureau of Meteorology website		neighbours		friends and family		work colleagues		
Other – please describe:								
24.b. How accurate do you think that the warnings and flood information for these floods was? Tick one box.								
Accurate all of the time	Accurate most of the time	Accurate some of the time	Very often not accurate	Never accurate				
Section 6. Preparations Before the Flood								
25. How prepared do you think your company was for the 2008 flood event? Tick one box.								
Not at all prepared	A little prepared	Moderately prepared	Significantly prepared	Very prepared				
26. Did you have copies of local flood plans of the area or were your aware if your business premises are located in a flood prone area prior to the 2008 floods?		Yes			No			
27. Did you have an Emergency Plan for your business prior to the disaster floods and if so did you use this during the 2008 floods? Tick one box.								
	Did not have an Emergency Plan for the business prior to the 2008 floods							
	Had an Emergency Plan for the business but no it was not used during the floods							
	Had an Emergency Plan for the business and yes it was used during the floods							

28. Did you have an Emergency Kit for your business prior to the disaster floods and if so did you use this during the 2008 floods? Tick one box. Equipment usually included in an emergency kit for flood prone areas: emergency phone numbers, portable radio, torch, spare batteries, first aid kit, strong plastic bags for clothing, plastic sheets, timber strips, hammers and nails for temporary repairs.	
	Did not have an Emergency Kit for the business prior to the 2008 floods
	Had an Emergency Kit for the business but no it was not used during the floods
	Had an Emergency Kit for the business and yes it was used during the floods
29. Did you have an Evacuation Plan for your business prior to the disaster floods and if so did you use this during the 2008 floods?	
	Did not have an Evacuation Plan for the business prior to the 2008 floods
	Had an Evacuation Plan for the business but no it was not used during the floods
	Had an Evacuation Plan for the business and yes it was used during the floods

30. Were you aware of evacuation routes and centres for your area prior to the 2008 floods?	Yes		No	

Section 7. Thoughts About Floods. This helps with planning for public education campaigns

31. How concerned do you think your company is about the risk of floods? Tick the box which you believe is closest to their level of concern.

	Not at all	Not much	Neutral	Quite a lot	A great deal
They think about floods					
They talk about floods					
They get information on floods					
They think a flood could pose a threat to personal safety					
They think a flood could pose a threat to daily business activities					

32. How prepared do you believe the following groups are for future floods affecting your community? Tick the box which is closest to your understanding

	Very prepared	Somewhat prepared	Not very prepared	Not at all prepared	Don't Know
Your business					
Your community					
Local Government					
Local Base Hospital					
State Government – Emergency Services etc					
Commonwealth government — Emergency Management, Health, Social Security etc)					
Bureau of Meteorology					
Utilities service providers – including roads, electricity, telecommunications etc					
Social welfare organizations – Red Cross, Salvation Army, Lifeline etc					

33. As a result of these floods does your company intend to? Tick the box which fits your intentions.			
	No	Possibly	Definitely
Seek information on flood risk in your community			
Seek information on things to do to prepare for a possible flood			
Increase level of insurance			
Raise the floor level of your business premises			
Become involved with a local group to discuss how to reduce flood risk in your community			
Other activities: Please describe:			

Background:

The *State Planning Policy 1/03* Guideline (SPP) relates to development issues, such as proposals to build retaining structures, and is designed to reduce the potential impact of natural hazards such as flood, bushfire and landslides in areas where the local Government has adopted a flood event for management or development in a particular area. Under the **Integrated Planning Act 1997**, the SPP takes effect when planning schedules are developed or amended, land is designated for community infrastructure, or development applications are assessed.

34. Has your company applied under the ***State Planning Policy 1/03*** **Guideline or the *Integrated Planning Act 1997*** to develop any proposal/s to construct or implement flood prevention measures? Yes/No (pls circle)
If Yes, please describe the circumstances

35. Do you think any improvements need to be made to the ***State Planning Policy 1/03*** **Guideline or the *Integrated Planning Act 1997*** to better mitigate against and manage flood events? Yes/No (pls circle)

If Yes, please describe what you think these improvements should be

36. Please indicate on the scale whose responsibility you believe it is to protect us from floods. Tick the box which is closest to your level of understanding.					
	Not at all	Not much	Neutral	Quite a lot	A great deal
Commonwealth government					
State government					
Local council					
Individual households					
There is no use preparing as we can't do much anyway					
Other: Please describe:					

37. Which, if any, volunteer organisations are you or your staff involved in? Tick any box.	
	State Emergency Service (SES)
	Neighbourhood watch
	Volunteer fire brigade
	Lions
	Rotary
	None
	Other(s) (Please specify)

38. To what extent might each of the following prevent your company from preparing for floods? Please tick the box that applies.

	Not at all	Not much	Neutral	Quite a lot	A great deal
Cost					
Skills required to prepare					
Other things to think about instead					
Need for cooperation with others					
Other: Please describe					

39. To what extent do you think that – tick the box that applies to you -

	Not at all	Not much	Neutral	Quite a lot	A great deal
Floods are too destructive to bother preparing for					
A flood is unlikely to occur during our lifetime					
It is unnecessary to prepare for floods as assistance will be provided by the Council and/or emergency services					
A damaging flood is something that could occur in the future					
Our business will move to a **different part** of Charleville if another flood effects our business premises					
Our business will move to a **different town** if another flood effects our business premises					

Section 8. Basic Demographic Information about you and your Business. It allows us to test that our survey sample is representative and to some extent lets us know a bit about how various groups of people deal with floods.

40. Name of Respondent:				
41. Are you ? pls tick one	Male		Female	
42. Are you ? pls tick one	Aboriginal	Torres Strait Islander	Aboriginal and Torres Strait Islander	None of these
	Pacific Islander Origin			

43. What is the main language spoken at home?

44. What is your highest educational qualification? Tick one box

No school qualifications			School qualifications		Trade certificate
Professional certificate or Diploma			University undergraduate degree (e.g. university diploma or bachelor's degree) or university postgraduate degree (e.g. Master's, Ph.D.)		

45. Your Business Title:	
46. Name of Business:	
47. Address of Business:	
48. Business Phone No:	

49. Type of Business:	
50. How many staff are employed in this business?	
51. Your business email address:	
52. How long has your business operated from its current premises?	

Section 9. Focus Groups and Copy of Survey Results

53. Would you be interested in taking part in focus groups which will discuss issues raised in our interviews with the community on the 2008 flood?	Yes	No	Maybe
54. Would you like to receive a copy of the survey results?		Yes	No

55. Are there any other comments you would like to make?

Please write in the space provided below, or feel free to attach additional pages.

Thank you very much for your participation in this survey.

Information you have provided will be stored at the University of Southern Queensland and will remain completely confidential.

SURVEY OF GOVERNMENT INSTITUTIONS AND MEMBERS OF

LOCAL AND DISTRICT DISASTER MANAGEMENT GROUPS

Australian Centre for Sustainable Catchments, Toowoomba

We are conducting a survey of Government institutions and members of the Local and District Disaster Management Groups in Charleville to discuss the events leading up to, during, and after the January and February 2008 floods, last year. This study is part of a national series of case studies of recent natural disasters from which we hope to learn ways in which future events can be managed. Householders and businesses affected by the 2008 floods in Charleville are also being interviewed in this study to gain an understanding of their characteristics of resilience, vulnerability and adaptive capacity. All information will remain completely confidential and will be stored at the Australian Centre for Sustainable Catchments office at the University of Southern Queensland, under the responsibility of Associate Professor Armando Apan, who can be contacted on 07 46311386 or email apana@usq.edu.au. The Australian Centre for Sustainable Catchments is conducting a number of studies related to climatic events, including flood events, which can be found on its website at http://www.usq.edu.au/acsc.

Section 1. Assisting your clients during the 2008 Floods				
1. What role did your organisation play in assisting your clients during the January and February 2008 floods, and what were the main issues that arose?	Role played:		Issues that arose:	
2. Did your organisation provide any financial assistance to those affected by the 2008 floods?	Yes		No	
3. If yes, what kind of financial assistance did you provide, and what was the total amount of funding provided to your clients?	Type of financial assistance:		Total Funding $	
Section 2. Your organisation's preparedness for flood events				
4. **Since the 1997 flood in Charleville**, has your organisation undertaken any specific actions to better prepare for and cope with flood events?	Yes		No	
5. If yes, what were these actions and how much did they cost to implement?	Actions taken:		Cost $:	
6. Were these mitigation measures (measures taken to prevent floods) tested?	Yes	No	Not applicable	
7. In light of the January and February 2008 floods, were these mitigation measures useful in coping with the floods?	Yes		No	
8. If no, what **could have been done** to make these mitigation measures more effective, and **how much might this have cost?**	Action could have taken:		Approx. cost $:	
9. In your organisation, how often is mitigation planning looked at and revised?	How often reviewed:			
10. Does your organisation's mitigation planning and measures need improving?	Yes		No	
11. If yes, what needs to be done and how much could this cost?	What done:		Approx. cost $:	
12. Does your organisation intend taking any specific actions to better prepare for and cope with floods in the next 5 years?	Yes		No	

13. If yes, what actions are these, when are they likely to be undertaken and when is completion expected?	Action/s:		When will be done:	When completion expected:
14. If your organisation had access to **additional funding** to better prepare for and cope with flood events in Charleville, what would your organisation do with this funding and how much would be needed?	Action/s would take		Approx. cost $:	
Section 3. What other organisations and members of the community can do to better prepare for flood events				
15. Is there any action your organisation considers could be taken **by other organisations or members of the community** to help the community in Charleville better cope with future flood events?	Yes		No	
16. If yes, what action would this be, by whom and approximately how much would it cost?	Action/s	By whom:	Approx. cost $:	
Section 4. Maintaining Charleville as a viable community in which to live and work				
17. In terms of future flood events, does your organisation consider any specific actions need to be taken in the next 5 years to ensure Charleville is a viable community in which to live and work?	Yes		No	
18. If yes, what needs to be done, by whom, and how much it is likely to cost:	What done:	By whom:	Approx. cost $:	
19.a. What **flood-related events** does your organisation consider may **cause members of the Charleville community** to consider leaving and moving out of Charleville completely?				
19.b. What flood-related events does your organisation consider **may cause your organisation** to consider leaving and moving out of Charleville completely?				

Section 5. The *State Planning Policy 1/03* Guideline (SPP) and the *Integrated Planning Act 1997* (IPA)

Background:

The *State Planning Policy 1/03* Guideline (SPP) relates to development issues, such as proposals to build retaining structures, and is designed to reduce the potential impact of natural hazards such as flood, bushfire and landslides in areas where the local Government has adopted a flood event for management or development in a particular area. Under the *Integrated Planning Act 1997*, the SPP takes effect when planning schedules are developed or amended, land is designated for community infrastructure, or development applications are assessed.

20. Has your organisation applied under the *State Planning Policy 1/03* Guideline or the *Integrated Planning Act 1997* to develop any proposal/s to construct or implement flood prevention measures? Yes/No (pls circle)

If Yes, please describe the circumstances

21. Do you think any improvements need to be made to the *State Planning Policy 1/03* Guideline or the *Integrated Planning Act 1997* to better mitigate against and manage flood events? Yes/No (pls circle)

If Yes, please describe what you think these improvements should be

Section 6: Your organisation's experience in the 2008 floods										
22. Did your organisation's premises and its contents suffer from flood damage during January and/or February 2008?	Yes		No							
23. If your answer was no to question 22, please go to question 40.										
24. If your answer to question 22 was yes, What parts of your organisation property/properties were flooded?										
25. Did flood water enter inside your organisation premises?	Yes		No							
26. If yes, how deep were the flood waters inside the organisation premises?	Millimetres		or metres							
27. Was your organisation premises isolated by the flood waters?	Yes		No							
28. Did your organisation bear any financial costs as a direct result of these floods, that were not covered by insurance (excluding loss of earnings, if any)? If yes, total cost incurred $ _____	Yes		No							
29. Did your organisation experience any financial gain as a direct result of these floods?	Yes		No							
30. Were any people in the organisation premises forced to leave during or after the flood?	Yes		No							
31.a. If the answer to 30 above was yes, where did they go when they evacuated?										
31.b. After evacuating how long was it before they returned to the organisation premises? Please specify hours or days.										
32. Please tick any of the following items which were moved to a higher location.	vehicles	outdoor equipment	garbage	chemicals and poisons	freezers	fridges	Other - please describe			
33. Please tick any of the following actions you completed when evacuating your organisation premises	Turn off power, water and gas	Put sandbags in the toilet bowl and over all laundry/bathroom drain holes to prevent sewage back-flow			Took evacuation route	Other - please describe				
Emptied freezers and refrigerators, leaving doors open	Locked organisation premises	Raised furniture, documents and other valuables onto tables and into roof spaces			Took emergency kit	Took evacuation kit				
34. How effective do you think Council responses were to the 2008 flood event?	Not at all responsive	A little responsive	Moderately responsive		Very responsive	Significantly responsive				
Section 7. Recovery After the Flood.										
35. Did your staff boil all tap water until supplies were declared safe?	Yes		No							
36. Did your organisation have electrical appliances checked for safety prior to continued use?	Yes		No							
37. Were any of the members of your staff sick immediately following the flooding event?	Yes		No							

Section 8. Precautions taken before the flood.

38. Had you undertaken any of these flood mitigation measures before these floods?

Taken out organisation insurance against flooding	Yes		No	
Raised the floor level of your organisation premises	Yes		No	
Regular maintenance to ensure the ditches and drains around the property are clean and free of debris	Yes		No	
Avoided keeping irreplaceable items or valuable goods on the ground floor level of your organisation premises	Yes		No	

39. Has your organisation undertaken (or do you intend to undertake) any of these flood prevention measures **after** the 2008 flood?

Take out organisation insurance against flooding	Yes		No	
Raise the floor level of your organisation premises	Yes		No	
Regular maintenance to ensure the ditches and drains around the property are clean and free of debris	Yes		No	
Avoid keeping irreplaceable items or valuable goods on the ground floor level of your premises	Yes		No	

Other measures: Please describe these:

Section 9. Previous Experience of Flooding

40. How many times has your organisation experienced flooding that has caused some disruption to your usual organisation operations since operating at your current premises?

Never been flooded	One	Two	Three	Four	Five	More than five times

41.a. Were the 2008 floods the worst (i.e. biggest impact) that you have experienced at this address?	Yes		No	
41.b. If not, when was your worst flooding experienced?				

Section 10. Warnings of the January and February 2008 Floods.

42.a. Was your organisation aware of flood warnings issued by anyone before the flood?	Yes		No	
42.b. If your answer was yes did your organisation take any special actions in response to the warning? If your answer was no, go on to question 47.				

43. How long before you were actually affected by the flood waters did you receive the first warning?

I did not receive any warning	Less than 1 hour	1-6 hours	7-12 hours	13-24 hours	More than 24 hours

44. From which authority did you receive warning(s)? Tick any box which applies.

I did not receive any warning	Local Council	Emergency Services	Bureau of Meteorology	Police	Fire Service	I can't remember	Another weather service - please specify	Other – please specify

45. How accurate do you think that the warnings and flood information for these floods was? Tick one box.				
Accurate all of the time	Accurate most of the time	Accurate some of the time	Very often not accurate	Never accurate

46. Which forms of communication were helpful in updating you of the developments of the 2008 flooding event? (please tick more than one box if applicable)			
Murweh Regional Council website	Email received from council	Message received from council to mobile phone	Television advertisements
Radio alerts	Newspaper alerts	Queensland Government website	SES workers
Bureau of Meteorology website	neighbours	friends and family	
Other - please describe:			

Section 11. Preparations Before the Flood

47. How prepared do you think your organisation was for the 2008 flood event? Tick one box.				
Not at all prepared	A little prepared	Moderately prepared	Significantly prepared	Very prepared

48. Did you have copies of local flood plans of the area or were your aware if your organisation's premises are located in a flood prone area prior to the 2008 floods?	Yes		No	

49. Did you have an Emergency Plan for your organisation prior to the disaster floods and if so did you use this during the 2008 floods? Tick one box.	
	Did not have an Emergency Plan for the organisation prior to the 2008 floods
	Had an Emergency Plan for the organisation but no it was not used during the floods
	Had an Emergency Plan for the organisation and yes it was used during the floods

50. Did you have an Emergency Kit for your organisation prior to the disaster floods and if so did you use this during the 2008 floods? Tick one box. Equipment usually included in an emergency kit for flood prone areas: emergency phone numbers, portable radio, torch, spare batteries, first aid kit, strong plastic bags for clothing, plastic sheets, timber strips, hammers and nails for temporary repairs.
Did not have an Emergency Kit for the organisation prior to the 2008 floods
Had an Emergency Kit for the organisation but no it was not used during the floods
Had an Emergency Kit for the organisation and yes it was used during the floods

51. Did you have an Evacuation Plan for your organisation prior to the disaster floods and if so did you use this during the 2008 floods?
Did not have an Evacuation Plan for the organisation prior to the 2008 floods
Had an Evacuation Plan for the organisation but no it was not used during the floods
Had an Evacuation Plan for the organisation and yes it was used during the floods

52. Were you aware of evacuation routes and centres for your area prior to the 2008 floods?	Yes	No

Section 12. Thoughts About Floods. This helps with planning for public education campaigns

53. How concerned do you think your organisation is about the risk of floods? Tick the box which you believe is closest to their level of concern.					
	Not at all	Not much	Neutral	Quite a lot	A great deal
They think about floods					
They talk about floods					
They get information on floods					
They think a flood could pose a threat to personal safety					
They think a flood could pose a threat to daily organisation activities					

54. How prepared do you believe the following groups are for future floods affecting your community? Tick the box which is closest to your understanding

	Very prepared	Somewhat prepared	Not very prepared	Not at all prepared	Don't Know
Your organisation					
Your community					
Local Government					
Local Base Hospital					
State Government – Emergency Services etc					
Commonwealth government — Emergency Management, Health, Social Security etc)					
Bureau of Meteorology					
Utilities service providers – including roads, electricity, telecommunications etc					
Social welfare organizations – Red Cross, Salvation Army, Lifeline etc					

55. As a result of these floods does your organisation intend to? Tick the box which fits your intentions.

	No	Possibly	Definitely
Seek information on flood risk in your community			
Seek information on things to do to prepare for a possible flood			
Increase level of insurance			
Raise the floor level of your organisation premises			
Become involved with a local group to discuss how to reduce flood risk in your community			

Other activities: Please describe:

56. Is there any information or campaigns which could be conducted to help the Charleville community better prepare, respond to and cope with flooding?	Yes	No	
57. If yes, what could be provided, to whom, how often and what would this cost?	What and to whom:	How often:	Approx. cost $:

58. Please indicate on the scale whose responsibility you believe it is to protect us from floods. Tick the box which is closest to your level of understanding.

	Not at all	Not much	Neutral	Quite a lot	A great deal
Commonwealth government					
State government					
Local council					
Individual households					
There is no use preparing as we can't do much anyway					

Other: Please describe:

59. Which, if any, volunteer organisations are you or your staff involved in? Tick any box.	
	State Emergency Service (SES)
	Neighbourhood watch
	Volunteer fire brigade
	Lions
	Rotary
	None
	Other(s) (Please specify)

60. To what extent might each of the following prevent your organisation from preparing for floods? Please tick the box that applies.					
	Not at all	Not much	Neutral	Quite a lot	A great deal
Cost					
Skills required to prepare					
Other things to think about instead					
Need for cooperation with others					
Other: Please describe					

61. To what extent do you think that – tick the box that applies to you -					
	Not at all	Not much	Neutral	Quite a lot	A great deal
Floods are too destructive to bother preparing for					
A flood is unlikely to occur during our lifetime					
It is unnecessary to prepare for floods as assistance will be provided by the Council and/or emergency services					
A damaging flood is something that could occur in the future					
Our organisation will move to a **different part** of Charleville if another flood effects our organisation premises					
Our organisation will move to a **different town** if another flood effects our organisation premises					

Section 13. Basic Demographic Information about you and your Organisation. It allows us to test that our survey sample is representative and to some extent lets us know a bit about how various groups of people deal with floods.

62. Name of Respondent:				
63. Are you ? pls tick one	Male		Female	
64. Are you ? pls tick one	Aboriginal	Torres Strait Islander	Aboriginal and Torres Strait Islander	None of these
	Pacific Islander Origin			
65. What is the main language spoken at home?				
66. What is your highest educational qualification? Tick one box				

No school qualifications			School qualifications		Trade certificate
Professional certificate or Diploma			University undergraduate degree (e.g. university diploma or bachelor's degree) or university postgraduate degree (e.g. Master's, Ph.D.)		

67. Your Organisation Title:	
68. Name of Organisation:	
69. Address of Organisation:	
70. Organisation Phone No:	
71. Type of Organisation:	
72. How many staff are employed in this organisation?	
73. Your business email address:	
74. How long has your organisation operated from its current premises?	

Section 14. Focus Groups and Copy of Survey Results

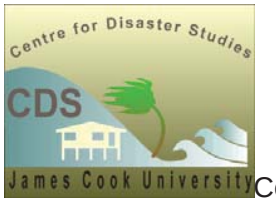
75. Would you be interested in taking part in focus groups which will discuss issues raised in our interviews with the community on the 2008 flood?	Yes	No	Maybe
76. Would you like to receive a copy of the survey results?		Yes	No

77. Are there any other comments you would like to make?

Please write in the space provided below, or feel free to attach additional pages.

Thank you very much for your participation in this survey.

Information you have provided will be stored at the University of Southern Queensland and will remain completely confidential.



Centre for Disaster Studies, James Cook University, Townsville Q4811

We are conducting a survey of households that were affected by the floods in Mackay in February 2008, last year. This study is part of a national series of case studies of recent natural disasters from which we and governments hope to learn of ways in which future events can be managed. If you are willing to participate in this survey we should be grateful if you will complete this form and return it to the researcher who approached you to request your participation, or leave it in your mailbox for collection, the next day. All information will be completely confidential and will be stored at the Centre for Disaster Studies office of James Cook University, under the responsibility of Associate Professor David King, who can be contacted on 0747814430 or email: david.king@jcu.edu.au The Centre for Disaster Studies has carried out many studies of disasters which can be found on its website at http://www.jcu.edu.au/cds/

Section 1. The 2008 Flood							
1. Did your home or its contents suffer from flood damage on in February 2008?		Yes		No			
2. If your answer was no to question 1, please go to question 20.							
3. If your answer to question 1 was yes, what parts of your property were flooded?		House and contents					
Garage		Block and garden					
Car, caravan or boat		Sheds and outbuildings					
Other – please describe							
4. Did flood water enter your home?		Yes		No			
5. If flood water entered your home how deep were the flood waters inside the house?		Millimetres		or metres			
6. Was your home isolated by the flood waters?		Yes		No			
7. Did you or your business bear any financial costs as a direct result of these floods, that were not covered by insurance (excluding loss of earnings, if any)?		Yes		No			
8. Did you or your business experience any financial gain as a direct result of these floods?		Yes		No			
9. Were you or anyone in your household forced to leave your home during or after the flood?		Yes		No			
10.a. If the answer to 9 above was yes, where did you go to when you evacuated?							
10.b. After evacuating how long was it before you returned to your home? Please specify hours or days.							
11. Please tick any of the following items which you moved to a higher location.	vehicles	outdoor equipment	garbage	chemicals and poisons	freezers	fridges	Other - please describe

12. Please tick any of the following actions you completed when evacuating your house	Turn off power, water and gas	Put sandbags in the toilet bowl and over all laundry/bathroom drain holes to prevent sewage back-flow		Took evacuation route	Other - please describe
Emptied freezers and refrigerators, leaving doors open	Locked home	Raised furniture, clothing and valuables onto beds, tables and into roof spaces		Took emergency kit	Took evacuation kit

13. How effective do you think council responses were to the 2008 flood event?	Not at all responsive	A little responsive	Moderately responsive	Very responsive	Significantly responsive

Section 2. Recovery After the Flood.

14. Did you boil all tap water until supplies were declared safe?	Yes		No	
15. Did you have electrical appliances checked for safety prior to continued use?	Yes		No	
16. Were any of the members of your household sick immediately following the flooding event?	Yes		No	

Section 3. Precautions taken before the flood.

17. Had you undertaken any of these flood mitigation measures before these floods?

Taken out household insurance against flooding	Yes	No
Raised the floor level of your house	Yes	No
Kept ditches and drains around the property clean	Yes	No
Avoided keeping irreplaceable items or goods of sentimental value on ground floor of your home	Yes	No

18. Has your household undertaken (or do you intend to undertake) any of these flood prevention measures after the 2008 flood?

Taken out household insurance against flooding	Yes	No
Raised the floor level of your house	Yes	No
Kept ditches and drains around the property clean	Yes	No
Avoided keeping irreplaceable items or goods of sentimental value on ground floor of your home	Yes	No

19. Have members of your household ever done any of these things?

Been a member of a local community group related to flooding	Yes		No	
Written letters to relevant authorities about flooding	Yes		No	
Attended meetings related to flooding	Yes		No	
None of these	Yes		No	

Section 4. Previous Experience of Flooding

20. How many times have you experienced flooding that has caused some disruption to your usual routines while living at this address?

Never been flooded	One	Two	Three	Four	Five	More than five times

21.a. Were these floods the worst (i.e. biggest impact) that you have experienced at this address?	Yes		No	
21.b. If not, when was your worst flooding experienced?				

Section 5. Warnings of the February 2008 Flood.

22.a. Were you aware of flood warnings issued by the Australian Government Bureau of Meteorology before the flood?	Yes		No	
22.b. If your answer was yes did you take any special actions in response to the warning? If your answer was no, go on to question 26.				

23. How long before you were actually affected by the flood waters did you receive the first warning?

I did not receive any warning	Less than 1 hour	1-6 hours	7-12 hours	13-24 hours	More than 24 hours

24. From which authority did you receive warning(s)? Tick any box which applies.

I did not receive any warning	Local Council	Emergency Services	Bureau of Meteorology	Police	Fire Service	I can't remember	Another weather service - please specify	Other – please specify

25. Which forms of communications were helpful in updating you of the developments of the 2008 flooding event? (please tick more than one box if applicable)

Mackay Regional Council website		Email received from council		Message received from council to mobile phone		Television advertisements	
Radio alerts		Newspaper alerts		Queensland Government website		SES workers	
Bureau of Meteorology website		neighbours		friends and family		work colleagues	
Other - please describe:							

26. How accurate do you think that the warnings and flood information for these floods was? Tick one box.

Accurate all of the time	Accurate most of the time	Accurate some of the time	Very often not accurate	Never accurate

Section 6. Preparations Before the Flood

27. How prepared do you think your household was for the 2008 flood event? Tick one box.

Not at all prepared	A little prepared	Moderately prepared	Significantly prepared	Very prepared

28. Did you have copies of local flood plans of the area or were your aware if your house is located in a flood prone area prior to the 2008 floods?	Yes		No	

29. Did you have a Household Emergency Plan prior to the disaster floods and if so did you use this during the 2008 floods? Tick one box.

	Did not have a household emergency plan prior to the 2008 floods
	Had a household emergency plan but no it was not used during the floods
	Had a household emergency plan and yes it was used during the floods

30. Did you have an Emergency Kit prior to the disaster floods and if so did you use this during the 2008 floods? Tick one box.
Equipment usually included in an emergency kit for flood prone areas: emergency phone numbers, portable radio, torch, spare batteries, first aid kit, strong plastic bags for clothing, plastic sheets, timber strips, hammers and nails for temporary repairs.

	Did not have an emergency kit prior to the 2008 floods
	Had an emergency kit but no it was not used during the floods
	Had an emergency kit and yes it was used during the floods

31. Did you have a Household Evacuation Plan prior to the disaster floods and if so did you use this during the 2008 floods?

	Did not have a household evacuation plan prior to the 2008 floods
	Had a household evacuation plan but no it was not used during the floods
	Had a household evacuation plan and yes it was used during the floods

32. Were you aware of evacuation routes and centres for your area before the 2008 floods?	Yes		No	

Section 7. Thoughts About Floods. This helps with planning for public education campaigns

33. How concerned are you about the risk of floods? Tick the box which is closest to your level of concern.

	Not at all	Not much	Neutral	Quite a lot	A great deal
I think about floods					
I talk about floods					
I get information on floods					
I think a flood could pose a threat to my personal safety					
I think a flood could pose a threat to my daily activities (work, leisure etc)					

34. How prepared do you believe the following groups are for future floods affecting your community? Tick the box which is closest to your understanding.

	Very prepared	Somewhat prepared	Not very prepared	Not at all prepared	Don't Know
Your household					
Your community					
Local Government					
Local Base Hospital					
State Government – Emergency Services etc					
Commonwealth government — Emergency Management, Health, Social Security etc)					
Bureau of Meteorology					
Utilities service providers – including roads, electricity, telecommunications etc					
Social welfare organizations – Red Cross, Salvation Army, Lifeline etc					

35. As a result of these floods do you intend to? Tick the box which fits your intentions.

	No	Possibly	Definitely
Seek information on flood risk in your community			
Seek information on things to do to prepare for a possible flood			
Increase level of insurance			
Raise the floor level of our house			
Become involved with a local group to discuss how to reduce flood risk in your community			

36. Please indicate on the scale whose responsibility you believe it is to protect us from floods. Tick the box which is closest to your level of understanding.

	Not at all	Not much	Neutral	Quite a lot	A great deal
Commonwealth government					
State government					
Local council					
Individual households					
There is no use preparing as we can't do much anyway					

37. Which, if any, volunteer organisations are you or anyone in your household involved in? Tick any box.

	State Emergency Service (SES)
	Neighbourhood watch
	Volunteer fire brigade
	Rotary
	Lions
	None

	Other(s) Organisations (Please specify)

38. Below is a list of statements on how you feel about living in your community. Please use the scale on the right to show how much each statement applies to you, or doesn't apply to you .

	Doesn’t apply	Not really	Neutral	Applies a bit	Applies strongly
I feel ‘at home' in this community					
I am satisfied living in this community					
I am a useful member of this community					
I have the same values and beliefs as my neighbours					
I feel I don't ‘belong' in this community					
I am interested in knowing what goes on in this community					
I would be happy to leave this community					
I know my neighbours and/or other community members					
I have no active involvement in this community					

39. To what extent might each of the following prevent you from preparing for floods? Tick the box that applies.

	Not at all	Not much	Neutral	Quite a lot	A great deal
Cost					
Skills required to prepare					
Other things to think about instead					
Need for cooperation with others					

40. To what extent do you think that – tick the box that applies to you -					
	Not at all	Not much	Neutral	Quite a lot	A great deal
Floods are too destructive to bother preparing for					
A flood is unlikely to occur during our lifetime					
It is unnecessary to prepare for floods as assistance will be provided by the Council and/or emergency services					
A damaging flood is something that could occur in the future					
I will move to a different part of Mackay if another flood affects my home					
I will move to a different town if another flood affects my home					

Section 8. Basic Demographic Information about you and your Household. It allows us to test that our survey sample is representative and to some extent lets us know a bit about how various groups of people deal with floods.

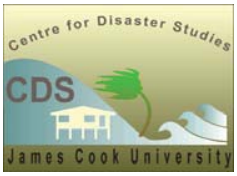
41. How long have you lived in this community?				years	
42. How long have you lived in this current home?				years	
43. Which best describes the situation you are living in now ?				Family with children	
Family without children		Alone		With other people, not family	
Other (Please specify)					

44. Please list how many adults and children under 18 years live in this household.							
	Male			Female			
Number of Adults							
Number of children under 18 years							
45. Are you?	Aboriginal		Torres Strait Islander		Pacific Islander Origin		
Aboriginal and Torres Strait Islander			None of these				
46. Are you?	Employed full-time		Employed part-time				
Self-employed full-time		Self-employed part-time		Not in paid employment			
47. What is your highest educational qualification? Tick one box							
No school qualifications		School qualifications		Trade certificate			
professional certificate or diploma		University undergraduate degree (e.g. university diploma or bachelor's degree) or university postgraduate degree (e.g. Master's, Ph.D.)					

48. Would you be interested in taking part in a focus group which will discuss issues raised in our community interviews about the 2008 flood?	Yes	No	Maybe

49. Would you like to receive a copy of the survey results? If yes please provide an address below.	Yes		No	
Your Mail Address:		Your email address:		
50. Are there any other comments you would like to make?				

Thank you very much for your participation in this survey.
Information you have provided will be stored at James Cook University and will remain completely confidential.



Centre for Disaster Studies, James Cook University, Townsville Q4811

SURVEY OF BUSINESSES – Mackay 2008 Flood

We are conducting a survey of businesses that were affected by the floods in Mackay during February 2008, last year. This study is part of a national series of case studies of recent natural disasters from which we and governments hope to learn of ways in which future events can be managed. All information will be completely confidential and will be stored at the Centre for Disaster Studies office of James Cook University, under the responsibility of Associate Professor David King, who can be contacted on 0747814430 or email: david.king@jcu.edu.au The Centre for Disaster Studies has carried out many studies of disasters which can be found on its website at http://www.jcu.edu.au/cds/

Section 1. The 2008 Flood										
1. Did your business premises and its contents suffer from flood damage during February 2008?	Yes		No							
2. If your answer was no to question 1, please go to question 19.										
3. If your answer to question 1 was yes, What parts of your business property/properties were flooded?										
4. Did flood water enter inside your business premises ?	Yes		No							
5. If yes, how deep were the flood waters inside the business premises?	Millimetres		or metres							
6. Were your business premises isolated by the flood waters?	Yes		No							
7. Did your business bear any financial costs as a direct result of these floods, that were not covered by insurance (excluding loss of earnings, if any)?	Yes		No							
8. Did your business experience any financial gain as a direct result of these floods?	Yes		No							
9. Were any people in the business premises forced to leave during or after the flood?	Yes		No							
10.a. If the answer to 9 above was yes, where did they go when they evacuated?										
10.b. After evacuating how long was it before they returned to the business premises? Please specify hours or days.										
11. Please tick any of the following items which were moved to a higher location.	vehicles	outdoor equipment	garbage	chemicals and poisons	freezers	fridges	Other - please describe			
12. Please tick any of the following actions you completed when evacuating your business premises	Turn off power, water and gas	Put sandbags in the toilet bowl and over all laundry/bathroom drain holes to prevent sewage back-flow	Took evacuation route	Other - please describe						
Emptied freezers and refrigerators, leaving doors open	Locked business premises	Raised furniture, documents and other valuables onto tables and into roof spaces	Took emergency kit	Took evacuation kit						

13. How effective do you think Council responses were to the 2008 flood event?	Not at all responsive	A little responsive	Moderately responsive	Very responsive	Significantly responsive

Section 2. Recovery After the Flood.

14. Did your staff boil all tap water until supplies were declared safe?	Yes		No	
15. Did your company have electrical appliances checked for safety prior to continued use?	Yes		No	
16. Were any of the members of your staff sick immediately following the flooding event?	Yes		No	

Section 3. Precautions taken before the flood.

17. Had you undertaken any of these flood mitigation measures before these floods?

Taken out business insurance against flooding	Yes		No	
Raised the floor level of your business premises	Yes		No	
Regular maintenance to ensure the ditches and drains around the property are clean and free of debris	Yes		No	
Avoided keeping irreplaceable items or valuable goods on the ground floor level of your business premises	Yes		No	

18. Has your business undertaken (or do you intend to undertake) any of these flood prevention measures after the 2008 flood?

Take out business insurance against flooding	Yes		No	
Raise the floor level of your business premises	Yes		No	
Regular maintenance to ensure the ditches and drains around the property are clean and free of debris	Yes		No	
Avoid keeping irreplaceable items or valuable goods on the ground floor level of your premises	Yes		No	

Other measures: Please describe these:

Section 4. Previous Experience of Flooding

19. How many times has your business experienced flooding that has caused some disruption to your usual business operations since operating at your current premises?

Never been flooded	One	Two	Three	Four	Five	More than five times

20.a. Were the 2008 floods the worst (i.e. biggest impact) that you have experienced at this address?	Yes	No
20.b. If not, when was your worst flooding experienced?		

Section 5. Warnings of the January and February 2008 Floods.

21.a. Was your company aware of flood warnings issued by anyone before the flood?	Yes		No	
21.b. If your answer was yes did your company take any special actions in response to the warning? If your answer was no, go on to question 25.				

22. How long before you were actually affected by the flood waters did you receive the first warning?					
I did not receive any warning	Less than 1 hour	1-6 hours	7-12 hours	13-24 hours	More than 24 hours

23. From which authority did you receive warning(s)? Tick any box which applies.								
I did not receive any warning	Local Council	Emergency Services	Bureau of Meteorology	Police	Fire Service	I can't remember	Another weather service - please specify	Other – please specify

24. How accurate do you think that the warnings and flood information for these floods was? Tick one box.				
Accurate all of the time	Accurate most of the time	Accurate some of the time	Very often not accurate	Never accurate

Section 6. Preparations Before the Flood

25. How prepared do you think your company was for the 2008 flood event? Tick one box.				
Not at all prepared	A little prepared	Moderately prepared	Significantly prepared	Very prepared

26. Did you have copies of local flood plans of the area or were your aware if your business premises are located in a flood prone area prior to the 2008 floods?	Yes		No	

27. Did you have an Emergency Plan for your business prior to the disaster floods and if so did you use this during the 2008 floods? Tick one box.	
	Did not have an Emergency Plan for the business prior to the 2008 floods
	Had an Emergency Plan for the business but no it was not used during the floods
	Had an Emergency Plan for the business and yes it was used during the floods

28. Did you have an Emergency Kit for your business prior to the disaster floods and if so did you use this during the 2008 floods? Tick one box. Equipment usually included in an emergency kit for flood prone areas: emergency phone numbers, portable radio, torch, spare batteries, first aid kit, strong plastic bags for clothing, plastic sheets, timber strips, hammers and nails for temporary repairs.	
	Did not have an Emergency Kit for the business prior to the 2008 floods
	Had an Emergency Kit for the business but no it was not used during the floods
	Had an Emergency Kit for the business and yes it was used during the floods

29. Did you have an Evacuation Plan for your business prior to the disaster floods and if so did you use this during the 2008 floods?	
	Did not have an Evacuation Plan for the business prior to the 2008 floods
	Had an Evacuation Plan for the business but no it was not used during the floods
	Had an Evacuation Plan for the business and yes it was used during the floods

30. Were you aware of evacuation routes and centres for your area prior to the 2008 floods?	Yes		No	

Section 7. Thoughts About Floods. This helps with planning for public education campaigns

31. How concerned do you think your company is about the risk of floods? Tick the box which you believe is closest to their level of concern.

	Not at all	Not much	Neutral	Quite a lot	A great deal
They think about floods					
They talk about floods					
They get information on floods					
They think a flood could pose a threat to personal safety					
They think a flood could pose a threat to daily business activities					

32. How prepared do you believe the following groups are for future floods affecting your community? Tick the box which is closest to your understanding

	Very prepared	Somewhat prepared	Not very prepared	Not at all prepared	Don't Know
Your business					
Your community					
Local Government					
Local Base Hospital					
State Government – Emergency Services etc					
Commonwealth government — Emergency Management, Health, Social Security etc)					
Bureau of Meteorology					
Utilities service providers – including roads, electricity, telecommunications etc					
Social welfare organizations – Red Cross, Salvation Army, Lifeline etc					

33. As a result of these floods does your company intend to? Tick the box which fits your intentions.

	No	Possibly	Definitely
Seek information on flood risk in your community			
Seek information on things to do to prepare for a possible flood			
Increase level of insurance			
Raise the floor level of your business premises			
Become involved with a local group to discuss how to reduce flood risk in your community			

Other activities: Please describe:

34. Has your company applied under the *State Planning Policy 1/03* Guideline or the *Integrated Planning Act 1997* to develop any proposal/s to construct or implement flood prevention measures?	Yes		No	
If Yes, please describe the circumstances				

35. Do you think any improvements need to be made to the *State Planning Policy 1/03* Guideline or the *Integrated Planning Act 1997* to better mitigate against and manage flood events?	Yes		No	
If Yes, please describe what you think these improvements should be				

36. Please indicate on the scale whose responsibility you believe it is to protect us from floods. Tick the box which is closest to your level of understanding.

	Not at all	Not much	Neutral	Quite a lot	A great deal
Commonwealth government					
State government					
Local council					
Individual households					
There is no use preparing as we can't do much anyway					

Other: Please describe:

37. Which, if any, volunteer organisations are you or your staff involved in? Tick any box.

	State Emergency Service (SES)
	Neighbourhood watch
	Volunteer fire brigade
	Lions
	Rotary
	None
	Other(s) (Please specify)

38. To what extent might each of the following prevent your company from preparing for floods? Please tick the box that applies.

	Not at all	Not much	Neutral	Quite a lot	A great deal
Cost					
Skills required to prepare					
Other things to think about instead					
Need for cooperation with others					

Other: Please describe

39. To what extent do you think that – tick the box that applies to you -

	Not at all	Not much	Neutral	Quite a lot	A great deal
Floods are too destructive to bother preparing for					
A flood is unlikely to occur during our lifetime					
It is unnecessary to prepare for floods as assistance will be provided by the Council and/or emergency services					
A damaging flood is something that could occur in the future					
Our business will move to a different part of Mackay if another flood effects our business premises					
Our business will move to a different town if another flood effects our business premises					

Section 8. Basic Demographic Information about you and your Business. It allows us to test that our survey sample is representative and to some extent lets us know a bit about how various groups of people deal with floods.				
40. Position in business				
41. Are you? please tick one	Male		Female	
42. Are you? please tick one	Aboriginal	Torres Strait Islander	Aboriginal and Torres Strait Islander	None of these
	Pacific Islander Origin			

43. What is your highest educational qualification? Tick one box				
No school qualifications		School qualifications		Trade certificate
Professional certificate or Diploma		University undergraduate degree (e.g. university diploma or bachelor's degree) or university postgraduate degree (e.g. Master's, Ph.D.)		

44. Your Business Title:	
45. Name of Business:	
46. Address of Business:	
47. Business Phone No:	
48. Type of Business:	
49. How many staff are employed in this business?	
50. Your business email address:	
51. How long has your business operated from its current premises?	

Section 9. Focus Groups and Copy of Survey Results			
52. Would you be interested in taking part in focus groups which will discuss issues raised in our interviews with the community on the 2008 flood?	Yes	No	Maybe
53. Would you like to receive a copy of the survey results?		Yes	No

54. Are there any other comments you would like to make?
Please write in the space provided below, or feel free to attach additional pages.

Appendix 5.1. Summary Tables of Household Survey for Mackay and Charleville

The 2008 Flood

Did your home or its contents suffer from flood damage in February 2008?

Flood damage	Town		
	Mackay	Charleville	Total
Yes	96.6%	98.2%	97.2%
No	3.4%	1.8%	2.8%
Total	100.0%	100.0%	100.0%

How deep were the flood waters inside the house?

Water depth scale	Town		Total
	Mackay	Charleville	
0-100mm	12.1%	21.7%	14.6%
100-500mm	37.9%	69.6%	46.1%
500-1000mm	30.3%	8.7%	24.7%
1000-2000mm	19.7%		14.6%
Total	100.0%	100.0%	100.0%

Was your home isolated by the flood waters?

Home isolated	Town		Total
	Mackay	Charleville	
Yes	75.3%	78.8%	76.7%
No	24.7%	21.2%	23.3%
Total	100.0%	100.0%	100.0%

Did you or your business bear any financial costs as a direct result of these floods, that were not covered by insurance

Business costs	Town		Total
	Mackay	Charleville	
Yes	37.0%	43.4%	39.6%
No	63.0%	56.6%	60.4%
Total	100.0%	100.0%	100.0%

Did you or your business experience any financial gain as a direct result of these floods?

Business gain	Town		Total
	Mackay	Charleville	
Yes	7.5%	34.7%	17.8%
No	92.5%	65.3%	82.2%
Total	100.0%	100.0%	100.0%

Were you or anyone in your household forced to leave your home during or after the flood?

Forced to leave home	Town		Total
	Mackay	Charleville	
Yes	54.8%	73.6%	62.0%
No	45.2%	26.4%	38.0%
Total	100.0%	100.0%	100.0%

Where did you go to when you evacuated?

Where did you go to when you evacuated	Town		Total
	Mackay	Charleville	
Rented	20.9%	2.9%	13.0%
Family or friends	51.2%	76.5%	62.3%
State school	7.0%		3.9%
Temporary accommodation	18.6%	17.6%	18.2%
Showgrounds		2.9%	1.3%
Family state; school	2.3%		1.3%
Total	100.0%	100.0%	100.0%

After evacuating how long was it before you returned to your home?

How long before returned home - hours or days	Town		
	Mackay	Charleville	Total
Less than a day	31.8%	12.8%	22.9%
1 day - a week	18.2%	74.4%	44.6%
Week - a month	9.1%	12.8%	10.8%
A month - 6 months	27.3%		14.5%
More than 6 months	13.6%		7.2%
Total	100.0%	100.0%	100.0%

How effective do you think council responses were to the 2008 flood event?

Council responses	Town		Total
	Mackay	Charleville	
Not at all responsive	18.7%	14.8%	17.1%
A little responsive	17.3%	7.4%	13.2%
Moderately responsive	38.7%	22.2%	31.8%
Very responsive	18.7%	50.0%	31.8%
Significantly responsive	6.7%	5.6%	6.2%
Total	100.0%	100.0%	100.0%

Recovery After the Flood.

Did you boil all tap water until supplies were declared safe

Boil tap waters	Town		Total
	Mackay	Charleville	
Yes	40.0%	14.8%	29.5%
No	60.0%	85.2%	70.5%
Total	100.0%	100.0%	100.0%

Did you have electrical appliances checked for safety prior to continued use?

Electrical appliances	Town		Total
	Mackay	Charleville	
Yes	68.8%	60.0%	65.2%
No	31.2%	40.0%	34.8%
Total	100.0%	100.0%	100.0%

Were any of the members of your household sick immediately following the flooding event?

Members of household sick	Town		Total
	Mackay	Charleville	
Yes	19.5%	13.0%	16.9%
No	80.5%	87.0%	83.1%
Total	100.0%	100.0%	100.0%

Precautions taken before the flood.

Had you undertaken any of these flood mitigation measures before these floods?

Insurance	Town		Total
	Mackay	Charleville	
Yes	67.9%	32.1%	53.4%
No	32.1%	67.9%	46.6%
Total	100.0%	100.0%	100.0%

Had you undertaken any of these flood mitigation measures before these floods?

Raised the floor level	Town		Total
	Mackay	Charleville	
Yes	1.3%	9.4%	4.6%
No	98.7%	90.6%	95.4%
Total	100.0%	100.0%	100.0%

Had you undertaken any of these flood mitigation measures before these floods?

Ditches and drains	Town		Total
	Mackay	Charleville	
Yes	71.8%	73.6%	72.5%
No	28.2%	26.4%	27.5%
Total	100.0%	100.0%	100.0%

Had you undertaken any of these flood mitigation measures before these floods?

Avoided irreplaceable items on ground floor	Town		Total
	Mackay	Charleville	
Yes	44.3%	51.9%	47.4%
No	55.7%	48.1%	52.6%
Total	100.0%	100.0%	100.0%

Has your household undertaken (or do you intend to undertake) any of these flood prevention measures after the 2008 flood?

Insurance	Town		Total
	Mackay	Charleville	
Yes	78.7%	35.2%	60.5%
No	21.3%	64.8%	39.5%
Total	100.0%	100.0%	100.0%

Has your household undertaken (or do you intend to undertake) any of these flood prevention measures after the 2008 flood?

Raised the floor level	Town		Total
	Mackay	Charleville	
Yes	2.6%	3.7%	3.1%
No	97.4%	96.3%	96.9%
Total	100.0%	100.0%	100.0%

Has your household undertaken (or do you intend to undertake) any of these flood prevention measures after the 2008 flood?

Ditches and drains	Town		Total
	Mackay	Charleville	
Yes	78.7%	86.8%	82.0%
No	21.3%	13.2%	18.0%
Total	100.0%	100.0%	100.0%

Has your household undertaken (or do you intend to undertake) any of these flood prevention measures after the 2008 flood?

Avoided irreplaceable items on ground floor	Town		Total
	Mackay	Charleville	
Yes	74.3%	69.1%	72.1%
No	25.7%	30.9%	27.9%
Total	100.0%	100.0%	100.0%

Have members of your household ever done any of these things

Member of local community group	Town		
	Mackay	Charleville	Total
Yes	8.4%	14.5%	10.9%
No	91.6%	85.5%	89.1%
Total	100.0%	100.0%	100.0%

Have members of your household ever done any of these things?

Written letters to authorities	Town		Total
	Mackay	Charleville	
Yes	13.3%	5.6%	10.2%
No	86.7%	94.4%	89.8%
Total	100.0%	100.0%	100.0%

Have members of your household ever done any of these things?

Meetings related to flooding	Town		Total
	Mackay	Charleville	
Yes	35.4%	21.8%	29.9%
No	64.6%	78.2%	70.1%
Total	100.0%	100.0%	100.0%

Have members of your household ever done any of these things?

None	Town		Total
	Mackay	Charleville	
Yes	47.0%	68.8%	55.0%
No	53.0%	31.3%	45.0%
Total	100.0%	100.0%	100.0%

Previous Experience of Flooding

How many times have you experienced flooding that has caused some disruption to your usual routines while living at this address?

Times experienced flooding	Town		Total
	Mackay	Charleville	
Never been flooded	50.6%	1.8%	31.2%
One	32.5%	47.3%	38.4%
Two	7.2%	16.4%	10.9%
Three	7.2%	20.0%	12.3%
Four		1.8%	.7%
Five		1.8%	.7%
More than five times	2.4%	10.9%	5.8%
Total	100.0%	100.0%	100.0%

Were these floods the worst (i.e. biggest impact) that you have experienced at this address?

Were these floods the worst	Town		Total
	Mackay	Charleville	
Yes	96.4%	59.6%	82.4%
No	3.6%	40.4%	17.6%
Total	100.0%	100.0%	100.0%

Warnings of the February 2008 Flood.

Were you aware of flood warnings issued by the Australian Government Bureau of Meteorology before the flood?

Flood warnings by anyone	Town		Total
	Mackay	Charleville	
Yes	7.0%	58.2%	27.0%
No	93.0%	41.8%	73.0%
Total	100.0%	100.0%	100.0%

From which authority did you receive warning(s)?

authority from whom received warning	Town		Total
	Mackay	Charleville	
I did not receive any warning	91.5%	6.3%	60.0%
local council	2.4%	8.3%	4.6%
Emergency services		14.6%	5.4%
BOM	3.7%	2.1%	3.1%
Police		6.3%	2.3%
Fire services		4.2%	1.5%
I can't remember		2.1%	.8%
Another weather service	2.4%	4.2%	3.1%
Other		29.2%	10.8%
Local council; emergency services		4.2%	1.5%
Local council; BOM		4.2%	1.5%
Emergency services; police		6.3%	2.3%
Local council; emergency services; BOM		2.1%	.8%
Local council; emergency services; police		2.1%	.8%
Emergency services; BOM; police		2.1%	.8%
Local council; emergency services; BOM; police		2.1%	.8%
Total	100.0%	100.0%	100.0%

How accurate do you think that the warnings and flood information for these floods was?

Accurate warnings and flood information	Town		Total
	Mackay	Charleville	
Accurate all of the time	3.1%	13.7%	7.8%
Accurate most of the time	9.4%	49.0%	27.0%
Accurate some of the time	34.4%	11.8%	24.3%
Very often not accurate	12.5%	13.7%	13.0%
Never accurate	40.6%	11.8%	27.8%
Total	100.0%	100.0%	100.0%

Preparations Before the Flood

How prepared do you think your household was for the 2008 flood event?

How prepared for the 2008 flood event	Town		Total
	Mackay	Charleville	
Not at all prepared	60.2%	35.8%	50.7%
A little prepared	20.5%	11.3%	16.9%
Moderately prepared	14.5%	26.4%	19.1%
Significantly prepared	3.6%	17.0%	8.8%
Very prepared	1.2%	9.4%	4.4%
Total	100.0%	100.0%	100.0%

Did you have copies of local flood plans of the area or were your aware if your house is located in a flood prone area prior to the 2008 floods?

Copies of local flood plan	Town		Total
	Mackay	Charleville	
Yes	31.4%	58.2%	41.8%
No	68.6%	41.8%	58.2%
Total	100.0%	100.0%	100.0%

Did you have a Household Emergency Plan prior to the disaster floods and if so did you use this during the 2008 floods?

Household emergency plan	Town		Total
	Mackay	Charleville	
No household emergency plan	77.1%	69.1%	73.9%
Household emergency plan not used	18.1%	5.5%	13.0%
Household emergency plan used	4.8%	25.5%	13.0%
Total	100.0%	100.0%	100.0%

Did you have an Emergency Kit prior to the disaster floods and if so did you use this during the 2008 floods?

Emergency kit	Town		Total
	Mackay	Charleville	
No emergency kit	60.2%	67.3%	63.0%
Emergency kit not used	30.1%	7.3%	21.0%
Emergency kit used	9.6%	25.5%	15.9%
Total	100.0%	100.0%	100.0%

Did you have a Household Evacuation Plan prior to the disaster floods and if so did you use this during the 2008 floods?

Household evacuation plan	Town		Total
	Mackay	Charleville	
No household evacuation plan	71.1%	55.6%	65.0%
Household evacuation plan not used	24.1%	14.8%	20.4%
Household evacuation plan used	4.8%	29.6%	14.6%
Total	100.0%	100.0%	100.0%

Were you aware of evacuation routes and centres for your area before the 2008 floods?

Evacuation routes & centres	Town		Total
	Mackay	Charleville	
Yes	28.0%	86.0%	50.0%
No	72.0%	14.0%	50.0%
Total	100.0%	100.0%	100.0%

Thoughts About Floods. This helps with planning for public education campaigns

How concerned are you about the risk of floods?

think about the risk of floods	Town		Total
	Mackay	Charleville	
Not at all	2.5%	9.1%	5.2%
Not much	30.0%	36.4%	32.6%
Neutral	17.5%	10.9%	14.8%
Quite a lot	35.0%	29.1%	32.6%
A great deal	15.0%	14.5%	14.8%
Total	100.0%	100.0%	100.0%

How concerned are you about the risk of floods?

Talk about the risk of floods -	Town		Total
	Mackay	Charleville	
Not at all	4.1%	15.1%	8.7%
Not much	35.6%	45.3%	39.7%
Neutral	27.4%	9.4%	19.8%
Quite a lot	23.3%	22.6%	23.0%
A great deal	9.6%	7.5%	8.7%
Total	100.0%	100.0%	100.0%

How concerned are you about the risk of floods?

Seek information	Town		Total
	Mackay	Charleville	
Not at all	22.7%	30.2%	26.1%
Not much	30.3%	22.6%	26.9%
Neutral	24.2%	13.2%	19.3%
Quite a lot	12.1%	24.5%	17.6%
A great deal	10.6%	9.4%	10.1%
Total	100.0%	100.0%	100.0%

How concerned are you about the risk of floods?

Concerned about personal safety	Town		Total
	Mackay	Charleville	
Not at all	21.1%	26.4%	23.4%
Not much	18.3%	28.3%	22.6%
Neutral	21.1%	13.2%	17.7%
Quite a lot	23.9%	18.9%	21.8%
A great deal	15.5%	13.2%	14.5%
Total	100.0%	100.0%	100.0%

How concerned are you about the risk of floods?

Pose a threat to daily activities	Town		Total
	Mackay	Charleville	
Not at all	10.0%	17.0%	13.0%
Not much	20.0%	7.5%	14.6%
Neutral	18.6%	3.8%	12.2%
Quite a lot	31.4%	32.1%	31.7%
A great deal	20.0%	39.6%	28.5%
Total	100.0%	100.0%	100.0%

How prepared do you believe the following groups are for future floods affecting your community?

How prepared groups are for future floods – your household	Town		Total
	Mackay	Charleville	
Very prepared	24.1%	27.3%	25.4%
Somewhat prepared	58.2%	47.3%	53.7%
Not very prepared	8.9%	21.8%	14.2%
Not at all prepared	6.3%	3.6%	5.2%
Don't know	2.5%		1.5%
Total	100.0%	100.0%	100.0%

How prepared do you believe the following groups are for future floods affecting your community?

How prepared groups are for future floods - community	Town		Total
	Mackay	Charleville	
Very prepared	10.3%	30.9%	18.8%
Somewhat prepared	53.8%	45.5%	50.4%
Not very prepared	19.2%	12.7%	16.5%
Not at all prepared	5.1%	3.6%	4.5%
Don't know	11.5%	7.3%	9.8%
Total	100.0%	100.0%	100.0%

How prepared do you believe the following groups are for future floods affecting your community?

how prepared groups are for future floods - local government	Town		Total
	Mackay	Charleville	
Very prepared	10.3%	29.6%	18.2%
Somewhat prepared	39.7%	38.9%	39.4%
Not very prepared	20.5%	13.0%	17.4%
Not at all prepared	14.1%	5.6%	10.6%
Don't know	15.4%	13.0%	14.4%
Total	100.0%	100.0%	100.0%

How prepared do you believe the following groups are for future floods affecting your community?

How prepared groups are for future floods - local hospital	Town		Total
	Mackay	Charleville	
Very prepared	21.5%	49.1%	32.8%
Somewhat prepared	43.0%	23.6%	35.1%
Not very prepared	10.1%	5.5%	8.2%
Not at all prepared	3.8%	1.8%	3.0%
Don't know	21.5%	20.0%	20.9%
Total	100.0%	100.0%	100.0%

How prepared do you believe the following groups are for future floods affecting your community?

How prepared groups are for future floods - state government	Town		Total
	Mackay	Charleville	
Very prepared	37.2%	78.2%	54.1%
Somewhat prepared	41.0%	10.9%	28.6%
Not very prepared	7.7%	5.5%	6.8%
Not at all prepared	2.6%	3.6%	3.0%
Don't know	11.5%	1.8%	7.5%
Total	100.0%	100.0%	100.0%

How prepared do you believe the following groups are for future floods affecting your community?

How prepared groups are for future floods - commonwealth government	Town		Total
	Mackay	Charleville	
Very prepared	16.7%	29.1%	21.8%
Somewhat prepared	51.3%	34.5%	44.4%
Not very prepared	10.3%	12.7%	11.3%
Not at all prepared	2.6%	1.8%	2.3%
Don't know	19.2%	21.8%	20.3%
Total	100.0%	100.0%	100.0%

How prepared do you believe the following groups are for future floods affecting your community?

How prepared groups are for future floods - BOM	Town		Total
	Mackay	Charleville	
Very prepared	25.0%	46.3%	33.6%
Somewhat prepared	50.0%	27.8%	41.0%
Not very prepared	7.5%	7.4%	7.5%
Not at all prepared	2.5%	1.9%	2.2%
Don't know	15.0%	16.7%	15.7%
Total	100.0%	100.0%	100.0%

How prepared do you believe the following groups are for future floods affecting your community?

How prepared groups are for future floods - utilities providers	Town		Total
	Mackay	Charleville	
Very prepared	11.3%	59.3%	30.6%
Somewhat prepared	43.8%	25.9%	36.6%
Not very prepared	16.3%	7.4%	12.7%
Not at all prepared	10.0%	1.9%	6.7%
Don't know	18.8%	5.6%	13.4%
Total	100.0%	100.0%	100.0%

How prepared do you believe the following groups are for future floods affecting your community?

How prepared groups are for future floods - social welfare organisationss	Town		Total
	Mackay	Charleville	
Very prepared	49.4%	56.4%	52.2%
Somewhat prepared	38.3%	23.6%	32.4%
Not very prepared	1.2%		.7%
Not at all prepared	1.2%		.7%
Don't know	9.9%	20.0%	14.0%
Total	100.0%	100.0%	100.0%

As a result of these floods do you intend to:

Do you intend to - seek information	Town		Total
	Mackay	Charleville	
No	32.5%	69.8%	47.7%
Possibly	45.5%	20.8%	35.4%
Definitely	22.1%	9.4%	16.9%
Total	100.0%	100.0%	100.0%

As a result of these floods do you intend to:

Do you intend to - seek information on preparing	Town		Total
	Mackay	Charleville	
No	23.4%	60.4%	38.5%
Possibly	44.2%	24.5%	36.2%
Definitely	32.5%	15.1%	25.4%
Total	100.0%	100.0%	100.0%

As a result of these floods do you intend to:

Do you intend to - increase insurance	Town		Total
	Mackay	Charleville	
No	37.5%	61.5%	47.0%
Possibly	25.0%	17.3%	22.0%
Definitely	37.5%	21.2%	31.1%
Total	100.0%	100.0%	100.0%

As a result of these floods do you intend to

Do you intend to - raise the floor level	Town		Total
	Mackay	Charleville	
No	87.2%	84.3%	86.0%
Possibly	7.7%	11.8%	9.3%
Definitely	5.1%	3.9%	4.7%
Total	100.0%	100.0%	100.0%

As a result of these floods do you intend to

Do you intend to - involve with a local group	Town		Total
	Mackay	Charleville	
No	57.0%	68.6%	61.5%
Possibly	35.4%	23.5%	30.8%
Definitely	7.6%	7.8%	7.7%
Total	100.0%	100.0%	100.0%

Please indicate on the scale whose responsibility you believe it is to protect us from floods.

Commonwealth Government	Town		Total
	Mackay	Charleville	
Not at all	9.2%	7.7%	8.5%
Not much	16.9%	19.2%	17.9%
Neutral	23.1%	23.1%	23.1%
Quite a lot	27.7%	34.6%	30.8%
A great deal	23.1%	15.4%	19.7%
Total	100.0%	100.0%	100.0%

Please indicate on the scale whose responsibility you believe it is to protect us from floods.

State Government	Town		Total
	Mackay	Charleville	
Not at all	6.0%	5.6%	5.8%
Not much	7.5%	5.6%	6.6%
Neutral	14.9%	24.1%	19.0%
Quite a lot	38.8%	40.7%	39.7%
A great deal	32.8%	24.1%	28.9%
Total	100.0%	100.0%	100.0%

Please indicate on the scale whose responsibility you believe it is to protect us from floods.

Local Council	Town		Total
	Mackay	Charleville	
Not at all	2.7%	5.6%	3.9%
Not much	5.3%	3.7%	4.7%
Neutral	5.3%	16.7%	10.1%
Quite a lot	22.7%	40.7%	30.2%
A great deal	64.0%	33.3%	51.2%
Total	100.0%	100.0%	100.0%

Please indicate on the scale whose responsibility you believe it is to protect us from floods.

Households	Town		Total
	Mackay	Charleville	
Not at all	2.9%	5.7%	4.1%
Not much	10.3%	1.9%	6.6%
Neutral	20.6%	11.3%	16.5%
Quite a lot	36.8%	41.5%	38.8%
A great deal	29.4%	39.6%	33.9%
Total	100.0%	100.0%	100.0%

Please indicate on the scale whose responsibility you believe it is to protect us from floods.

No use preparing	Town		Total
	Mackay	Charleville	
Not at all	29.3%	70.2%	47.6%
Not much	17.2%	10.6%	14.3%
Neutral	29.3%	2.1%	17.1%
Quite a lot	6.9%	6.4%	6.7%
A great deal	17.2%	10.6%	14.3%
Total	100.0%	100.0%	100.0%

Which, if any, volunteer organisations are you or anyone in your household involved in?

Volunteer organisations	Town		Total
	Mackay	Charleville	
State emergency service	4.9%	7.4%	5.9%
Neighbourhood watch	1.2%	1.9%	1.5%
Volunteer fire brigade	1.2%		.7%
Rotary	1.2%	3.7%	2.2%
None	85.4%	79.6%	83.1%
Other	6.1%	5.6%	5.9%
SES & Rotary		1.9%	.7%
Total	100.0%	100.0%	100.0%

How do you feel about living in your community?

Feel at home	Town		Total
	Mackay	Charleville	
Doesn't apply	2.5%	3.6%	2.9%
Not really	2.5%	3.6%	2.9%
Neutral	18.5%	7.3%	14.0%
Applies a bit	13.6%	9.1%	11.8%
Applies strongly	63.0%	76.4%	68.4%
Total	100.0%	100.0%	100.0%

How do you feel about living in your community?

Satisfied living in this community	Town		Total
	Mackay	Charleville	
Doesn't apply		3.6%	1.5%
Not really	5.1%	5.5%	5.2%
Neutral	15.2%	5.5%	11.2%
Applies a bit	16.5%	7.3%	12.7%
Applies strongly	63.3%	78.2%	69.4%
Total	100.0%	100.0%	100.0%

How do you feel about living in your community?

Useful member	Town		Total
	Mackay	Charleville	
Doesn't apply	2.5%	5.5%	3.7%
Not really	6.3%	10.9%	8.2%
Neutral	39.2%	9.1%	26.9%
Applies a bit	26.6%	14.5%	21.6%
Applies strongly	25.3%	60.0%	39.6%
Total	100.0%	100.0%	100.0%

How do you feel about living in your community?

Same values and beliefs	Town		Total
	Mackay	Charleville	
Doesn't apply	2.6%	3.6%	3.0%
Not really	11.7%	12.7%	12.1%
Neutral	31.2%	5.5%	20.5%
Applies a bit	23.4%	25.5%	24.2%
Applies strongly	31.2%	52.7%	40.2%
Total	100.0%	100.0%	100.0%

How do you feel about living in your community?

Don't belong	Town		Total
	Mackay	Charleville	
Doesn't apply	61.3%	51.9%	57.4%
Not really	16.0%	42.6%	27.1%
Neutral	17.3%	3.7%	11.6%
Applies a bit	2.7%	1.9%	2.3%
Applies strongly	2.7%		1.6%
Total	100.0%	100.0%	100.0%

How do you feel about living in your community?

Happy to leave	Town		Total
	Mackay	Charleville	
Doesn't apply	42.1%	31.5%	37.7%
Not really	22.4%	51.9%	34.6%
Neutral	21.1%	5.6%	14.6%
Applies a bit	7.9%	7.4%	7.7%
Applies strongly	6.6%	3.7%	5.4%
Total	100.0%	100.0%	100.0%

How do you feel about living in your community?

Know my neighbours	Town		Total
	Mackay	Charleville	
Doesn't apply	2.5%		1.5%
Not really	6.3%	3.6%	5.2%
Neutral	17.5%	1.8%	11.1%
Applies a bit	36.3%	14.5%	27.4%
Applies strongly	37.5%	80.0%	54.8%
Total	100.0%	100.0%	100.0%

How do you feel about living in your community?

No active involvement	Town		Total
	Mackay	Charleville	
Doesn't apply	22.5%	38.2%	29.4%
Not really	19.7%	32.7%	25.4%
Neutral	40.8%	3.6%	24.6%
Applies a bit	11.3%	7.3%	9.5%
Applies strongly	5.6%	18.2%	11.1%
Total	100.0%	100.0%	100.0%

To what extent might each of the following prevent you from preparing for floods?

Cost	Town		Total
	Mackay	Charleville	
Not at all	15.1%	44.4%	27.6%
Not much	15.1%	5.6%	11.0%
Neutral	28.8%	5.6%	18.9%
Quite a lot	17.8%	13.0%	15.7%
A great deal	23.3%	31.5%	26.8%
Total	100.0%	100.0%	100.0%

To what extent might each of the following prevent you from preparing for floods?

Skills	Town		Total
	Mackay	Charleville	
Not at all	20.6%	63.6%	39.8%
Not much	22.1%	12.7%	17.9%
Neutral	30.9%	7.3%	20.3%
Quite a lot	20.6%	10.9%	16.3%
A great deal	5.9%	5.5%	5.7%
Total	100.0%	100.0%	100.0%

To what extent might each of the following prevent you from preparing for floods?

Other things to think about	Town		Total
	Mackay	Charleville	
Not at all	29.4%	52.7%	39.8%
Not much	13.2%	14.5%	13.8%
Neutral	32.4%	16.4%	25.2%
Quite a lot	16.2%	14.5%	15.4%
A great deal	8.8%	1.8%	5.7%
Total	100.0%	100.0%	100.0%

To what extent might each of the following prevent you from preparing for floods?

Cooperation with others	Town		Total
	Mackay	Charleville	
Not at all	17.6%	53.7%	33.6%
Not much	8.8%	13.0%	10.7%
Neutral	35.3%	14.8%	26.2%
Quite a lot	20.6%	7.4%	14.8%
A great deal	17.6%	11.1%	14.8%
Total	100.0%	100.0%	100.0%

To what extent do you think that?

Floods are too destructive to prepare for	Town		Total
	Mackay	Charleville	
Not at all	35.1%	66.7%	48.4%
Not much	13.5%	22.2%	17.2%
Neutral	25.7%	3.7%	16.4%
Quite a lot	16.2%	3.7%	10.9%
A great deal	9.5%	3.7%	7.0%
Total	100.0%	100.0%	100.0%

To what extent do you think that?

Another flood unlikely to occur	Town		Total
	Mackay	Charleville	
Not at all	32.9%	75.9%	51.2%
Not much	13.7%	11.1%	12.6%
Neutral	20.5%	3.7%	13.4%
Quite a lot	16.4%	5.6%	11.8%
A great deal	16.4%	3.7%	11.0%
Total	100.0%	100.0%	100.0%

To what extent do you think that?

It is unnecessary to prepare for floods	Town		Total
	Mackay	Charleville	
Not at all	52.7%	79.2%	63.8%
Not much	21.6%	13.2%	18.1%
Neutral	12.2%	1.9%	7.9%
Quite a lot	8.1%	5.7%	7.1%
A great deal	5.4%		3.1%
Total	100.0%	100.0%	100.0%

To what extent do you think that?

A damaging flood could occur	Town		Total
	Mackay	Charleville	
Not at all	2.5%	1.8%	2.2%
Not much	8.8%		5.2%
Neutral	20.0%	5.5%	14.1%
Quite a lot	28.8%	45.5%	35.6%
A great deal	40.0%	47.3%	43.0%
Total	100.0%	100.0%	100.0%

To what extent do you think that?

I would move to a different part of Mackay	Town		Total
	Mackay	Charleville	
Not at all	42.7%	46.3%	44.2%
Not much	9.3%	11.1%	10.1%
Neutral	25.3%	11.1%	19.4%
Quite a lot	5.3%	22.2%	12.4%
A great deal	17.3%	9.3%	14.0%
Total	100.0%	100.0%	100.0%

To what extent do you think that?

Move to a different town if another flood occurs	Town		Total
	Mackay	Charleville	
Not at all	54.7%	63.0%	58.1%
Not much	14.7%	14.8%	14.7%
Neutral	16.0%	9.3%	13.2%
Quite a lot	4.0%	5.6%	4.7%
A great deal	10.7%	7.4%	9.3%
Total	100.0%	100.0%	100.0%

Basic Demographic Information

How long have you lived in this community?

Long lived in this community scale	Town		Total
	Mackay	Charleville	
Less than 1 year		1.8%	.7%
1-5 years	15.3%	10.9%	13.6%
6-10 years	22.4%	20.0%	21.4%
More than 10 years	62.4%	67.3%	64.3%
Total	100.0%	100.0%	100.0%

How long have you lived in this current home?

Long in this current home scale	Town		Total
	Mackay	Charleville	
Less than 1 year	3.5%	1.8%	2.9%
1-5 years	27.1%	34.5%	30.0%
6-10 years	37.6%	21.8%	31.4%
More than 10 years	31.8%	41.8%	35.7%
Total	100.0%	100.0%	100.0%

Which best describes the situation you are living in now?

Situation you are living in now	Town		Total
	Mackay	Charleville	
Family with	44.0%	41.8%	43.2%
Family without	44.0%	34.5%	40.3%
Alone	8.3%	21.8%	13.7%
With other people,	3.6%	1.8%	2.9%
Total	100.0%	100.0%	100.0%

Type of Employment

Employment	Town		Total
	Mackay	Charleville	
Employed full-time	45.5%	27.8%	38.2%
Employed part-time	14.3%	20.4%	16.8%
Self-employed full-time	7.8%	14.8%	10.7%
Self-employed part-time	3.9%	1.9%	3.1%
Not in paid employment	28.6%	35.2%	31.3%
Total	100.0%	100.0%	100.0%

What is your highest educational qualification?

Highest educational qualification	Town		Total
	Mackay	Charleville	
No school qualifications	12.0%	9.3%	10.9%
School qualifications	28.0%	55.6%	39.5%
Trade certificate	28.0%	13.0%	21.7%
Professional certificate or diploma	18.7%	11.1%	15.5%
University undergraduate or postgraduate degree	13.3%	11.1%	12.4%
Total	100.0%	100.0%	100.0%

Would you like to receive a copy of the survey results?

Receive a copy	Town		Total
	Mackay	Charleville	
Yes	58.0%	79.6%	66.7%
No	42.0%	20.4%	33.3%
Total	100.0%	100.0%	100.0%

Appendix 5.2. Summary Tables of Business Survey for Mackay and Charleville

The 2008 Flood

Did your business premises and its contents suffer from flood damage during February 2008?

Business premises flood damaged	Town		
	Mackay	Charleville	Total
Yes	78.7%	100.0%	83.3%
No	21.3%		16.7%
Total	100.0%	100.0%	100.0%

Did flood water enter inside your business premises?

Flood water inside premises	Town		
	Mackay	Charleville	Total
Yes	97.2%	100.0%	98.0%
No	2.8%		2.0%
Total	100.0%	100.0%	100.0%

How deep were the flood waters inside the business premises?

Depth of floodwater in mms	Town		
	Mackay	Charleville	Total
0-100mm	10.0%	18.2%	12.9%
100-500mm	55.0%	54.5%	54.8%
500-1000mm	25.0%	18.2%	22.6%
1000mm and over	10.0%	9.1%	9.7%
Total	100.0%	100.0%	100.0%

Were your business premises isolated by the flood waters?

Business premises isolated	Town		
	Mackay	Charleville	Total
Yes	85.7%	92.3%	87.5%
No	14.3%	7.7%	12.5%
Total	100.0%	100.0%	100.0%

Did your business bear any financial costs as a direct result of these floods, that were not covered by insurance (excluding loss of earnings, if any)?

Damage costs not covered by insurance	Town		
	Mackay	Charleville	Total
Yes	57.6%	91.7%	66.7%
No	42.4%	8.3%	33.3%
Total	100.0%	100.0%	100.0%

Did your business experience any financial gain as a direct result of these floods?

Financial gain from flood	Town		
	Mackay	Charleville	Total
Yes	5.7%	7.7%	6.3%
No	94.3%	92.3%	93.8%
Total	100.0%	100.0%	100.0%

Were any people in the business premises forced to leave during or after the flood?

people in the business forced to leave	Town		
	Mackay	Charleville	Total
Yes	28.6%	38.5%	31.3%
No	71.4%	61.5%	68.8%
Total	100.0%	100.0%	100.0%

Where did they go when they evacuated?

Where evacuated	Town		
	Mackay	Charleville	Total
Went home	80.0%	100.0%	85.7%
Higher ground within business	10.0%		7.1%
Temporary location	10.0%		7.1%
Total	100.0%	100.0%	100.0%

How effective do you think Council responses were to the 2008 flood event?

Council responses to 2008 flood	Town		
	Mackay	Charleville	Total
Not at all responsive	17.6%	7.7%	14.9%
A little responsive	14.7%	15.4%	14.9%
Moderately responsive	38.2%	30.8%	36.2%
Very responsive	26.5%	38.5%	29.8%
Significantly responsive	2.9%	7.7%	4.3%
Total	100.0%	100.0%	100.0%

Recovery After the Flood.

Did your staff boil all tap water until supplies were declared safe?

Boil tap water following flood	Town		
	Mackay	Charleville	Total
Yes	21.9%	25.0%	22.7%
No	78.1%	75.0%	77.3%
Total	100.0%	100.0%	100.0%

Did your company have electrical appliances checked for safety prior to continued use?

Electrical appliances checked	Town		
	Mackay	Charleville	Total
Yes	80.0%	84.6%	81.3%
No	20.0%	15.4%	18.8%
Total	100.0%	100.0%	100.0%

Did your company have electrical appliances checked for safety prior to continued use?

Members of staff sick	Town		
	Mackay	Charleville	Total
Yes	5.6%	38.5%	14.3%
No	94.4%	61.5%	85.7%
Total	100.0%	100.0%	100.0%

Precautions taken before the flood

Had you undertaken any of these flood mitigation measures before these floods?

Flood mitigation measures - business insurance	Town		
	Mackay	Charleville	Total
Yes	62.9%	42.9%	59.5%
No	37.1%	57.1%	40.5%
Total	100.0%	100.0%	100.0%

Had you undertaken any of these flood mitigation measures before these floods?

Flood mitigation measures - raised the floor level	Town		
	Mackay	Charleville	Total
Yes	5.6%	18.2%	8.5%
No	94.4%	81.8%	91.5%
Total	100.0%	100.0%	100.0%

Had you undertaken any of these flood mitigation measures before these floods?

Flood mitigation measures - maintain ditches and drains	Town		
	Mackay	Charleville	Total
Yes	37.1%	92.3%	52.1%
No	62.9%	7.7%	47.9%
Total	100.0%	100.0%	100.0%

Had you undertaken any of these flood mitigation measures before these floods?

Flood mitigation measures - avoided irreplaceable items on ground floor	Town		
	Mackay	Charleville	Total
Yes	20.0%	84.6%	37.5%
No	80.0%	15.4%	62.5%
Total	100.0%	100.0%	100.0%

Has your business undertaken (or do you intend to undertake) any of these flood prevention measures after the 2008 flood?

Flood prevention measures - business insurance	Town		
	Mackay	Charleville	Total
Yes	70.6%	37.5%	64.3%
No	29.4%	62.5%	35.7%
Total	100.0%	100.0%	100.0%

Has your business undertaken (or do you intend to undertake) any of these flood prevention measures after the 2008 flood?

Flood prevention measures - raise the floor level	Town		
	Mackay	Charleville	Total
Yes	2.8%	27.3%	8.5%
No	97.2%	72.7%	91.5%
Total	100.0%	100.0%	100.0%

Has your business undertaken (or do you intend to undertake) any of these flood prevention measures after the 2008 flood?

Flood prevention measures - maintain ditches and drain	Town		
	Mackay	Charleville	Total
Yes	54.3%	92.3%	64.6%
No	45.7%	7.7%	35.4%
Total	100.0%	100.0%	100.0%

Has your business undertaken (or do you intend to undertake) any of these flood prevention measures after the 2008 flood?

Flood prevention measures - avoid irreplaceable items on ground floor	Town		
	Mackay	Charleville	Total
Yes	60.0%	83.3%	66.0%
No	40.0%	16.7%	34.0%
Total	100.0%	100.0%	100.0%

How many times has your business experienced flooding that has caused some disruption to your usual business operations since operating at your current premises?

Times experienced flooding	Town		
	Mackay	Charleville	Total
Never been flooded	67.4%	27.3%	59.6%
One	26.1%	9.1%	22.8%
Two	4.3%	36.4%	10.5%
Three		18.2%	3.5%
Four	2.2%	9.1%	3.5%
Total	100.0%	100.0%	100.0%

Were the 2008 floods the worst (i.e. biggest impact) that you have experienced at this address?

2008 floods the worst	Town		
	Mackay	Charleville	Total
Yes	100.0%	63.6%	92.9%
No		36.4%	7.1%
Total	100.0%	100.0%	100.0%

Warnings of the January and February 2008 Floods.

Was your company aware of flood warnings issued by anyone before the flood?

flood warnings by anyone	Town		
	Mackay	Charleville	Total
Yes	14.9%	69.2%	26.7%
No	85.1%	30.8%	73.3%
Total	100.0%	100.0%	100.0%

How long before you were actually affected by the flood waters did you receive the first warning

How long before affected receive the first warning	Town		
	Mackay	Charleville	Total
I did not receive any	78.3%	9.1%	64.9%
Less than 1 hour	6.5%	18.2%	8.8%
1-6 hours	10.9%	36.4%	15.8%
7-12 hours	2.2%	9.1%	3.5%
13-24 hours		18.2%	3.5%
More than 24 hours	2.2%	9.1%	3.5%
Total	100.0%	100.0%	100.0%

From which authority did you receive warning(s)?

authority receive warning(s)	Town		
	Mackay	Charleville	Total
I did not receive any warning	74.5%	27.3%	65.5%
local council		9.1%	1.7%
Emergency services	4.3%		3.4%
BOM	14.9%		12.1%
Police		9.1%	1.7%
Fire service		9.1%	1.7%
I can't remember	2.1%	9.1%	3.4%
Other	4.3%	9.1%	5.2%
Emergency services; other		9.1%	1.7%
Local council; emergency services; fire services		18.2%	3.4%
Total	100.0%	100.0%	100.0%

How accurate do you think that the warnings and flood information for these floods was?

Accuracy of warnings and flood information	Town		
	Mackay	Charleville	Total
Accurate all of the time	4.0%		2.7%
Accurate most of the time	12.0%	41.7%	21.6%
Accurate some of the time	32.0%	33.3%	32.4%
Very often not accurate	24.0%	8.3%	18.9%
Never accurate	28.0%	16.7%	24.3%
Total	100.0%	100.0%	100.0%

Preparations Before the Flood

How prepared do you think your company was for the 2008 flood event?

prepared for the 2008 flood	Town		
	Mackay	Charleville	Total
Not at all prepared	66.0%	7.7%	53.3%
A little prepared	12.8%	30.8%	16.7%
Moderately prepared	12.8%	30.8%	16.7%
Significantly prepared	4.3%	23.1%	8.3%
Very prepared	4.3%	7.7%	5.0%
Total	100.0%	100.0%	100.0%

Did you have copies of local flood plans of the area or were your aware if your business premises are located in a flood prone area prior to the 2008 floods?

local flood plans	Town		
	Mackay	Charleville	Total
Yes	21.3%	58.3%	28.8%
No	78.7%	41.7%	71.2%
Total	100.0%	100.0%	100.0%

Did you have an Emergency Plan for your business prior to the disaster floods and if so did you use this during the 2008 floods?

emergency plan	Town		
	Mackay	Charleville	Total
Did not have an emergency plan	80.9%	36.4%	72.4%
Had emergency plan not used	14.9%	18.2%	15.5%
Had emergency plan was used	4.3%	45.5%	12.1%
Total	100.0%	100.0%	100.0%

Did you have an Emergency Kit for your business prior to the disaster floods and if so did you use this during the 2008 floods?

emergency kit	Town		
	Mackay	Charleville	Total
Did not have an emergency kit	70.2%	81.8%	72.4%
Had emergency kit not used	23.4%	18.2%	22.4%
Had emergency kit was used	6.4%		5.2%
Total	100.0%	100.0%	100.0%

Did you have an Evacuation Plan for your business prior to the disaster floods and if so did you use this during the 2008 floods?

evacuation plan	Town		
	Mackay	Charleville	Total
Did not have an emergency plan	59.6%	54.5%	58.6%
Had emergency plan not used	38.3%	18.2%	34.5%
Had emergency plan was used	2.1%	27.3%	6.9%
Total	100.0%	100.0%	100.0%

Were you aware of evacuation routes and centres for your area prior to the 2008 floods?

aware of evacuation routes and centres	Town		
	Mackay	Charleville	Total
Yes	40.4%	66.7%	45.8%
No	59.6%	33.3%	54.2%
Total	100.0%	100.0%	100.0%

Thoughts About Floods. This helps with planning for public education campaigns

How concerned do you think your company is about the risk of floods?

They think about floods	Town		
	Mackay	Charleville	Total
Not at all	15.6%		12.1%
Not much	24.4%	23.1%	24.1%
Neutral	22.2%	15.4%	20.7%
Quite a lot	31.1%	30.8%	31.0%
A great deal	6.7%	30.8%	12.1%
Total	100.0%	100.0%	100.0%

How concerned do you think your company is about the risk of floods

Talk about floods	Town		
	Mackay	Charleville	Total
Not at all	14.0%		10.7%
Not much	32.6%	15.4%	28.6%
Neutral	18.6%	15.4%	17.9%
Quite a lot	27.9%	38.5%	30.4%
A great deal	7.0%	30.8%	12.5%
Total	100.0%	100.0%	100.0%

How concerned do you think your company is about the risk of floods

Get information about floods	Town		
	Mackay	Charleville	Total
Not at all	23.8%	18.2%	22.6%
Not much	26.2%	18.2%	24.5%
Neutral	33.3%	18.2%	30.2%
Quite a lot	14.3%	18.2%	15.1%
A great deal	2.4%	27.3%	7.5%
Total	100.0%	100.0%	100.0%

How concerned do you think your company is about the risk of floods

Personal safety	Town		
	Mackay	Charleville	Total
Not at all	9.5%		7.3%
Not much	38.1%	30.8%	36.4%
Neutral	40.5%	23.1%	36.4%
Quite a lot	9.5%	23.1%	12.7%
A great deal	2.4%	23.1%	7.3%
Total	100.0%	100.0%	100.0%

How concerned do you think your company is about the risk of floods?

Business activities	Town		
	Mackay	Charleville	Total
Not at all	4.5%		3.5%
Not much	18.2%	7.7%	15.8%
Neutral	22.7%	15.4%	21.1%
Quite a lot	27.3%	23.1%	26.3%
A great deal	27.3%	53.8%	33.3%
Total	100.0%	100.0%	100.0%

How prepared do you believe the following groups are for future floods affecting your community?

Your business	Town		
	Mackay	Charleville	Total
Very prepared	23.9%	30.8%	25.4%
Somewhat prepared	58.7%	69.2%	61.0%
Not very prepared	8.7%		6.8%
Not at all prepared	8.7%		6.8%
Total	100.0%	100.0%	100.0%

How prepared do you believe the following groups are for future floods affecting your community?

Your community	Town		
	Mackay	Charleville	Total
Very prepared	10.9%		8.5%
Somewhat prepared	47.8%	69.2%	52.5%
Not very prepared	28.3%	15.4%	25.4%
Not at all prepared	6.5%		5.1%
Don't know	6.5%	15.4%	8.5%
Total	100.0%	100.0%	100.0%

How prepared do you believe the following groups are for future floods affecting your community?

Local Government	Town		
	Mackay	Charleville	Total
Very prepared	13.0%	23.1%	15.3%
Somewhat prepared	41.3%	30.8%	39.0%
Not very prepared	19.6%	23.1%	20.3%
Not at all prepared	10.9%	7.7%	10.2%
Don't know	15.2%	15.4%	15.3%
Total	100.0%	100.0%	100.0%

How prepared do you believe the following groups are for future floods affecting your community?

local hospital	Town		
	Mackay	Charleville	Total
Very prepared	19.6%	61.5%	28.8%
Somewhat prepared	47.8%	30.8%	44.1%
Not very prepared	13.0%		10.2%
Not at all prepared	6.5%		5.1%
Don't know	13.0%	7.7%	11.9%
Total	100.0%	100.0%	100.0%

How prepared do you believe the following groups are for future floods affecting your community?

State Government	Town		
	Mackay	Charleville	Total
Very prepared	32.6%	69.2%	40.7%
Somewhat prepared	50.0%	15.4%	42.4%
Not very prepared	2.2%	7.7%	3.4%
Not at all prepared	15.2%	7.7%	13.6%
Total	100.0%	100.0%	100.0%

How prepared do you believe the following groups are for future floods affecting your community?

Commonwealth Government	Town		
	Mackay	Charleville	Total
Very prepared	17.4%	38.5%	22.0%
Somewhat prepared	47.8%	23.1%	42.4%
Not very prepared	13.0%	15.4%	13.6%
Not at all prepared	4.3%		3.4%
Don't know	17.4%	23.1%	18.6%
Total	100.0%	100.0%	100.0%

How prepared do you believe the following groups are for future floods affecting your community?

BOM	Town		
	Mackay	Charleville	Total
Very prepared	34.8%	50.0%	37.9%
Somewhat prepared	45.7%	33.3%	43.1%
Not very prepared	6.5%		5.2%
Not at all prepared	13.0%	16.7%	13.8%
Total	100.0%	100.0%	100.0%

How prepared do you believe the following groups are for future floods affecting your community?

Utilities providers	Town		
	Mackay	Charleville	Total
Very prepared	8.7%	30.8%	13.6%
Somewhat prepared	54.3%	53.8%	54.2%
Not very prepared	19.6%	7.7%	16.9%
Not at all prepared	2.2%		1.7%
Don't know	15.2%	7.7%	13.6%
Total	100.0%	100.0%	100.0%

How prepared do you believe the following groups are for future floods affecting your community?

Social welfare organisations	Town		
	Mackay	Charleville	Total
Very prepared	30.4%	38.5%	32.2%
Somewhat prepared	43.5%	38.5%	42.4%
Not very prepared	8.7%		6.8%
Not at all prepared	2.2%		1.7%
Don't know	15.2%	23.1%	16.9%
Total	100.0%	100.0%	100.0%

As a result of these floods does your company intend to?

Does your company intend to - seek information on floods	Town		Total
	Mackay	Charleville	
No	33.3%	36.4%	33.9%
Possibly	48.9%	45.5%	48.2%
Definitely	17.8%	18.2%	17.9%
Total	100.0%	100.0%	100.0%

As a result of these floods does your company intend to?

Does your company intend to - seek information to prepare	Town		
	Mackay	Charleville	Total
No	28.9%	33.3%	29.8%
Possibly	48.9%	41.7%	47.4%
Definitely	22.2%	25.0%	22.8%
Total	100.0%	100.0%	100.0%

As a result of these floods does your company intend to?

Does your company intend to - increase level of insurance	Town		
	Mackay	Charleville	Total
No	43.2%	50.0%	44.4%
Possibly	25.0%	30.0%	25.9%
Definitely	31.8%	20.0%	29.6%
Total	100.0%	100.0%	100.0%

As a result of these floods does your company intend to?

Does your company intend to - raise the floor level	Town		
	Mackay	Charleville	Total
No	90.5%	81.8%	88.7%
Possibly	7.1%	9.1%	7.5%
Definitely	2.4%	9.1%	3.8%
Total	100.0%	100.0%	100.0%

As a result of these floods does your company intend to?

Does your company intend to - involve with a local group	Town		
	Mackay	Charleville	Total
No	69.8%	46.2%	64.3%
Possibly	25.6%	38.5%	28.6%
Definitely	4.7%	15.4%	7.1%
Total	100.0%	100.0%	100.0%

Whose responsibility you believe it is to protect us from floods?

Whose responsibility to protect from floods - commonwealth government	Town		
	Mackay	Charleville	Total
Not at all	12.8%		10.0%
Not much	12.8%		10.0%
Neutral	28.2%	9.1%	24.0%
Quite a lot	25.6%	36.4%	28.0%
A great deal	20.5%	54.5%	28.0%
Total	100.0%	100.0%	100.0%

Whose responsibility you believe it is to protect us from floods?

Whose responsibility to protect from floods - state government	Town		
	Mackay	Charleville	Total
Not at all	9.5%		7.5%
Not much	7.1%		5.7%
Neutral	14.3%	9.1%	13.2%
Quite a lot	38.1%	45.5%	39.6%
A great deal	31.0%	45.5%	34.0%
Total	100.0%	100.0%	100.0%

Whose responsibility you believe it is to protect us from floods?

Whose responsibility to protect from floods - local council	Town		
	Mackay	Charleville	Total
Not at all	7.0%	7.7%	7.1%
Not much	14.0%		10.7%
Neutral	20.9%	30.8%	23.2%
Quite a lot	58.1%	61.5%	58.9%
Total	100.0%	100.0%	100.0%

Whose responsibility you believe it is to protect us from floods

Whose responsibility to protect from floods - individual businesses	Town		
	Mackay	Charleville	Total
Not at all	7.3%	9.1%	7.7%
Not much	4.9%	9.1%	5.8%
Neutral	31.7%	18.2%	28.8%
Quite a lot	29.3%	45.5%	32.7%
A great deal	26.8%	18.2%	25.0%
Total	100.0%	100.0%	100.0%

Whose responsibility you believe it is to protect us from floods

Whose responsibility to protect from floods - no use preparing	Town		
	Mackay	Charleville	Total
Not at all	27.0%	37.5%	28.9%
Not much	5.4%		4.4%
Neutral	35.1%	12.5%	31.1%
Quite a lot	16.2%	25.0%	17.8%
A great deal	16.2%	25.0%	17.8%
Total	100.0%	100.0%	100.0%

Which, if any, volunteer organisations are you or your staff involved in?

Volunteer organisations	Town		
	Mackay	Charleville	Total
SES	9.1%	7.7%	8.8%
Volunteer fire brigade	6.8%	30.8%	12.3%
Lions	6.8%		5.3%
Rotary		15.4%	3.5%
None	77.3%	46.2%	70.2%
Total	100.0%	100.0%	100.0%

To what extent might each of the following prevent your company from preparing for floods?

Prevent your company from	Town		
	Mackay	Charleville	Total
Not at all	27.5%	23.1%	26.4%
Not much	7.5%	7.7%	7.5%
Neutral	25.0%	23.1%	24.5%
Quite a lot	27.5%	7.7%	22.6%
A great deal	12.5%	38.5%	18.9%
Total	100.0%	100.0%	100.0%

To what extent might each of the following prevent your company from preparing for floods?

Prevent your company from preparing for floods - skills	Town		
	Mackay	Charleville	Total
Not at all	29.3%	36.4%	30.8%
Not much	9.8%	9.1%	9.6%
Neutral	31.7%	45.5%	34.6%
Quite a lot	24.4%	9.1%	21.2%
A great deal	4.9%		3.8%
Total	100.0%	100.0%	100.0%

To what extent might each of the following prevent your company from preparing for floods?

Prevent your company from preparing for floods - others things to think about	Town		
	Mackay	Charleville	Total
Not at all	28.2%	41.7%	31.4%
Not much	10.3%	8.3%	9.8%
Neutral	33.3%	25.0%	31.4%
Quite a lot	12.8%	16.7%	13.7%
A great deal	15.4%	8.3%	13.7%
Total	100.0%	100.0%	100.0%

To what extent might each of the following prevent your company from preparing for floods?

Prevent your company from preparing for floods - cooperation with others	Town		
	Mackay	Charleville	Total
Not at all	26.3%	50.0%	30.4%
Not much	10.5%		8.7%
Neutral	36.8%		30.4%
Quite a lot	23.7%	25.0%	23.9%
A great deal	2.6%	25.0%	6.5%
Total	100.0%	100.0%	100.0%

To what extent do you think that?

Extent that - floods are too destructive	Town		
	Mackay	Charleville	Total
Not at all	28.6%	72.7%	37.7%
Not much	19.0%		15.1%
Neutral	35.7%	18.2%	32.1%
Quite a lot	16.7%	9.1%	15.1%
Total	100.0%	100.0%	100.0%

To what extent do you think that?

Flood is unlikely to occur	Town		
	Mackay	Charleville	Total
Not at all	36.6%	90.9%	48.1%
Not much	17.1%		13.5%
Neutral	31.7%		25.0%
Quite a lot	14.6%		11.5%
A great deal		9.1%	1.9%
Total	100.0%	100.0%	100.0%

To what extent do you think that?

Unnecessary to prepare for floods	Town		
	Mackay	Charleville	Total
Not at all	55.0%	81.8%	60.8%
Not much	15.0%	18.2%	15.7%
Neutral	25.0%		19.6%
Quite a lot	5.0%		3.9%
Total	100.0%	100.0%	100.0%

To what extent do you think that?

Damaging floods could occur	Town		
	Mackay	Charleville	Total
Not at all	4.5%	7.7%	5.3%
Not much	20.5%		15.8%
Neutral	54.5%	23.1%	47.4%
Quite a lot	20.5%	69.2%	31.6%
Total	100.0%	100.0%	100.0%

To what extent do you think that?

Business may move to different part of town	Town		
	Mackay	Charleville	Total
Not at all	54.8%	90.9%	62.3%
Not much	9.5%	9.1%	9.4%
Neutral	14.3%		11.3%
Quite a lot	19.0%		15.1%
A great deal	2.4%		1.9%
Total	100.0%	100.0%	100.0%

To what extent do you think that?

Business may move to different town	Town		
	Mackay	Charleville	Total
Not at all	85.4%	81.8%	84.6%
Not much	7.3%		5.8%
Neutral	7.3%		5.8%
Quite a lot		9.1%	1.9%
A great deal		9.1%	1.9%
Total	100.0%	100.0%	100.0%

Basic Demographic Information about you and your Business

Position in business

Position in Business	Town		
	Mackay	Charleville	Total
Manager	45.7%	27.3%	42.1%
Director/ owner	41.3%	63.6%	45.6%
Administration	10.9%		8.8%
Other employee	2.2%	9.1%	3.5%
Total	100.0%	100.0%	100.0%

Gender of respondent

Gender	Town		
	Mackay	Charleville	Total
Male	61.7%	30.8%	55.0%
Female	38.3%	69.2%	45.0%
Total	100.0%	100.0%	100.0%

Ethnicity of respondent

Ethnicity	Town		
	Mackay	Charleville	Total
Pacific islander origin	4.3%		3.5%
None of these	95.7%	100.0%	96.5%
Total	100.0%	100.0%	100.0%

Highest educational qualification of respondent

Highest educational qualification	Town		
	Mackay	Charleville	Total
No school qualifications	2.2%		1.7%
School qualifications	39.1%	46.2%	40.7%
Trade certificate	28.3%	30.8%	28.8%
Professional certificate or diploma	21.7%	7.7%	18.6%
Undergraduate or postgraduate degree	8.7%	15.4%	10.2%
Total	100.0%	100.0%	100.0%

How long has your business operated from its current premises?

Long business has operated from	Town		
	Mackay	Charleville	Total
1-5 years	41.9%	27.3%	38.9%
6-10 years	25.6%	18.2%	24.1%
More than 10	32.6%	54.5%	37.0%
Total	100.0%	100.0%	100.0%

Type of Business

Type of business	Town		
	Mackay	Charleville	Total
Retail	60.0%	76.9%	63.8%
Skilled trade	28.9%	23.1%	27.6%
Estate agent	2.2%		1.7%
Financial	4.4%		3.4%
Residential aged	2.2%		1.7%
Airport	2.2%		1.7%
Total	100.0%	100.0%	100.0%

Would you like to receive a copy of the survey results?

Copy of the survey	Town		
	Mackay	Charleville	Total
Yes	63.0%	92.3%	69.5%
No	37.0%	7.7%	30.5%
Total	100.0%	100.0%	100.0%

Appendix 5.3. Additional Comments Made By Householders About The Flood Events During Interviews

Charleville Householders

- *Flood waters came so quick no chance to prepare;*
- *Away at time of flood, came back when safe. Did not get insurance but received Red Cross payments. Major failing of the Council is that they did not provide a path for the gully water to drain into the river. A system is needed to keep drains open and implement more drainage;*
- *In the 2008 flood, we were told the gully had peaked on that day. We were awaken at about 4am and the water was already 1.5 foot through our yard. Still left wondering why we were alerted after the water was in our yard. Not nice feeling to be awaken and find the gully in our yard. The levee has eased a few fears of flood from the river;*
- *For the situation at the time my family and I were quite organised and had a place to go. Clean up was not pretty;*
- *Question, not representative. Confusion: response from insurance, which area, etc.*
- *Emotional and mental health;*
- *Pipe, Council not fixing gully, levee;*
- *Levee;*
- *Fix pipes and levee bank;*
- *Murweh Shire Council should look into diverting Bradley's Gully as that is where all our floodwater came from in 2008;*
- *Need to expand pipes in levee bank;*
- *More flood-proof bridges across gully;*
- *Council: more action on drainage. 750mm pipe!;*
- *Council actions detrimental to people's well-being. Mental anxiety and depression. Catchment management cause of problem, not recognised. Mayor fails to recognise long-term knowledge. Poor financial management over at least 4 preceding Council terms. Levee poorly designed and failed, does not divert upper reaches into river;*
- *Fix the gully;*
- *Divert Bradley's Gully into the river east of the town;*
- *Floods are unavoidable and you just have to deal with it as best as possible;*
- *There are two threats in Charleville - the river and the gully - when the river is full and heavy rain falls in the catchment to the gully it floods quickly. This has become worse over the years as the catchment is close to town and the land has been cleared extensively - the process happens quicker now. The levee bank has provided new problems as occurred in the 2008 floods with areas affected worse than they had been previously. The river was not such a threat this time but information was not easy too obtain e.g. the leaders of the community were not prepared to advise people to leave or stay - just give river heights and you make up your own mind. Directions had been clearer in previous floods. Media made things worse - waiting for a catastrophe;*
- *I think local and state governments should make greater efforts in the following areas. Allowing new development in flood-prone areas (shouldn't happen) and allowing development to occur on or near rivers, creeks and other watercourses (shouldn't happen). Reducing silt loads in river and creeks by addressing overgrazing, land clearing and other land uses that affect watercourses;*
- *Safety issues - exceptions made/to be reviewed in disaster situations. 2008 blamed the levee bank, 1963 flood, 1973 flood, not agree with the general view that levee bank is the cause of 2008 floods;*
- *People voluntarily help each other a lot during floods;*
- *Gully - need a big pipe (not small as at present). Husband first-hand experience about the volume of water and this is reliable information;*
- *Council caused the flood (with bad engineering). Man-made flood because of the levee bank construction. Overall good job for levee but not for gully flood; and*
- *Council caused flood (due to smaller drain pipe).*

Mackay Householders

- *Poorly designed & maintained drainage;*
- *Flood maps show that area was second last place to flood;*
- *Council need to fix drains, past floods, flood maps no good;*
- *Floods affected pets as well;*
- *Jane Creek full of rubbish. Culverts are too small to cope;*
- *Local Council need to move flood waters;*
- *The Jones Creek bridge over Bruce Highway needs to be cleaned out;*
- *The speed of the flood waters;*
- *Told by the council they were in zone 8 unlikely to flood;*
- *Unavoidable due to the amount of rainfall;*
- *Clean the creek behind house;*
- *Council and developers should complete drainage plans;*
- *Was hospitalized due to the flood;*
- *Not possible to prepare for the flood due to speed of the water rising;*
- *Annoyed with council for water bill for cleaning their house;*
- *Floods caused by a once in lifetime rainfall;*
- *Flooding can be prevented in future by local and state governments;*
- *Flood came in the early hours no way the authorities could have warned people;*
- *No chance of reaching evacuation centres due to rising water;*
- *No way to prevent the flood after that much rain;*
- *Red Cross and Salvos were great maybe Local Government could learn from them;*
- *Worse flood for the 37 years she has lived here;*
- *Yard flooded but not really affected by the flood;*
- *Area is a flood free zone according to Council;*
- *Local council is responsible;*
- *Waterways must be kept clear;*
- *No improvements to drainage since flood;*

Appendix 5.4. Other Comments Made By Businesses

Mackay businesses:

- *Flood happened early in the morning nothing could have been done;*
- *Thanks to those for producing this survey;*
- *Unable to get to the store on the day of the flood;*
- *Too much rain in 5 hours, no chance to prepare;*
- *Council don't clear and maintain the drains;*
- *No one could have been fully prepared for flood;*
- *Flood happened quickly - no time to prepare; and*
- *As flood water didn't enter premises not eligible for assistance.*

Charleville businesses:

- *Levee bank blocked natural flow of gully to river leading to an unnecessary flood;*
- *No warning from SES or Council. This business checks the heights in the gully themselves. A phone call could have been good. Railway and Council came in with trucks and people to help;*
- *Divert the gully Please! When the levee was built back up stream, it blocked the water from the gully getting over to the river, the pipes were not big enough;*
- *Stormwater drains do not drain on the corner of Parry and Wills Street and the drains are fed by the gully;*
- *Gully cleaned up more and cleared out more. Be a good thing if commercial premises are able to get flood insurance. No commercial insurance was available for floods in Charleville after the 1990 flood. After the levee bank was constructed it is not proven yet, so still no insurance. They have tried unsuccessfully every broker in Australia to obtain flood insurance;*
- *Pump the water over the levee with one, one foot portable pump used for irrigating. Make sure that a hole is there to get the volume of water out. A reservoir needs to be built of about 2 megalitres. If the level of the river rises to threaten the gully, then this process (described above) could not be used. The one foot pump would be valued at around $500,000 and could be sourced e.g., from Cubby station or the Murray Darling Basin, e.g., a second-hand pump may be able to be obtained for e.g., $100,000. It was suggested that the current system could be used as the backup system;*
- *Husband caught Barma Forest Fever after the flood. Media could be managed better. Fear and an element of doom was spread. Should report facts and provide info. No assistance to cope with the flood, damage and potential loss;*
- *We were treated as failures because river did not bust the levee bank and wreck havoc. Having a levee was dictated to us by the State and Federal Govt and this enhanced the flood damage. Channelled and changed natural water courses*
- *Building was inundated before the sirens went off, we only saved a couple of things, could not get an answer about how much more was coming. Prison camp was great help and quick. Fortunate fuel stored in underground tanks was untouched and the old pumps worked. Older stuff survived better;*
- *Our business premises is heritage-listed and cannot be insured in Australia and hence is insured through an overseas company, who used every means not to pay; and*
- *Losing all the motel rooms was very costly. Water damage continued to be ongoing due to moisture rising and continuing to destroy more stock. Prison camp was great and quick in helping us. We felt forgotten by authorities. Our flat in the building had water in it. Had to ring the Major and CEO to get some assistance.*

Appendix 5.5. Other Comments from Institutions in Charleville

Additional comments made by institutions in Charleville included the following:

- *The Red Cross were the first there; they were very well-organised;*
- *The SES is well prepared;*
- *The 2008 levee was marvellous;*
- *Most people here are comfortable with floods and can be on their own for a week, they have their own generators (e.g., in rural areas), not a problem*
- *The communication network between people goes for a couple of hundred kilometers, people keep each other informed;*
- *Everyone seemed to cope during the flood. No one was angry;*
- *The Council has been proactive with cleaning the Gully and building the levy;*
- *With the levee bank now it feels safer and the way the gully has been cleaned and widened has helped. People feel safer;*
- *The Queensland Ambulance Service does not have access to helicopters, making it hard to access people due to flooding on the roads and driving their cars in these conditions;*
- *A lot of people still talk about the flood. There was a psychological impact. The 1990 flood could still be having a psychological effect;*
- *Private business is very fragile;*
- *Flooding in the lower parts of Charleville is hard mentally and financially on people;*
- *This town is pretty up to speed, know what they are doing, they are well-rehearsed;*
- *In Charleville they have a good network and people have lived through floods, been there done that;*
- *Organisations and members of the Charleville community are well-prepared;*
- *Lessons were learned from the 1990 and 1997 floods. In the 1990 flood there was no communication. The 2008 flood ran so smooth. Inspectors were bought into Charleville for the 2008 flood who were here during the previous flood;*
- *We have improved since the 2008 flood. We learn from every process. They are conditioned to expect the unexpected. The 1990 flood kept the town alive, it made the SES etc work together. Disaster bought the people together;*
- *Potential lessons learned;*
- *Queensland Health need to be listening to instructions given by the State Emergency Coordinator and not waiting to make their own decision;*
- *Sometimes the opinions and experience of the older residents who have experience with the floods is not listened to;*
- *The recovery stage of a flood event needs a bit more work and improvement*
- *More areas are being opened up now on higher ground;*
- *There were instances of rorting (cheating) the flood relief system. Maybe staff brought in from outside the local area reported properties as being flood-affected when in fact they suffered from poor maintenance;*
- *There are concerns about building in the gully. Itinerant town - people are still building on the gully. Lesson learned is don't build in the flood-prone area*
- *The 1997 flood was well run. In 1990 a few left but they came back; and*
- *Prisoners are now seen as an asset to the community, due to their help in the flood event.*

Suggestions for future actions:

- *SMS messages could be a good way, another way to communicate with people*
- *A new engineer or community presence to clear the gully;*
- *More interpreters in town would be good;*
- *Since the 1990 flood, the gully has been widened but not tested and has been cleaned out;*
- *The community has made suggestions that the Council should clean out the gully and make it wider, 3 times wider in some areas; and*
- *A move away further from town.*

Appendix 5.6. Respondent Comments on SPP 1/03

Comments by Charleville businesses as to how the SPP could be improved included the following:

- *Need more outlet pipes in levee bank to allow the gully excess to flow into the river;*
- *Pumps or bigger openings in the levee bank; and*
- *Survey town drainage again and divert some gully water.*

Mackay businesses felt the SPP could be improved by:

- *Cleaning drains;*
- *Removing the Highway Dam;*
- *Stop building in flood prone areas;*
- *Better drainage;*
- *Council to clear out drains;*
- *Better drainage; and*
- *Better assessment of drainage requirements.*

For institutions in Charleville, only one specific comment was made about improving the SPP:
"*The legal system needs to be the backing for the local government. If local government rejects an application, the point of people appealing is a waste. More linkages are needed between the SPP 1/03 Guideline and the Sustainable Planning Policy (new name for the Integrated Planning Act) to give local government more teeth to put the matters in place. When they are not up to scratch, then the legal system is used*."

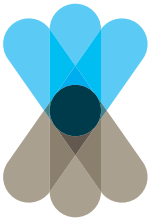
The study revealed that mitigation activities that were considered *could have been done* to better prepare for floods in Charleville would have cost around $600,000, and have included:

- *De-silting Bradley's Gully (estimated cost $500,000); and*
- *Installing more river height reading stations on Bradley's Creek and the Warrego River and also on the Nieve River (estimated cost $50,000-$100,000).*

Institutions in Charleville generally reviewed their mitigation planning annually, with one organisation reviewing it quarterly, including meetings and training. Such planning is also carried out at event times when floods occurred, as part of disaster management planning and community recovery meetings and training, at Local and District Disaster Committee Meetings, and in conjunction with OH&S planning.
Only one organisation in Charleville felt their mitigation planning needed improving, and this would involve:

- *Installing more warning devices upstream in Warrego River;*
- *Better flood mapping including GIS data;*
- *Delivering community education programs and training for SES volunteers; and*
- *Regular monitoring, clearing and de-silting of the river and Bradley's Gully.*

The initial cost of implementing these mitigation activities is estimated at $2 million, with a recurrent cost of $100,000.



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