James Cook University
School of TESAG

ARE THE KNOWLEDGEABLE BETTER PREPARED IN THE EVENT OF A CYCLONE?

ASSESSING CYCLONE VULNERABILITY IN SOUTH TOWNSVILLE AND RAILWAY ESTATE

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Executive Summary

Although a better knowledge disasters and threats they pose to the local environment is assumed to lead to better preparation in the face of disasters, there appears to have been little research examining the relationship between the two. This report attempts to quantify this relationship, if it exists, based on a random sample of 80 households within the two Townsville suburbs of Railway Estate and South Townsville. Analysis of survey data revealed that respondents generally had a limited knowledge and awareness of local cyclone vulnerability and had carried out little preparatory action. A relationship between knowledge and preparation could not be conclusively determined, because whether respondents decided to take these actions or not seemed to depend very much on their own perceptions and understanding of the risk.

This report provides some insight into how increased cyclone knowledge does not necessarily lead to increased preparedness and a reduction in the vulnerability of residents of South Townsville and Railway Estate to tropical cyclone and storm surge hazards, but is influenced by many external factors, including a range of community specific attributes and characteristics that form the basis of an individual's perception of risk. Cyclone awareness education should therefore be aimed largely at defining and explaining the risk in an interactive way if it is to be effective in encouraging risk minimising and preparedness behaviours.

Background

Tropical cyclones and associated storm surge represent the most significant natural hazard threat to north Queensland coastal communities. These intense, low pressure systems usually form over the warm ocean waters at low latitudes in the Coral Sea during the tropical monsoon season between the months of November and April and can vary immensely in intensity, speed, destructive power and path (BOM and EMA, 2005). The extreme winds generated tropical cyclones are usually accompanied by heavy rain that can produce extensive flooding, exacerbated by a storm surge where the cyclone crosses the coast. This wind driven, raised dome of ocean water may be up to five metres higher than the normal tide level, and if it occurs at the same time as a high tide it may cause extensive inundation of coastal areas. Based on central pressure and estimated wind strength, Australian tropical cyclones are rated in categories from 1 being the least severe to 5 being the most severe (Figure 1).

Category	Strongest Gust (km/h)	Typical Effects (indicative only)
1 (Tropical Cyclone)	Less than 125 (Gales)	Negligible house damage. Damage to some crops, trees and caravans. Craft may drag moorings.
2 (Tropical Cyclone)	125-169 (Destructive winds)	Minor house damage. Significant damage to signs, trees and caravans. Heavy damage to some crops. Risk of power failure. Small craft may break moorings.
3 (Severe Tropical Cyclone eg. *Roma*)	170-224 (Very destructive winds)	Some roof and structural damage. Some caravans destroyed. Power failure likely.
4 (Severe Tropical Cyclone eg. *Tracy*)	225-279 (Very destructive winds)	Significant roofing loss and structural damage. Many caravans destroyed and blown away. Dangerous airborne debris. Widespread power failures.
5 (Severe Tropical Cyclone eg. *Vance*)	More than 280 (Very destructive winds)	Extremely dangerous with widespread destruction.

Figure 1: Cyclone Categories
(Source: BOM and EMA, 2005)

Over the last 130 years north Queensland has experienced 47 severe tropical cyclones resulting in 393 recorded deaths and millions of dollars in property loss (Nott, 2003). However, of these, only one has been a category 5 and two have been a category 4, and meteorologists and researchers agree that the last century has been relatively quiet in terms of cyclone activity cycles (Nott and Hayne, 2001; Smithson, 1993). Indeed, the major cause of increasing cost of natural disasters is not so much the increased frequency or severity of natural hazards, but the growth and expansion of population, industry and agriculture into more marginal areas that concentrate infrastructure and property in vulnerable floodplains and the coastal fringe (King, 2004).

The relative rarity and lack of familiarity with these extreme events has led to a relatively blasé attitude towards the severity and consequences of the cyclone hazard present in many north Queensland communities with the assumption that they are unlikely ever to occur within the lifetime of many individuals (Anderson-Berry, 2003; Nott, 2003). This unfortunate misconception has guided construction of dwellings in areas extremely vulnerable to the possible threat of cyclones, commonly in areas less than a few metres above mean sea-level and well within the zone of possible storm tide inundation. As shown in Figure 2, the Townsville suburbs of Railway Estate and

South Townsville, used as the basis for this study, lie within this area vulnerable to storm surge.

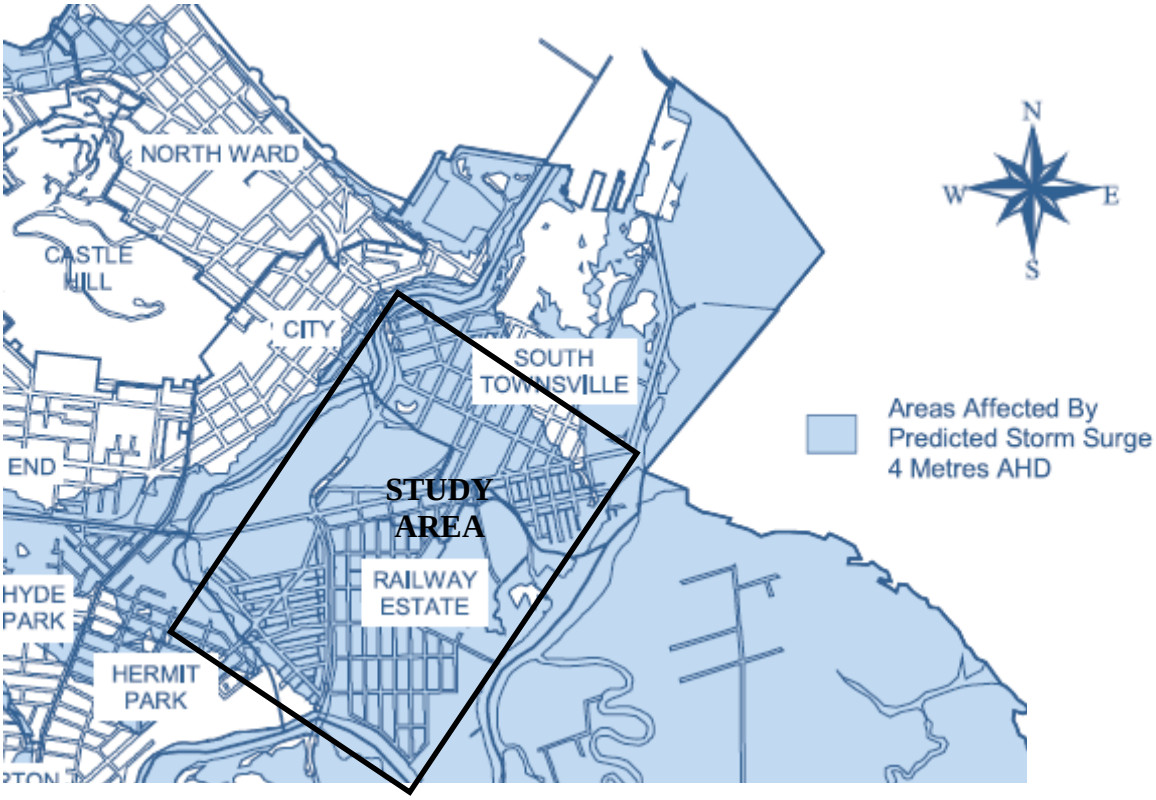

Figure 2: Townsville Storm Surge Map
Source: Townsville City Council, 2005

Tropical cyclones, like other natural hazards are not, in themselves, disasters (Hewitt, 1997). In their most general form, natural disasters are the result of the interaction between a natural hazard and a vulnerable human community. Thus a natural hazard becomes a disaster when a vulnerable individual or community is impacted (Hewitt, 1997; Buckle, 1999). At its simplest, vulnerability has been conceptualised as a pre-existing set of attributes that make people or communities more, or less, susceptible to loss (King, 2000).

In the Australian emergency management context, vulnerability is defined as "the degree of susceptibility and resilience of the community and environment to hazards" (Emergency Management Australia, 2000). Blaikie *et al.* (1994) builds on this definition by arguing that vulnerability can be reasonably defined by the characteristics of individuals or communities in terms of their capacity to anticipate, cope with, resist and recover from the impact of a hazard. The hazard event is no longer viewed as the primary cause of loss and instead focus is directed towards the human community and people's living conditions, social and economic resources, livelihood patterns and social power and includes a consideration of resilience, a more empowering concept (King, 2002). It is, therefore, the vulnerability of the community that determines its residents' susceptibility to loss and harm in the event of hazard impact.

Community vulnerability does not remain static, but is dynamic and ever-changing, due to the complex relationships and inter-relationships arising from the unique actions and interactions of the social, community and demographic attributes and characteristics of a particular population (Buckle, 1999). An appreciation of vulnerability is therefore central to risk management and to the development of hazard mitigation strategies (Anderson-Berry and King, 2005). In combination, these form the basis of community, family and individual knowledge, understanding and life processes that gives rise to the individual and community perception of risk (Drabek, 1986).

Risk perception is an important component that may complicate the relationship between knowledge and action. Mathematically, risk is the product of all potential hazard events and the vulnerability of the exposed elements at risk (Buckle et al., 2000; King 2000). That, is:

Total Risk = Hazard x Elements at Risk x Vulnerability

Individuals and communities make decisions on what precautionary measures will be undertaken to ensure that loss resulting from a hazard event is limited to an 'acceptable' level based on the level of risk they perceive to be associated with these events (Smith, 1996; Berry and King, 1998). If perceived risk accurately portrays the actual risk associated with a particular hazard, then mitigation strategies and response preparedness are likely to be appropriate and vulnerability can be minimised. If risk perception is biased, the reverse is true and vulnerability may be increased (Anderson-Berry, 2003). In relation to the question under investigation, where individuals have a good cyclone awareness, but are risk taking, they may have a lower preparedness than individuals who may have a poor cyclone awareness, but are risk averse. This has the potential to cause anomalies within the data set, especially as it is very difficult to determine the risk-taking nature of respondents based purely on the survey results.

Research undertaken by staff at James Cook University's Centre for Disaster Studies in the tropical cyclone prone north of Australia has gathered extensive datasets on community awareness, preparedness and knowledge, in order to contribute to education campaigns and mitigation strategies (see Anderson-Berry, 2003; Berry, 1999). One of these longitudinal studies has involved the cyclone-prone Cairns community over a period of several years (Anderson-Berry, 2003). Generally, there has been a lack of awareness of the local hazard and a failure to prepare adequately (Berry and King, 1998). These and other findings derived from this study have contributed to mitigation through education, improving awareness and preparedness, and directing behavioural change throughout the cyclone-prone regions of northern Australia.

The focus of cyclone mitigation has been the improved awareness and preparedness of the general population to improve their resilience in coping with disasters (Anderson-Berry and King, 2005). To aid in this, Anderson-Berry (2002) has developed a community vulnerability and capacity model that may be applied to any community in order to assess levels of capability to mitigate and deal with the cyclone hazard (Figure 3). This diagram shows that through societal and community structures, vulnerability to natural hazards may be reduced through hazard education and effective warnings (King, 2004). However, this transfer of information is a

complex process where the media and the general public select, reinterpret, and weigh up meteorological and hazard information, applying a complex set of attitudes, perceptions, experiences, biases and misinformation to the initial message (King, 2004).

Figure 3: Community Vulnerability and Capacity
Source: Anderson-Berry, 2002

Preparedness is widely known to be a factor that reduces vulnerability (Faupel, Kelee and Petee., 1992). Although much emphasis is placed on the importance of individual preparedness in the face of natural disasters and extensive community education to improve the long-term resilience of communities, little if any research has been conducted to ascertain whether a relationship exists between the two. However, one such study to investigate this was conducted by Faupel, Kellee and Petee (1992), which investigated the impact of disaster education on hurricane preparedness among residents in Charleston, South Carolina. The article examines the impact of participation in disaster education programs generally, but also takes this further to investigate the impact of hurricane experience as a type of education. Two indices of preparedness are used: household planning activities and adaptive response activities. The major finding was that participation in some type of disaster education program is strongly related to the preparedness measures undertaken. Although the framework and methodologies for the study were far removed from those undertaken to produce this report, the general findings from Faupel, Kellee and Petee's 1992 study are still applicable in that they indicate the possible effects of education on preparation measures and ways that these can be improved to reduce community vulnerability to tropical cyclones.

Aims, Objectives and Hypothesis

Aim:
To determine whether knowledge of tropical cyclone processes and potential threats influences the precautionary measures that people will take to prepare for a possible cyclone/storm surge event.

Objectives:
Analyse a second-hand data set in order to–

1. Ascertain the potential cyclone risk for residents living in South Townsville and Railway Estate;

2. Determine the level of knowledge of cyclone processes and threats displayed by residents of South Townsville and Railway Estate; and
3. Determine what precautionary measures people in South Townsville and Railway Estate have taken to prepare for the upcoming cyclone season.

Hypothesis:
People who have a better knowledge and understanding of cyclone processes and potential threats are more likely to take precautionary action than those who have a limited understanding of such processes and threats.

Methodology

In order to transfer the data used for this report from raw field data into a useful format, where meaningful conclusions and recommendations can be made, three main steps were undertaken:

Data collection in the field

A survey, composed of 96 questions multiple choice and short answer responses (for full copy of survey see Appendix A) was distributed to a random selection of 80 residences in Townsville suburbs of South Townsville and Railway Estate. Although an extensive questionnaire, it was drafted in such a way as to lead thinking naturally from one area to the next. The survey, written by a post-graduate student of James Cook University (JCU), was distributed at the onset of the 2001 cyclone season (early December) in order to determine the vulnerability of South Townsville and Railway Estate communities to cyclones and storm surge. The surveys were left at the premises to be completed at the respondent's convenience over the weekend to be collected on Monday 10th December.

Data entry

In 2005, the raw data was entered into the computer program SPSS by two fourth year Urban Planning students of JCU as part of their minor project. Several variables were recoded.

Data processing and analysis

Data was analysed by third and fifth year JCU students undertaking the subject EV3606/5606 Disasters: vulnerability, mitigation and planning, where each student chose an aspect to specialise in. In the case of this report, in order to achieve the aim mentioned previously, the analysis consisted of three parts:

i. Analysis of the level of cyclone knowledge of respondents;
ii. Analysis of the level of precautionary measures taken to prepare for the upcoming cyclone season; and
iii. Critical evaluation of the results obtained in i. and ii. to determine if any relationships or correlations are evident between the two.

To allow for analysis as described above, much of the data in SPSS had to be recoded from string to numeric. Although this lost detail, coding the data in categories with similar responses was the only way that relationships could be investigated. To statistical identify any relationships that existed and thus what relationships in particular should be investigated, using the program SPSS (Statistical Package for the Social Sciences) Pearson's Correlation Coefficients were calculated to quantitatively determine the existence, strength and direction

(positive or negative) of any correlations between the variables. However, only those variables that could be recoded either into ordinal data or be given a classification where 1=correct, 2=partly correct and 3=incorrect for knowledge questions (where those scoring 1 are more knowledgeable) or 1=yes and 2=no for preparation questions (where scoring with 1 are better prepared) could be included for statistical analysis. Also in SPSS, bar charts were produced for single variables that were of particular relevance and showed important trends in knowledge or preparation of respondents; general tables were produced for more complex relationships between several nominal variables; correlation tables were produced for ordinal data and cross-tabulations were produced for nominal (categorical) data. The data were also transferred in Microsoft Excel to produce several graphs where the data could be displayed alternatively to the output produced in SPSS.

It must be noted that this three step analysis, interspersed by several years, has a high potential for inaccuracies and human error. Where the process involves three different parties carrying out the three steps above, rather than the same person completing the project from start to finish, the scope for human error in entering and interpreting the data is increased. Also, while recoding the data often leads to a loss of detail, methods for recoding and classifying the data remain open to interpretation at the author's discretion. Thus, especially for qualitiative responses, there is the potential for the author to distort the data in his/her favour and introduce bias into the sample.

Reliability must also be considered in collection of the data. Based on the 2001 census data (Australian Bureau of Statistics, 2001), there were 2008 households in South Townsville and Railway Estate, and thus a sample of 80 used for this report represents only 4% of total households. Although to be representative of the population this figure should ideally be 10%, a sample size above 30 is considered statistically reliable.

Results and Discussion

Part i) Analysis of cyclone knowledge

Research indicates that many people are inadequately prepared or have flawed knowledge of hazards that they may experience (King, 2000; Raggatt, Butterworth and Morrissey, 1993). This is particularly true of many studies investigating the cyclone hazard present in north Queensland, such as Anderson-Berry's Cairns study (2003), and residents of South Townsville and Railway Estate do not seem to be any exception. To address this problem, public cyclone awareness education campaigns are conducted annually both prior to and during the cyclone season, providing accurate information from authoritative and expert bodies. Unfortunately, as the following results testify, the effectiveness of most education campaigns appears to have been limited, in that consequent increases in levels of preparedness resulting from increases in cyclone knowledge have been rare. This is because these campaigns have tended to simply present information and instruction, rather than to provide the detailed information and explanation that will empower residents to make their own informed decisions (Anderson-Berry and King, 2005).

Researchers such as Berry and King (1998) emphasise a need for focused cyclone-awareness education, particularly for school students. One such project which addresses this lack of information is the *Stormwatchers* initiative aimed at increasing

cyclone awareness among upper primary school students. This is a vital part of increasing community awareness in general as children can effectively be targeted at school and often they pass information learned at school onto their parents. Also, learning from an early age these children should retain some of this knowledge into adulthood, resulting in a cohort of future citizens who have increased cyclone awareness and (hopefully) preparedness.

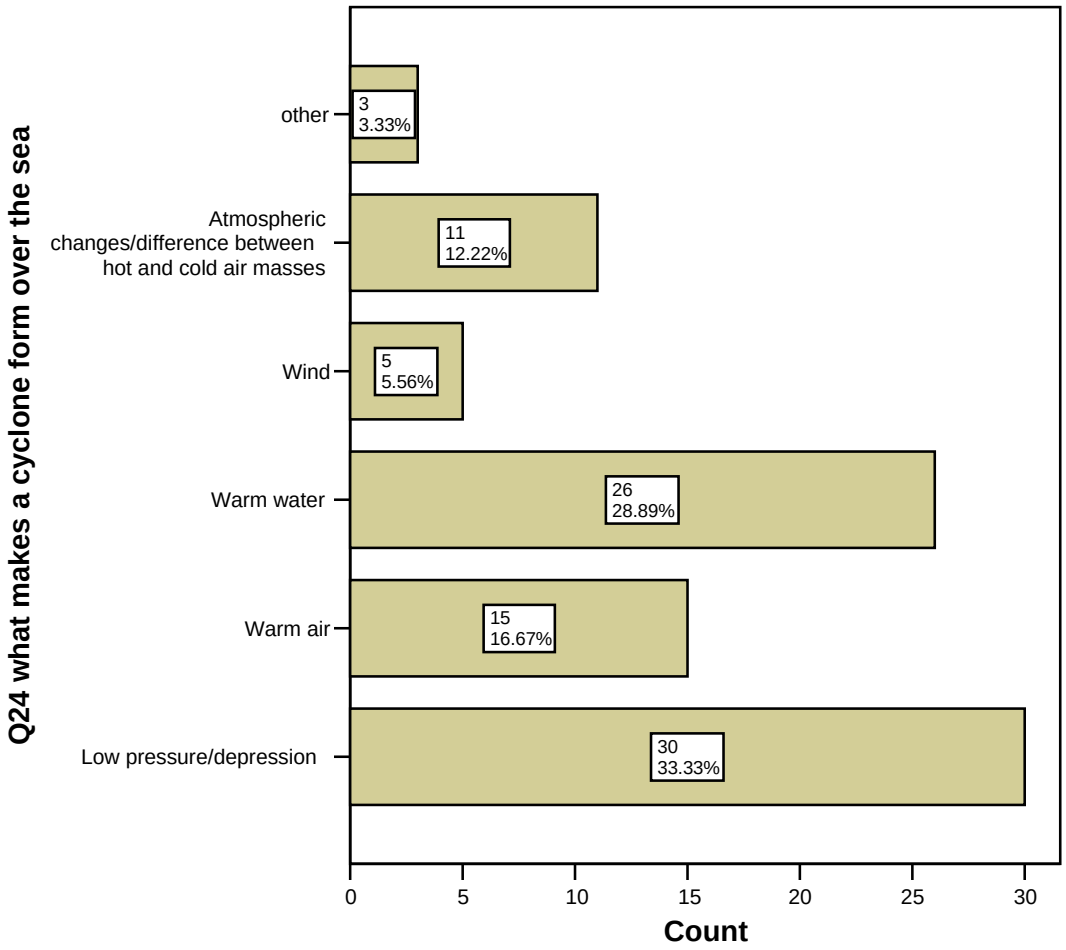

Figure 4: Bar Chart of Response to Question 24 – Cyclone Formation

According to BOM & EMA (2005) "Tropical Cyclones derive their energy from the warm tropical oceans and do not form unless the sea-surface temperature is above 26.5°C". Therefore cyclones form over the ocean as there is a supply of warm water needed to drive the cyclone. Out of 74 respondents to this question, giving a total of 90 different responses (some people gave multiple reasons), not even a third correctly identified warm water as the reason why cyclones form over the sea (Figure 4). Surprisingly, the most common response cause identified was areas of low pressure (33%), which indicates that people either did not understand the question or do not understand basic cyclone dynamics, because although a low pressure system is required for cyclone formation, it does not cause cyclone formation.

There are also high levels of misunderstanding of terms such as storm surge and categories of cyclones. Fortunately, at least there is almost universal understanding that Category 5 is the most severe cyclone and Category 1 the least. It is worrying though that only 37.5% of the 80 people surveyed correctly identified which categories indicate a severe tropical cyclone. However, a further 31.3% were partly correct, the most common mistake being the inclusion of category 2 in the 'severe' category, perhaps due to inaccurate media portrayals inadvertently referring to category 2 cyclones as 'severe' or using other synonyms that people would interpret as severe.

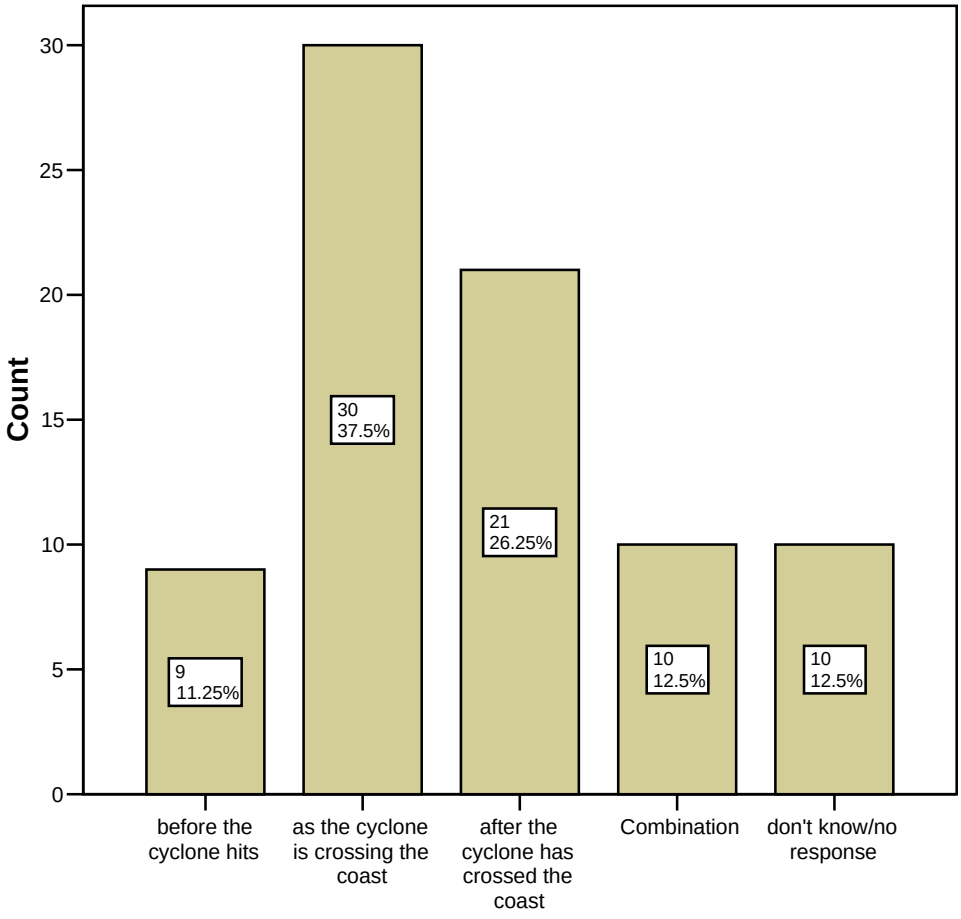

Figure 5: Bar Chart of Response to Question 31 – Storm Surge Occurrence

Potentially, the most destructive phenomenon associated with tropical cyclones that make landfall is the storm surge – a "rise above the normal water level along a shore that is the result of strong onshore winds and/or reduced atmospheric pressure" (BOM and EMA, 2005). Therefore, an adequate understanding of the causes, effects and implications of an impending storm surge is vital to enable appropriate community preparation and response. Opinion was mixed regarding when a storm surge actually occurs. However, as the definition implies, a storm surge occurs as the cyclone crosses the coast, and unfortunately less than half (38%) of the households surveyed correctly answered this question (Figure 5). 26% would not expect a storm surge

until after the cyclone has crossed the coast, and this misconception could have implications in terms of evacuation and loss of life, where people think they have more time to prepare than they actually do.

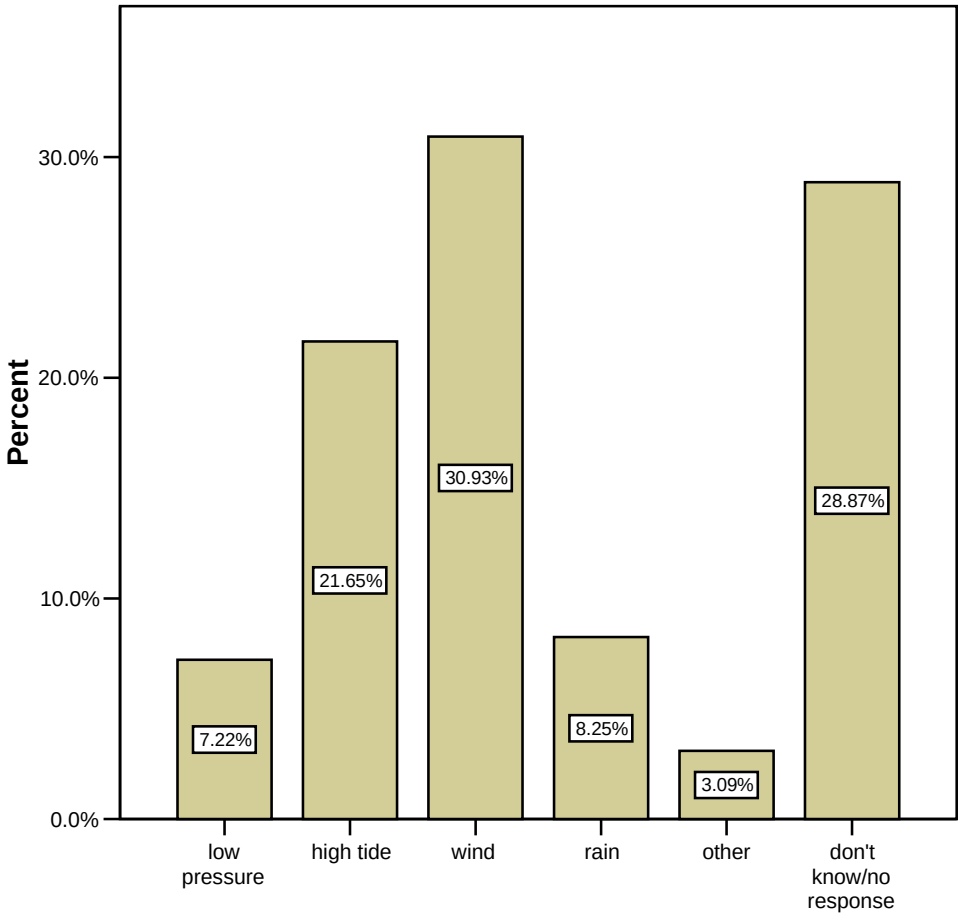

Figure 6: Bar Chart of Response to Question 30 – Causes of Storm Surge

A storm surge is caused by the low pressure and/or high winds of a cyclone (BOM, 2005). As shown in Figure 6, above, a large proportion of households surveyed had no idea, and while many respondents said wind was a major cause of storm surge, very few (7%) registered the main cause of storm surge – low atmospheric pressure. If the surge occurs at the same time as a high tide then the area inundated can be quite extensive, particularly in low-lying coastal areas, such as Railway Estate and South Townsville. The combination of storm surge and normal tide level is known as a 'storm tide', which 22% of respondents seem to have confused with 'storm surge'. The difference between the two is illustrated in Figure 7 below.

South Townsville and Railway Estate are situated in one of Townsville's residential areas most vulnerable to the effects of storm surge and cyclones in general (BOM, 2005; TCC, 2005). Storm surge maps reveal a storm surge of only 4m AHD (approximately 4m above mean sea level) would inundate both suburbs entirely (Figure 2). Being close to the port and light industry, residents would be particularly susceptible to toxic spills and loose debris should a storm surge occur. Furthermore, the vernacular of long-established suburbs such as South Townsville and Railway

Estate is mostly old-style wooden Queenslanders and the structural integrity of these buildings may be substandard such that they do not comply with modern cyclone regulation building standards, and in addition to the threat of flying debris, there is the possibility structural collapse in the event of a severe cyclone.

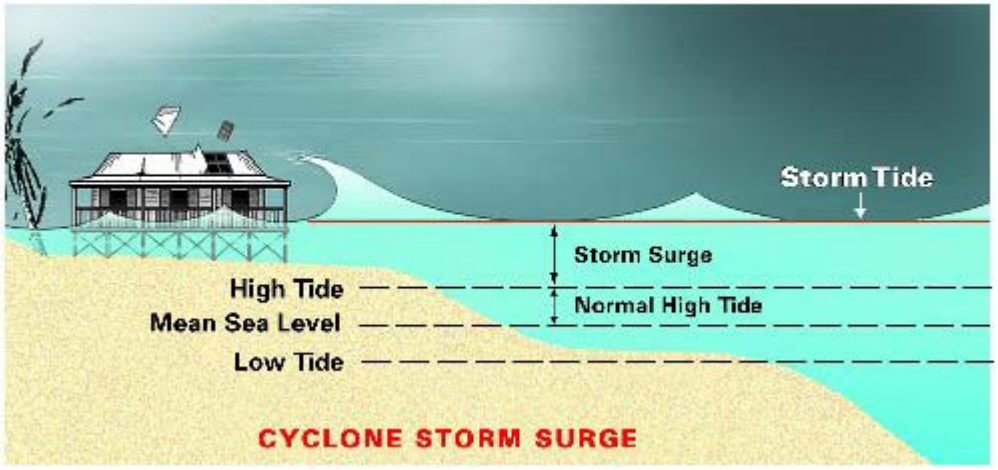

Figure 7: Diagrammatic Representation of Storm Surge and Storm Tide
Source: BOM and EMA, 2005

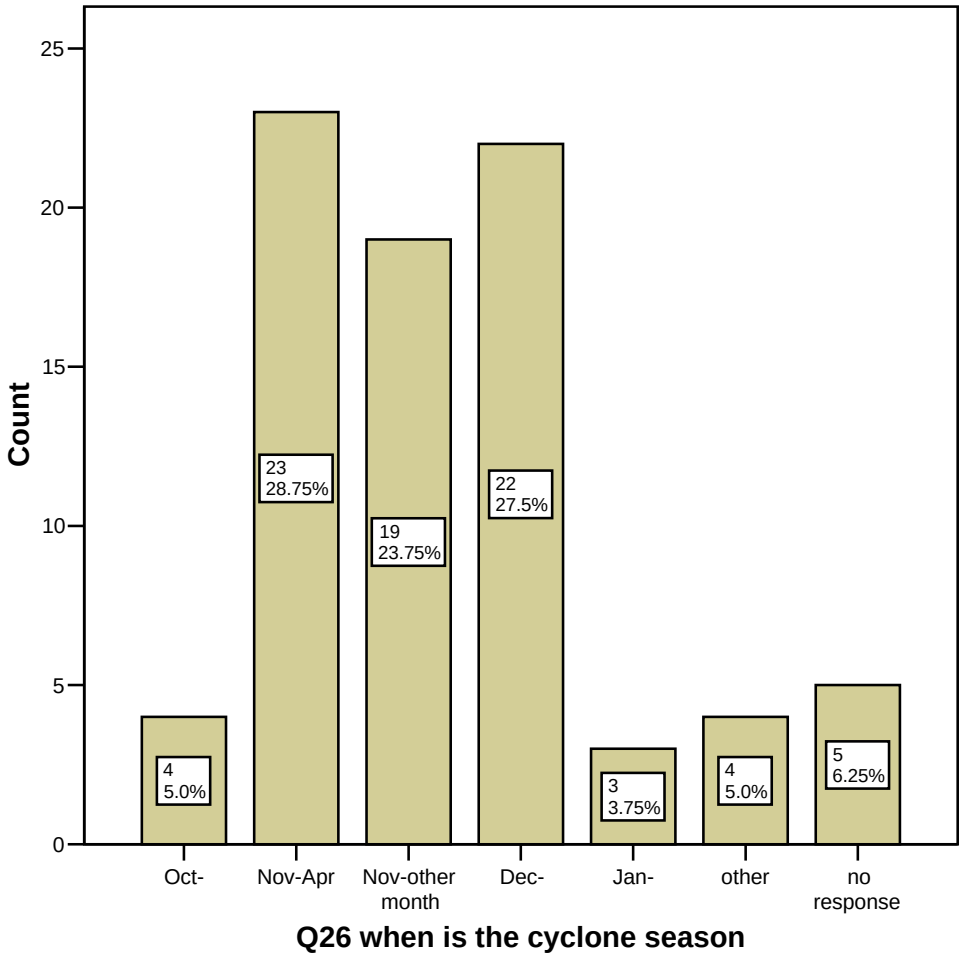

Figure 8: Bar Chart of Response to Question 26 – Cyclone Season

According to the Bureau of Meteorology (2005), severe tropical cyclones affect Townsville on average once every twenty years, while storm surge is even more unlikely - it is estimated that a surge one metre above the high water mark (about 3-4m above AHD as shown in Figure 2) would occur, on average, once in a hundred years. This undoubtedly adds to the general complacency of the population and lackadaisical attitude towards preparing for the cyclone season each year. Indeed few residents are even sure of when the cyclone season is (Figure 8). Not even a third (29%) correctly identified that the cyclone season extends from November to April, although a further 24% correctly identified November as the starting month. However, the most worrying finding derived from the response to this question is that 32% of respondents thought that the cyclone season began in December or January. If people are unaware of when cyclones first have the potential to make landfall, then they will be less likely to make preparations before then. Thus 32% of respondents would be totally surprised and most likely unprepared should a cyclone threaten the region in November.

Part ii) Analysis of cyclone preparedness and risk perception

Queensland State Emergency Services, the Bureau of Meterology and Local Government authorities throughout north Queensland annually advise households to carry out pre-cyclone season preparations that will help to minimise loss to life and property in the event of a cyclone (BOM and EMA, 2005; TCC, 2005). Final preparatory measures are given when a 'warning' or 'watch' is in force. The level to which people carry out recommended preparations is determined largely by their perceptions of what actions are deemed necessary to preserve their lives and livelihoods (that is, risk perception), and by the financial means available to achieve them (Anderson-Berry, 2003). Therefore, preparatory behaviours may give an indication of the true risk perception within the community (Anderson-Berry, 2003).

Based on best available science (see BOM & EMA, 2005;), South Townsville and Railway Estate are extremely vulnerable to cyclones and storm surge, thus a rating of 6 or 7 is realistic of the threat posed to residents of these suburbs. As Figure 9, above, shows, most respondents appreciated the very real and great threat posed by storm surge and cyclones. Over half of households surveyed believed that storm surge and cyclones posed a very great threat to South Townsville and Railway Estate. While this acknowledgement of the vulnerability of these suburbs is encouraging, this does not indicate the risk perception associated with these natural hazards or preparatory behaviour; it only indicates that if one of these hazards were to actually threaten the region, South Townsville and Railway Estate would be highly vulnerable.

Although the survey was conducted already over a month into the cyclone season (early December), based on the data provided in Table 1.0, 37% of households still had an emergency supplies kit only partially prepared (q57) while a further 25% had not even thought about it, and still only 61% had valuables, important documents and mementos in readily accessible locations. Encouragingly 75% of households claimed to have carried out the major pre-season preparation of clearing their yards of debris, dead branches and rubbish, even though a large proportion of this was probably due to the council's pre-cyclone season collection. Based on this, the community generally perceived that the risk of a cyclone impacting the region was low and believed that

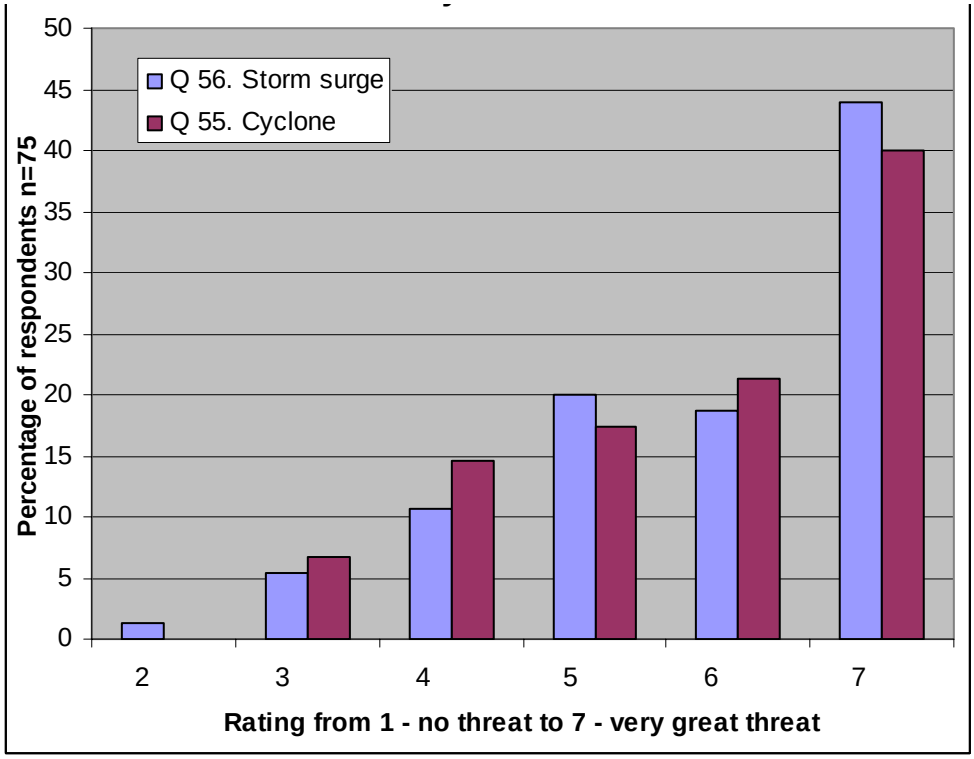

Figure 9: Perceived Threat of Storm Surge and Cyclones

Table 1: Selected Indicators of Cyclone Hazard Preparedness

q67	dont know			1	1.3%
	no answer			11	13.9%
	yes			27	35.5%
	no			20	26.3%
	partially			28	36.8%
	no answer			1	1.3%
q70	no	q71	yes	21	26.3%
			no	11	13.8%
			dont know/ no answer	4	5.0%
	dont know/no response	q71	yes	1	1.3%
			dont know/ no answer	6	7.5%
q72	yes	q73	yes	57	71.3%
			dont know/ no response	2	2.5%
	no	q73	yes	10	12.5%
			no	3	3.8%
			dont know/ no response	2	2.5%
	dont know/no response	q73	dont know/ no response	6	7.5%
q74	yes			60	75.0%
	no			13	16.3%
	dont know/no response			7	8.8%
Q90	yes			46	58.2%
	no			21	26.6%

that there would be enough time to prepare when, and if, a cyclone posed an imminent threat during the watch and warning periods.

According to Sweet (1998), households that have discussed, and agreed, emergency plans tend to follow them in an emergency situation. This reduces the likelihood of residents panicking and not knowing what to do when warnings commence, but fewer than 35% of households had discussed with their families what they should do in the event of a cyclone emergency. Less than half (46%) of respondents had a tide chart in their home although 72% of households had one member who was capable of reading one. For two suburbs that are entirely located within 4m storm surge zones, this lack of preparedness is a cause for concern. Cyclone tracking maps were far more common (74%), perhaps due to their wider availability through phone books and council brochures and were almost universally understood (84%).

Risk perception is heavily based on the loss of life, livelihood and material belongings that is perceived to be acceptable (Anderson-Berry, 2003). Insurance can be used as an indicator of risk perception, where it can be assumed that perception of risk is lower if it is believed that the cost of insurance outweighs the probability of the event occurring. From this survey, at least a quarter of the residents surveyed indicated that their households had no insurance cover (14% of the survey population did not respond to this question). However, it is uncertain whether this indicates a low risk associated with cyclone impact, or whether insurance policies would not cover the effects of cyclones.

Figure 10, clearly shows the majority respondents (52%) estimated they would require only a few hours to prepare for an incoming cyclone and it can be seen that the number of responses declines proportionately as preparation time increases. At first glance this may appear as a very good result, as it seems that most people are so well prepared that they will require very little time to make further preparations for an incoming cyclone. More likely however, and reflected in the other results, respondents are unaware of the appropriate preparation measures that would need to be carried out, and thus underestimate their preparation time. Furthermore, due to a relatively entrenched blasé attitude of north Queenslanders towards cyclones in general (Nott, 2003), they would not take the appropriate action due to laziness or the perceived low probability of an incoming cyclone actually making landfall, again reducing the preparation time.

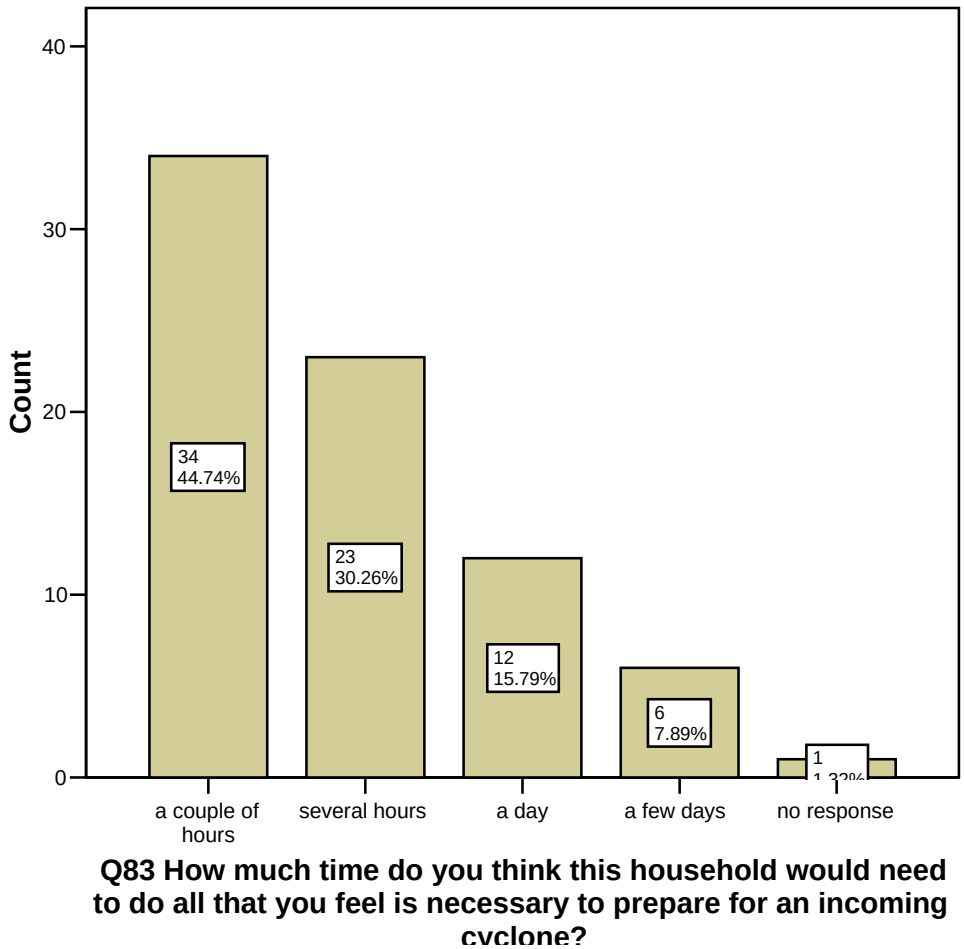

Figure 10: Bar Chart of Response to Question 83 – Perceived Preparation Time

Part iii) Analysis of relationship between cyclone knowledge and preparedness

Table 2: Pearson's Correlation Coefficients for Selected Indicators

		General knowledge					Local knowledge					Preparation							
		Q25	**Q26**	**q35**	**q63**	**q64**	**Q57**	**Q58**	**q80**	**Q81**	**Q52**	**Q51**	**q67**	**q69**	**q70**	**q72**	**q74**	**Q90**	**Q59**
General knowledge	**Q25**	1	-.256(*)	-.049	-.316(**)	.098	-.134	-.148	.147	-.158	-.142	.165	.067	.012	.046	-.129	-.073	.087	-.007
	Q26	**-.256(*)**	1	.149	.009	.082	.147	.094	.203	-.209	.063	-.080	-.054	.119	.073	.175	-.021	.107	.018
	q35	-.049	.149	1	.043	.067	.179	.142	.096	-.061	.078	-.121	-.022	-.101	-.011	-.022	-.062	.186	-.035
	q63	**-.316(**)**	.009	.043	1	.191	-.082	-.107	-.067	-.018	.187	.156	.021	.000	.070	.250(*)	.083	-.092	-.069
	q64	.098	.082	.067	.191	1	.056	-.031	-.184	-.083	.016	.086	.180	.051	-.048	.154	.033	.023	-.102
Local knowledge	**Q57**	-.134	.147	.179	-.082	.056	1	.556(**)	.202	-.008	.074	.227	.043	.039	.104	.147	-.042	.062	.310(**)
	Q58	-.148	.094	.142	-.107	-.031	**.556(**)**	1	.283(*)	-.170	.134	.027	.052	.087	.138	.109	-.125	-.028	.168
	q80	.147	.203	.096	-.067	-.184	.202	**.283(*)**	1	.046	.105	.163	.152	.064	.214	.056	-.061	.165	.198
	Q81	-.158	-.209	-.061	-.018	-.083	-.008	-.170	.046	1	.075	-.111	.122	.154	.141	.035	-.137	-.025	.060
	Q52	-.142	.063	.078	.187	.016	.074	.134	.105	.075	1	.249(*)	.272(*)	.112	.086	.301(*)	-.006	.124	-.011
Preparation	**Q51**	.165	-.080	-.121	.156	.086	.227	.027	.163	-.111	***.249(*)***	1	.231	.181	.289(*)	.005	.121	-.125	.225
	q67	.067	-.054	-.022	.021	.180	.043	.052	.152	.122	***.272(*)***	.231	1	.236(*)	.016	.095	.247(*)	-.010	.228
	q69	.012	.119	-.101	.000	.051	.039	.087	.064	.154	.112	.181	**.236(*)**	1	.248(*)	.000	.047	-.149	.305(*)
	q70	.046	.073	-.011	.070	-.048	.104	.138	.214	.141	.086	**.289(*)**	.016	**.248(*)**	1	.185	-.030	.014	.077
	q72	-.129	.175	-.022	***.250(*)***	.154	.147	.109	.056	.035	***.301(*)***	.005	.095	.000	.185	1	.026	.189	.169
	q74	-.073	-.021	-.062	.083	.033	-.042	-.125	-.061	-.137	-.006	.121	**.247(*)**	.047	-.030	.026	1	.078	.107
	Q90	.087	.107	.186	-.092	.023	.062	-.028	.165	-.025	.124	-.125	-.010	-.149	.014	.189	.078	1	-.086
	Q59	-.007	.018	-.035	-.069	-.102	***.310(**)***	.168	.198	.060	-.011	.225	.228	**.305(*)**	.077	.169	.107	-.086	1

Pearson's Correlation Coefficients were used to determine whether a statistically significant relationship existed between selected indicators of cyclone knowledge and preparedness. As Table 2 shows, however, very few statistically significant relationships were found. Out of a possible 80 relationships that could be observed between either cyclone knowledge or local awareness factors and preparedness variables, only five of these were statistically significant, as shown in bold and italics. This shows that some external factor/s intercept the assumedly direct relationship between knowledge and preparedness. The most influential of these is most likely risk perception as discussed previously, but numerous other community and individual factors may exert influence, making vulnerability analysis through the use of only knowledge and preparedness indicators very limited in its scope. Those indicators of preparedness and knowledge that were statistically correlated are discussed further in the crosstabulations below.

The relationship between variables was equally as weak – only five of the preparedness indicators were correlated with each other and only two general cyclone knowledge and local knowledge indicators showed statistical correlations. Therefore, in general, not only is there a very weak relationship between knowledge and preparedness, thus rejecting the hypothesis being tested, but there is also little consistency among variables. This means, for example, a respondent who correctly answers one general knowledge question, is not, on average, any more likely to answer any of the other general knowledge questions correctly. This surprising result has implications for emergency management in that it appears people possess only selective knowledge and preparation factors, and as such education campaigns must target each component individually in order to contribute to an overall high level of knowledge and preparedness.

Table 3: Crosstabulation of Questions 57 and 59

		Q59 Did you consider the potential for cyclones when choosing the structure and location of this dwelling?		
		yes	no	Total
Q57 Were you aware that this area is considered to be prone to cyclones when you moved here	yes (better prepared)	45	23	68
	no	1	6	7
Total		46	29	75

Table 3 shows that although only seven respondents were not aware that the South Townsville-Railway Estate area was prone to cyclones when they resided there, all bar one, also failed to consider the potential for cyclones when choosing the structure and location of their dwelling. This makes logical sense – someone could not consider the potential for cyclones to effect their dwelling if they had no knowledge that the area they were moving to was prone to cyclones. While most respondents were aware of the area's vulnerability to cyclones, only 61% considered this when choosing the location and structure of their dwelling. This lack of forethought is particularly dangerous when making long-term investments, such as purchasing a house, especially when deciding on

its location and structure. By considering the potential impacts cyclones and storm surge may have prior to purchase, loss of life and damage to property could be minimised should a cyclone hazard threaten the coast.

Counter-disaster plans are immensely important in providing a link between hazard research and on the ground practice, giving guidance on local disaster response and preparation measures (Emergency Management Australia, 1999). The knowledge of whether a counter-disaster plan exists seems to have a positive correlation with whether people are likely to have a cyclone tracking map, whether they have an emergency supplies kit packed and whether a household evacuation plan has been discussed (Table 4). In other words, respondents who knew that the Railway Estate-South Townsville area had counter-disaster plan were more likely to have a cyclone tracking map, have an emergency supplies kit packed and have discussed a household evacuation plan. Those people who knew of the existence of the counter-diaster plan, most probably also knew its contents, which undoubtedly discussed the importance of having an emergency supplies kit, household evacuation plan and perhaps even a cyclone tracking map. This is one example where knowledge (of the existence of a counter-disaster plan and most probably its contents) does influence the preparations that people are willing to undertake and result in a direct decrease in vulnerability. Perhaps making information regarding local cyclone conditions and recommended preparations available at a local community level through a counter-disaster plan is more relevant to individuals within a particular community rather than widespread generic information.

Table 4: Crosstabulation of Question 52 with 72, 67 and 51

		q72 do you have a cyclone tracking map in your home		q67 do you already have your cyclone emergency supplies kit packed and prepared for this household			Q51 Have you and other members of this household discussed an evacuation plan for this household	
		yes	no	yes	no	partially	yes	no
Q52 Do you know whether this area has a counter disaster plan in the event of a cyclone or storm surge disaster	yes	24	1	13	7	5	10	14
	no	30	12	9	19	14	8	35

Table 5, demonstrates applied knowledge integrated into a question aimed at evaluating an aspect of preparedness. It is interesting to note that of the 25 respondents who either incorrectly identified which categories represent a *severe* cyclone or didn't answer (and effectively didn't know), over half (14) believed their residence would withstand *severe* cyclonic conditions, despite not knowing what a severe cyclone was. Those who correctly identified the meaning of 'severe' were actually those who were the least certain that their dwelling would withstand severe conditions, perhaps because these respondents

were more logical, rather than dismissive, in their approach to the question. While some houses would survive a severe category 3 cyclone, it is unlikely that any dwelling would survive a severe category 5 cyclone, so only if a dwelling is able to withstand cyclonic conditions greater than a category 3 cyclone, then the impact depends on the severity of the cyclonic conditions. Current cyclone building standards generally only cater for category 3 cyclones, so it is likely that most dwellings in Railway Estate and South Townsville, being built prior to cyclone Tracy (when cyclone building standards were introduced), unless renovated to improve structural safety would not withstand severe cyclonic conditions. However, as a natural psychological reaction, people discount the threat of an event that is likely to have devastating consequences but has a low perceived probability of occurrence.

Table 5: Crosstaulation of Question 35 and 81

		Q81 Do you believe this residence is structurally sound enough to withstand *severe* cyclonic conditions				Total
		yes	not sure/hopefully	no	No response	
q35 which categories indicate a *severe* cyclone	3-5 - correct	14	11	0	5	30
	other partially correct	18	2	2	3	25
	incorrect	5	1	1	0	7
	No response	9	4	1	4	18
Total		46	18	4	12	80

Conclusion

The vulnerability of a human community to the potentially devastating effects of a natural hazard is the product of a range of community specific attributes and characteristics that form the basis of an individual's perception of risk (Anderson-Berry, 2003). Community hazard vulnerability is a process that is both complex and multidimensional. While hazard awareness education and personal preparedness are significant and important factors influencing community vulnerability, this study has shown that although one does not necessarily influence the other. Instead, an independent increase in both ultimately results in a decrease in the vulnerability of community residents to tropical cyclone impact.

Based on the previously discussed results, this study indicates that a relatively weak relationship exists between the level of cyclone knowledge and preparedness of the residents of South Townsville and Railway Estate. That is, those who have a greater cyclone knowledge are only somewhat more likely to be better prepared than those who have a limited knowledge of cyclone processes and local cyclone risk. However, the relationship was slightly stronger between knowledge of local cyclone risk (rather than

general cyclone knowledge) and preparedness. Thus basic background knowledge is less likely to influence the preparation measures that residents are likely to take than an awareness of each individual's and the community's collective risk of cyclone damage and storm surge. The results notwithstanding, the structure of the survey instrument used and relatively small sample size may have detracted from the scientific merit of this study. If a study was conducted purely with the goal of testing this hypothesis, and a more appropriate survey was formulated using a larger more representative sample, a stronger relationship may emerge. However, general cyclone knowledge alone does not necessarily lead to better preparedness, due to the influence of risk perception and the 'generic' nature of much information that fails to address identified and specific community needs (Anderson-Berry, 2003). Thus people cannot relate to this on a local level and knowledge cannot be transferred into action.

Despite the inconclusiveness of the general hypothesis, some other findings were of particular importance. Alarmingly, survey respondents showed not only a common misunderstanding and lack of general cyclone knowledge, but also demonstrated a lack of knowledge of the threats in their immediate environment. Although respondents displayed a basic level of preparedness, if these results are representative of the wider Townsville and north Queensland regions, then this is a cause for concern for emergency managers, especially if a severe cyclone threatens the region. Unless information is presented in an interactive way, and the very real risk of cyclones and storm surge is acknowledged, the local population is still highly likely to suffer unnecessary and avoidable loss associated with the tropical cyclone and storm surge hazards.

References

Anderson-Berry, L. (2003). 'Community Vulnerability to Tropical Cyclones: Cairns, 1996–2000'. *Natural Hazards*, 30:209-232.

Anderson-Berry, L. (2002). *Community Vulnerability to Landfalling Tropical Cyclones and Storm Surge.* PhD Thesis, James Cook University, Townsville.

Anderson-Berry, L. & King, D. (2005). 'Mitigation of the Impact of Tropical Cyclones in Northern Australia through Community Capacity Enhancement'. *Mitigation and Adaptation Strategies for Global Change*, 10(3):367-392.

Australian Bureau of Statistics. (2001). *2001 Census of Population and Housing – CDATA.* Australian Government, Canberra.

Berry, L. J. (1999), *Cyclone Rona – Evacuation of Caravonica and Lake Placid*, Centre for Disaster Studies, James Cook University, Cairns.

Berry, L. & King, D. (1998). 'Tropical cyclone awareness & education' *Australian Journal of Emergency Management.* 13(3):25-30.

Blakie, P., Cannon, T., Davis, I. and Wisner, B. (1994). *At Risk – Natural Hazards, People's Vulnerability, and Disasters.* Routledge, London.

Buckle, P. (1999), 'Redefining community and vulnerability in the context of emergency management'. *Australian Journal of Emergency Management*, 13(4):21-26.

Buckle, P., Marsh, G., and Smale, S. (2000). 'New approaches to assessing vulnerability and resilience'. *Australian Journal of Emergency Management*, 15(2):8-14.

Bureau of Meterology. (2005). *Climate of Townsville*. Commonwealth of Australia, accessed 30th October 2005, available: http://www.bom.gov.au/weather/qld/townsville/climate.shtml

Bureau of Meteorology & Emergency Management Australia. (2005). *Surviving Cyclones*. Commonwealth of Australia, accessed 30th October 2005, available: (http://www.bom.gov.au/info/cyclone/#introduce

Drabek, T. E. and Stephenson, J. (1971). 'When disaster strikes'. *Journal of Applied Social Psychology*, 1(2):187-203.

Emergency Management Australia. (2000). *Emergency Risk Management: Applications Guide.* Emergency Management Australia, Canberra.

Emergency Management Australia. (1999). *Australian Emergency Manuals Series Part 3, Emergency Management Practice Volume 3—Guidelines Guide 6*

Flood Response. Emergency Management Australia, Canberra. Available: http://www.ema.gov.au/agd/EMA/rwpattach.nsf/VAP/(383B7EDC29CDE21FBA276BBBCE12CDC0)~Manual+22A.pdf/$file/Manual+22A.pdf, accessed 28th October 2005.

Faupel, C. E., Kelley, S. P. & Petee, T. (1992), 'The impact of disaster education on household preparedness for Hurricane Hugo'. *International Journal of Mass Emergencies and Disasters*, 10(1):5–24.

Hewitt, K. (1997). *Regions of Risk: A Geographical Introduction to Disasters*, Longman Ltd, Essex UK.

King, D. (2004). 'Understanding the Message: Social and Economic Impacts of Weather Generated Natural Hazards'. *International Journal of Mass Emergencies and Disasters*, 22(1):57-74.

King, D. (2002). 'Post Disaster Surveys: experience and methodology'. *Australian Journal of Emergency Management*. 17(3).

King, D. (2000). 'You're on Your Own: Community Vulnerability and the Need for Awareness and Education for Predicatable Natural Disasters'. *Journal of Contingencies and Crisis Management*. 8(4):223-228.

Nott, J. (2003). 'The Importance of Prehistoric Data and Variability of Hazard Regimes in Natural Hazard Risk Assessment – Examples from Australia'. *Natural Hazards*, 30:43-58.

Nott, J. & Hayne, M. (2001). 'High frequency of 'super cyclones' along the Great Barrier Reef over the past 5000 years'. *Nature*, 413:508–512.

Raggatt P., Butterworth E. & Morrissey S. (1993). 'Issues in Natural Disaster Management: Community Response to the Threat of Tropical Cyclones in Australia'. *Disaster Prevention and Management*, 2(3):12-21.

Smith, K. (1996). *Environmental Hazards: Assessing Risks and Reducing Disaster (2nd Edition)*. Routledge, New York.

Smithson, P. (1993). 'Tropical cyclones and their changing impact'. *Geography*, 339(78):170-174.

Sweet, S. (1998). 'The effect of a natural disaster on social cohesion: a longitudinal study', *International Journal of Mass Emergencies and Disasters.* 16(3), 321-331.

Townsville City Council. (2005). *Storm Surge Action Guide*. Accessed 30th October 2005, available: http://www.townsville.qld.gov.au/emergency/surge/default.asp

Appendix A: Survey instrument

PLEASE LEAVE COMPLETED SURVEY FOR COLLECTION ON MONDAY 10 DECEMBER

SURVEY TO DETERMINE THE VULNERABILITY OF THE SOUTH TOWNSVILLE AND RAILWAY ESTATE COMMUNITIES TO CYCLONES AND STORM SURGE

. . Please fill in answers in the spaces provided.
Where alternative answers are provided please circle your answer or the number beside your answer.
If a question has more than one correct answer circle all correct answers (unless otherwise directed).
- If you need more space please use the back page, clearly indicating which questions your answers refer to.

(1) What type of residence is this? (please circle one)
1. Highset house
2. lowset house -single story
3. lowset house -double/multi story
4. FlatlUnit
5. Caravan

(2) Do you have a telephone in this residence?
Yes

(3) Do you have a television in this residence?
Yes

If yes, when is it usually on?

(4) Do you have a radio in this residence?
Yes No

If yes, when is it usually on?

(5) Do you have a battery powered radio in this residence?
Yes No

(6) How many people usually live in this household?

(7) How many of these people are adults 18 years and older'?

(8) How many are children under the age of 18 years?
1 2 3 4 5 6 7 8 9 10 10+

What are their ages'!

(9) Do any of your relatives (other than your immediate family) live in this household?
Yes No

(10) Do any of your relatives live in the South Townsville / Railway Estate area?
Yes No

(11) Do any of your relatives live in the Townsville or Thuringowa Council Local Government Areas?
Yes No

Do any of your relatives live in the North Queensland region (between Tully and Bowen)? Yes No

(13) What is the highest level of education achieved by anyone person in your household? (Circle one only)
1. University
2. T AFE
3. Secondary
4. Primary
5. Other (please specify)

(14) How many community organisations (such as P&C's, playgroups, sports clubs, service clubs etc.) do members this household belong to? Would you please name them and indicate where they are located.

How well do you know your neighbours? (the people who live next door and behind you)

(16) Approximately how many people in your immediate neighbourhood do members of your residence talk with on average of 3 or more times a week?

(17) How long have you lived **in** this residence?

How long have you lived in the South Townsville / Railway Estate area?

(19) Are you buying this residence, is it paid off or are you renting If?

(20) What is the approximate combined annual income in this household? 1. Less than $25,000
2. $25,001 -$50,000
3. $50,001 -$75,000
4. $75,001 -$100,000
5. More than $100,001

(21) Is every member of this household, over the age of 5 years, able to communicate effectively in the English language?

Yes No

If not, who does not, and, what language(s) do they speak and understand.

(22) In which country(s) were the Adult residents in this household born?

Are you or Aboriginal or Torres Strait Islander descent? Yes No

(23) If not born in Australia how long have they been living in Australia?

(24) What makes a cyclone form over the sea?

(25) Is it possible for cyclones to form over land?

(26) When is the cyclone season?

(27) In which direction does the wind circulate in an Australian cyclone?

(28) How many kilometres from a severe tropical cyclone centre would you expect significant damage to extend?

(29) What is a storm surge?

(30) Wbat causes a storm surge during a cyclone?

(31) Wben would you expect to experience a storm surge?
1. Before the cyclone hits
2. As the cyclone is crossing the coast
3. After the cyclone has crossed the coast
4. Do not know

(32) Are there any other conditions that may cause a storm surge to be greater?

(33) How would you usually become aware of an incoming cyclone?
1. A change in the weather
2. Word of mouth
3. Radio
4. Television
5. Print media
6. Other, (please specify)

(34) Which is a more destructive cyclone?

1. **Category 1 2. Category 5**

(35) Which categories indicate a severe cyclone?

(36) What means of transport do you and members of this household usually have the use of? 1. 4 Wheel drive vehicles
2. Motorcar
3. Motor bike
4. Bicycle
5. Public transport
6. Other, (please specify)

(37) How many motor vehicles are usually garaged at your home and are available for members of this household to use?

(38) Do you own or have the use of transport which is capable of carrying every usual member of your household in a single trip?

Yes No

If no, how many would require additional transport?

(39) Do any members of your household have any special needs? -such as:- 1. Prescribed medication
2. Crutches I walking frame
3. Wheelchair
4. Oxygen
5. Diet
6. Home Dialysis
7. Regular hospital out-patient treatment
8. Other. (please specify)

(40) Are any members of this household disabled?
Yes No
If yes, what is/are the disability(ies)?

Does any member of this household require special transport?
Yes No

If yes, what kind of special transport?

Do you have relatives or friends in the area where you and other members of this household could go in the event of an evacuation being necessary?

Yes No

Would you mind telling us the where they live (street, suburb /township)?

(43) If advised by authorities that it would be wise to leave your premises would you evacuate your residence voluntarily?

(44) **If** directed to evacuate would you comply with the direction?
Yes No

(45) What would be your main objection(s) to evacuating?

(46) Do you have any pets which would require care? Yes No

If yes, what type of animals are they and how many?

(47) In the event of an evacuation what would you expect to happen to your pets?

(48) Who would you expect to have the responsibility for issuing and authorising the tropical cyclones public information, warnings, and advice bulletins that are broadcast on television, radio and in the print media?

(49) Who would you expect to issue evacuation advice and/or orders?

(50) If it appeared that a cyclone was heading straight for Townsvillerrhuringowa and your household decided to leave the area by what mode of transport would you choose to leave?

(51) Have you and other members of this household discussed an evacuation plan for this household?

(52) Do you know whether this area has a counter disaster plan in the event of a cyclone or storm surge disaster?

(53) Where would you expect to find copies of such a plan?

(54) Do any members of this household have any previous experience of cyclones (have they ever been through a cyclone?)

If yes, which cyclone(s)? (If you cannot recall exactly, can you estimate approximately how many years ago and where it/they crossed the coast)

How far from the eye (centre) of the cyclone where were you/they physically located?

(55) Do you think cyclones are a threat to the South Townsville / Railway Estate area? Please mark on the scale

not at all 1 2 3 4 5 6 7 very great threat

(56) Do you think Storm Surge is a threat to the South Townsville / Railway Estate area? Please mark on the scale
not at all 1 2 3 4 5 6 7 very great threat

(57) Were you aware that this area is considered to be prone to cyclones when you moved here?
Yes No

(58) Were you aware that this area is considered to be prone to storm surges when you moved here?
No

(59) Did you consider the potential for cyclones when choosing the structure and location of this dwelling?
No

(60) Have you ever lived in any other cyclone prone areas?
Yes No
If yes, where?

(61) Have you ever lived in any other storm surge prone areas? Yes No
If yes, where?

(62) Can you explain the difference between a Cyclone **Watch** and a Cyclone **Warning?**

(63) Is at least one member *of* this household able to recognise and identify the sound *of* the cyclone warning siren.'
Yes No

(64) Is at least one member of this household able to recognise and identify the cyclone warning
symbol? No

(65) Have you and/or any other members of this household experienced a cyclone watch?
Yes No

~ If so can you recall how it made you feel?
1. Frightened
2. Excited
3. Anxious
4. Disbelief
5. No reaction
6. Cannot recall
7. Other, (please specify)

Can you recall how you acted upon this feeling?

"-"

(66) Have you and/or other members of this household experienced a cyclone warning?
Yes No

If so, can you recall how it made you feel?
1. Frightened
2. Excited
3. Disbelief
4. Anxious
5. No reaction
6. Cannot recall
6. Other, (please specify)

Can you recall how you acted upon this feeling?

(67) Do you already have your cyclone emergency supplies kit packed and prepared for this household?
Yes No Partially

If yes, or partially. what are the contents of this kit?

(68) If you do not already have an emergency supplies kit packed and prepared, or if it is only partially done when (if at all) do you intend to get it ready?

What will the contents of this kit be?

(69) Are this household's valuables, important documents and irreplaceable mementos (photographs etc.) located together where they can be readily found if necessary?
Yes No

(70) Do you have a tide chart in your home?
Yes No

(71) Does at least one member of this household know how to read/use a tide chart?
Yes No

(72) Do you have a cyclone tracking map in your home? Yes No

(73) Does at least one member of this household know how to read/use a cyclone tracking map?

Yes No

(74) Have you cleaned up your yard and removed any objects that could potentially become missiles in the event of a cyclone or severe storm?

Yes No

(75) Are you able to transport to the dump large refuse items that do not fit into your rubbish bins that could potentially become missiles in the event of a cyclone or severe storm?

Yes No

(76) Has the Townsville City Council delivered to this residence any information on how to best prepare for cyclones and storm surges this cyclone season?

Yes No

(77) Where have you received information on how to prepare for this cyclone season from?

(78) Who, or where, would you go to if you were looking for advice on how best to prepare your household for the cyclone season?

(79) Is this residence in a possible storm surge zone?

Yes No

If yes, do you know which one?

(80) Do you know how high above sea-level this block of land is?

(81) Do you believe this residence is structurally sound enough to withstand severe cyclonic conditions?

(82) Where would you get information on this residence's height above sea level. its structural strength and its position in relation to expected storm surge zones?

(83) How much time do you think this household would need to do all that you feel is necessary to prepare for an incoming cyclone?
1. A couple of hours
2. Several hours
3. A day
4. A few days
5. No idea

(84) If it appeared that a cyclone was heading for TownsvillefThuringowa would you need to attend to any other premises in addition to this residence?
Yes No

If yes. what are the premises?

(85) **In** the event of a cyclone would any member of this household have to attend to the needs of anyone who is not a member of this household (eg. elderly parents, neighbours etc.)
Yes No
If yes, who?

(86) Upon the arrival of a cyclone where, in this residence, would you and other members of this household shelter?

What sort of damage and disruption to services in the community would you expect if a severe tropical cyclone were to cross the coast near-by?

(88) When do you think TownsvillefThuringowa is likely to be hit by a destructive cyclone?
1. This year
2. Within the next 5 years
3. Within the next 50 years
4. Not in my lifetime
5. Never

Do you think Townsville/Thuringowa is protected to some degree from a direct cyclone hit? Yes No

If yes, what do you believe protects the region?

(90) Are you insured for cyclone damage?
Yes No
If yes. What does your insurance cover?

Does your insurance also cover?
1. Stormsurge
2. Erosion
3. Landslide
4. Flood damage

Have you taken out additional flood cover?

Yes No

(91) If this dwelling suffered significant structural damage as the result of a tropical cyclone do you think you would be
more likely to:-
1. Repair and rebuild at this location
2. Relocate within the South Townsville / Railway Estate area
3. Relocate within the Townsville/Thuringowa region
4. Move out of the North Queensland coastal regions altogether

(92) If this dwelling was destroyed by a cyclone do you think you would be more likely to:-
1. Rebuild at this location
2. Relocate within the South Townsville / Railway Estate area
3. Relocate within the Townsville/Thuringowa region
4. Move out of the North Queensland coastal regions altogether

(93) If this dwelling was inundated with water as the result of a storm surge do you think you would be more likely to:-
1. Repair and rebuild at this location
2. Relocate within the South Townsville / Railway Estate area
3. Relocate within the TownsvillefThuringowa region
4. Move out of the North Queensland coastal regions altogether.

(94) Do you think Local Councils and State governments are planning developments with cyclone and storm surge risks in mind?

(95) What do you think of the Bureau of Meteorology's forecasting and monitoring the movement of tropical cyclones?

(96) What do you think of the Bureau of Meteorology's forecasting and monitoring the height of storm surges?

(97) Are you concerned that any dangerous substances or fauna may not be adequately contained in the event of a severe cyclone crossing the coast near TownsvillefThuringowa?

Yes No

If yes, what may they be?

(98) What aspects of a cyclone cause you the most concern?

(99) Would you be prepared to participate in a follow up survey in 12-18 months time?

(100) Would you like to add any suggestions as to how you think Local Government Authorities and Emergency Services can make the community more aware of and better prepared for cyclone and storm surge disasters?

THANK YOU VERY MUCH FOR PARTICIPATING IN THIS SURVEY!