Protecting the North

The benefits of cyclone mitigation

20 July 2015

urbis

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An MS Word version of this report, Protecting the North, has been provided to Suncorp for convenience. However, for purposes of certainty, the PDF version, dated 20 July 2015, should be regarded as the final and definitive version.

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CHARTS

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Executive summary

Over the past decade alone, Northern Australia has experienced 18 severe tropical cyclones that have made landfall[1], resulting in loss of life, extensive property damage and social and economic disruption to both the region and more broadly across Australia.

The financial cost of such disasters has had a measurable impact on insurance premium affordability for home-owners in cyclone-prone regions. In 2012-13, Australian premium rates were, on average, around 50 per cent of North Queensland premiums (Martin, 2014).

Declining premium affordability prompted the Federal Government to announce, in March 2015, the Northern Australia Insurance Premiums Taskforce, which is

> *charged with exploring the feasibility of options that use the Commonwealth balance sheet to reduce home, contents and strata insurance premiums in those regions of Northern Australia that are experiencing insurance affordability concerns due to cyclone risk. (Josh Frydenberg MP, 2015)*

Two options put forward by the Taskforce for consideration include a mutual cyclone insurer and a cyclone reinsurance pool. These options – an example of which is the US National Flood Insurance Program (NFIP) – reduce premiums to consumers by providing a government subsidy. The cost of such an approach is increased cost and risk to Government.

By contrast, mitigation options to reduce property damage from cyclones have the potential to not only lower premiums **but also to reduce the indirect economic costs borne by the community and governments**.

Such costs include loss of life and injury (both physical and psychological), disruption to businesses and services, absenteeism, presenteeism, dislocation and wider community property damage. These costs are difficult to estimate precisely, but are reported to be in the order of 20% (minor flooding) to 200% (Hurricanes Sandy and Katrina) of total property losses, increasing with the severity of the event (Walker et al, 2015). The portion of these broader impacts that is directly attributable to damage to housing – rather than the winds themselves – is difficult to estimate, but would conservatively be in the order of 10% for higher category cyclones.

The Taskforce's remit includes both housing stock and strata properties across all of Northern Australia. North Queensland, with more than 350,000 houses and a population of over one million, including a number of major regional population centres is the largest and most densely populated cyclone-prone region in Australia. This combination of factors also makes the region potentially the most viable in terms of investing in cyclone mitigation strategies.

Understanding the fragility of strata complexes and the implications for insurance premiums is covered separately in research undertaken by James Cook University's (JCU) Cyclone Testing Station on behalf of the Insurance Council of Australia (Henderson & Ginger, 2013).

This report examines costs and benefits of a range of mitigation options for housing stock in North Queensland, drawing on work undertaken by JCU's Cyclone Testing Station based on outcomes from Tropical Cyclone (TC) Yasi, and detailed insurance information provided by Suncorp Group.

Mitigation strategies modelled were chosen based on a range of research that supports the proposed options, including the CSIRO submission to the Productivity Commission Inquiry into Natural Disaster Funding which states that:

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[1] TC Ingrid (2005), TC Claire (2006, WA), TC Larry (2006), TC Glenda (2006, WA), TC Monica (2006), TC George (2007, WA), TC Hamish (2009), TC Laurence (2009), TC Magda (2010, WA), TC Ului (2010, QLD), TC Yasi (2011), TC Heidi (2012), TC Lua (2012), TC Rusty (2013), TC Christine (2013), TC Ita (2014), TC Lam (2015), TC Marcia (2015); (Queensland Government, 2014) (BOM, 2015b)

There are some retrofitting activities which are inexpensive and easily implemented, which provide significant benefits (even if these fall considerably short of those achievable in new buildings), and which could be encouraged by governments and potentially by building standards. For example, modest and inexpensive improvements to roof ties deliver significant protection for old buildings in cyclone areas. (CSIRO, 2014)

Findings from Queensland (Smith & Henderson, 2015) and Florida (Malik, Brown, & York, 2012) both identified roofing and damage through openings as key drivers of insured losses.

APPROACH TO COST BENEFIT ANALYSIS

Modelling undertaken assessed the relative costs and benefits of three mitigation measures for houses:

1. structural roof upgrading (applied to pre-1980s housing only)
2. opening protection for windows and roller doors (applied to all housing ages)
3. community preparedness/awareness campaign (applied to all housing ages).

Costing for each housing measure was provided by JCU's Cyclone Testing Station with a range of options at different price points. The community awareness campaign was costed on the basis of the *Get Ready Queensland* program; it is assumed that a similar (additional) program that specifically targets cyclone prevention measures is delivered annually over the forecast period.

Three different house types were modelled, based on age brackets and design similarities.

- House Type A: Pre-1960
- House Type B: 1960-1980
- House Type C: Post-1980

Benefits were measured in terms of avoided losses to houses as a result of implementing mitigation options, using estimates provided by JCU's Cyclone Testing Station. These estimates have been derived based on actual outcomes for TC Yasi, drawing on Suncorp Group's database. Losses for household contents and global community losses were also taken into account.

Costs and benefits were measured over a fifty year period, with payback periods calculated for each measure (the payback period is applied across all parties, not just the consumer).

Forecast wind speeds over the fifty year period were modelled using eight return period events, ranging from five years through one thousand years. The modelling captures speeds of between 75 kph and 250 kph, Both cyclonic and non-cyclonic winds below this band are excluded while winds in excess of 250 kph are treated as inflicting the same level of damage as a 250 kph wind. Estimates are therefore likely to be conservative.

The wind speeds modelled drew on four reputable catastrophe models. The range of forecasts across the four models was used to reflect what is inherently an uncertain outlook by effectively providing sensitivity testing for the analysis; actual outcomes are most likely to fall somewhere between the range of results presented and Urbis has used the two central case outcomes as a benchmark, with both the lower and upper bounds considered less probable.

FINDINGS

Low-cost mitigation options for roofing and openings produced benefit-cost ratios (BCRs) above one, (that is, benefits outweighed costs) under modelled wind speeds, as shown in the following table. The table reflects the range of possible outcomes for the two central case models.

TABLE E-1 BENEFIT COST RATIOS FOR MITIGATION

MITIGATION OPTION	COST PER HOUSEHOLD	TOTAL BENEFIT PER HOUSEHOLD**	BCR	PAYBACK PERIOD***
Community awareness campaign*	$55 - $136	$440-$820	3.2 – 14.8	<1- 6 years
Opening protection – self-installed (Low cost scenario)	$1,660	$1,990-$6,400	1.2 – 3.9	4 – 21 years
Roofing option – strapping only (Low cost scenario)	$3,000	$12,900-$38,800	4.3 – 12.9	2 - 4 years
Roofing option – over-batten system (Medium cost scenario)	$12,000	$13,500-$39,400	1.1 – 3.3	5 – 37 years

*NB: Values taken as an average over House Type A and House Type B, except for community awareness campaign, which is an average over all house types. Total Benefit does not discount the cost of mitigation. The lower range of values are based on conservative wind speeds and are modelled over only 39 postcodes. **Government funded campaign, applied per household. **NPV over 50 years. ***Payback period refers to the number of years required for the value of benefit to outweigh cost of mitigation option – applied across all parties, not just the consumer.*

Source: Urbis modelling, JCU, Suncorp Group

The community awareness campaign and the low-cost ($3,000) roofing option delivered BCRs greater than one for all four modelled wind speeds.

A suite of low cost mitigation measures delivered a BCR of 3.2 under low wind speeds and, in the case of TC Yasi, the BCR for the same options was 1.2 for this single event.

It is important to note that the avoided costs of physical damage to property as a result of mitigation fall across different groups. Insured households avoid any excess that would be payable, insurance companies avoid payouts and government avoids the cost of collateral damage to community property.

CONCLUSION

The benefit cost modelling for mitigation strategies demonstrates that these can be cost-effective at the right price points in high-risk areas. Implementation of these options can therefore lead to lower premiums for households as well as improved economic outcomes for the broader community through lower direct and collateral damage.

Households will only undertake mitigation, however, if there is the correct incentive to do so; in particular, any reduction in premiums must be at least equal to the cost of mitigation. In other words, the lower payout and recovery costs for insurance companies and governments need to be at least in part transferred to households so that they do not bear all the cost of mitigation without commensurate benefit. At current price points, a combination of government rebate and insurance premium reduction is likely to be necessary to ensure a reasonable pay-back period.

The level of rebates required over and above premium reductions to ensure take-up will, in some instances, exceed the estimated benefit to government via avoided community losses. In such instances, a benefit cost analysis of alternative options to government (as the provider of rebates), needs to be considered to ensure this represents the best outcome. Current alternative options under consideration are a reinsurance pool or mutual insurance, which involve increased cost to government in the event of a cyclone, in contrast to mitigation which lowers costs for all parties.

In addition, it is worth exploring new ways to reduce mitigation costs through further detailed research of enhanced, lower cost product options and large scale roll-outs to achieve economies of scale. There may be a role for government to fund such research, to be conducted by existing centres of excellence in Australia, such as JCU's Cyclone Testing Station.

Creating a market for mitigation products may also provide opportunities for cost reductions. Experience curves for other products, notably solar panels, but also energy-efficiency innovations in the building sector more generally, demonstrate the potential for mitigation options to improve pricing outcomes over time. For example, capital expenses for solar are forecast to fall in Australia by over 40%, between 2010 and 2030, as the use of solar becomes more widespread (Hearps & McConnell, 2011).

Undertaking mitigation reduces the risk and magnitude of damage to a household. Furthermore, mitigation strategies such as the community awareness campaign can reduce the large number of minor claims that typically result from a cyclone which are also administratively burdensome for householders and insurance companies. These improved outcomes provide scope for potential reductions in insurance premiums.

This report is a first step towards understanding the potential for mitigation options to deliver substantial economic and social benefit by reducing damage when cyclones hit and by lowering premiums. This outcome is considered superior to that of a reinsurance pool or mutual insurance that reduce premiums only, through increased risk to government balance sheets without any concurrent reduction in actual damage.

Finally, in recognition of the importance of Northern Australia – that is, the Northern Territory and those parts of Queensland and Western Australia that sit above the Tropic of Capricorn – to Australia's future economic prosperity, the Federal Government this year released the White Paper, *Developing Northern Australia (2015).*The White Paper looks at opportunities to expand the economic development of Northern Australia, particularly in agriculture, mining and tourism, through investment in infrastructure and a strong workforce. Building resilience in the homes of that workforce will be a significant element in the successful further development of the North.

Introduction

> *As Australia's population density increases as well as the severity and frequency of storms, floods, cyclones and bushfires, costs [are] projected to soar from $6.3 billion a year [in 2013] to about $23 billion a year in 2050. (Munich Re, 2013)*

As Australia's economic development increases the stock of the economy's physical assets, and especially housing, the impact and cost of natural disasters is also rising. This has been exacerbated over the last decade by an increasing incidence of extreme weather events, including 18 severe tropical cyclones in Northern Australia that have made landfall.

The differing nature of housing types and ages, population density and cyclone frequency and severity differs across the expanse of Northern Australia indicates that mitigation measures may have quite varied outcomes in different locations.

Properties in North Queensland are exposed to a much higher cyclone risk than other areas of Australia (James Cook University, 2015), which in turn has led to a significant increase in residential property premiums – and a decline in affordability – for home-owners in cyclone-prone regions. For this reason, modelling has been focussed, in the first instance, on housing stock in North Queensland.

The Australian Government Actuary has observed that property insurance prices in North Queensland are significantly higher for home insurance than elsewhere in Australia (Martin, 2014). The Northern Australia Insurance Premiums Taskforce was established by the Federal Government in March 2015 in response to declining insurance affordability and increased costs for damage repair falling on Government following cyclones.

The Taskforce has therefore been

> *charged with exploring the feasibility of options that use the Commonwealth balance sheet to reduce home, contents and strata insurance premiums in those regions of Northern Australia that are experiencing insurance affordability concerns due to cyclone risk. (Josh Frydenberg MP, 2015)*

While the initial focus of the Taskforce was around a mutual cyclone insurer and a cyclone reinsurance pool, the Taskforce is open to other options.

In this context, Urbis was engaged by Suncorp Group to examine the economic benefits of cyclone mitigation investments and to understand how outcomes could lead to a cost-effective reduction in cyclone damage that can be passed on to households in the form of lower premiums.

Using a forward-looking framework for considering new cyclone mitigation activities, this paper demonstrates the value of a number of different mitigation strategies which involve a broad community education and awareness program and the retrofitting of existing housing in North Queensland.

The work undertaken in this report builds on Smith & Henderson (2015). It is recommended that this report be read in conjunction with the JCU report.

This report is a first step towards understanding the potential for mitigation options to deliver substantial economic and social benefit by reducing damage when cyclones hit and by lowering premiums. There is room to achieve better mitigation outcomes by driving down costs through improved products and economies of scale in roll-outs. There may be a role for governments to fund additional research in this field.

This report is structured in the following chapters.

Chapter 1 discusses the nature and degree of cyclone risks in North Queensland and the damage which can be inflicted, with reference to historical cyclone impacts.

Chapter 2 examines the role of cyclone mitigation investments in reducing vulnerability and the case for mitigation strategies.

Chapter 3 discusses cost benefit modelling undertaken by Urbis.

Chapter 4 looks at implications, recommendations and next steps as a result of the cost benefit modelling.

1 Cyclone risks in Northern Australia

There is an extensive history of tropical cyclones in coastal regions of Australia, in particular Northern Australia. While all northern coastal regions of Australia are vulnerable to cyclones, the density of population and housing stock on the North Queensland coast increase the risk of significant damage. Furthermore, there have been 207 known impacts of cyclones along the east coast of Australia dating back to 1858, with the majority falling in North Queensland (Bureau of Meteorology (BOM), 2015).

Given the risk posed to the population centres, and the availability of data, the focus of the modelling undertaken for this report is North Queensland. To some extent, the analysis can be extrapolated to other parts of Northern Australia. However the specific impacts will vary according to population density, the nature of wind events and house age and structure. Therefore, separate modelling would need to be undertaken to fully appreciate the specific benefit-cost ratios (BCRs) that apply to other parts of Northern Australia.

This chapter discusses the extent and impact of cyclone risks in North Queensland, including the impact of recent category four and five cyclones. The wider economic impact of cyclones is also covered.

1.1 HOUSING AND POPULATION PROFILE

Profile of North Queensland

The North Queensland region has over 350,000 houses (RP Data, 2015) and a population of over one million (Australian Bureau of Statistics (ABS), 2014), including a number of major regional population centres. It is the largest and most densely populated cyclone prone region in Australia. Listed below are four of the largest local government areas (LGAs) in the region.

TABLE 1-1 – NORTH QUEENSLAND LOCAL GOVERNMENT AREAS

LGA	HOUSING STOCK	POPULATION	DENSITY
Townsville	59,000	192,038	51.5 pop/km^2
Cairns	45,000	158,985	94.2 pop/km^2
Mackay	38,000	123,383	16.2 pop/km^2
Rockhampton	28,000	83,439	12.7 pop/km^2

Source: Population and density data from ABS. Housing stock data from RP Data

The combination of large, dense population areas and high frequency of cyclones makes the region especially vulnerable to cyclone damage. With over 350,000 houses, this combination of factors also makes the region potentially the most viable in terms of investing in cyclone mitigation strategies.

1.2 THE EXTENT AND NATURE OF CYCLONE RISKS

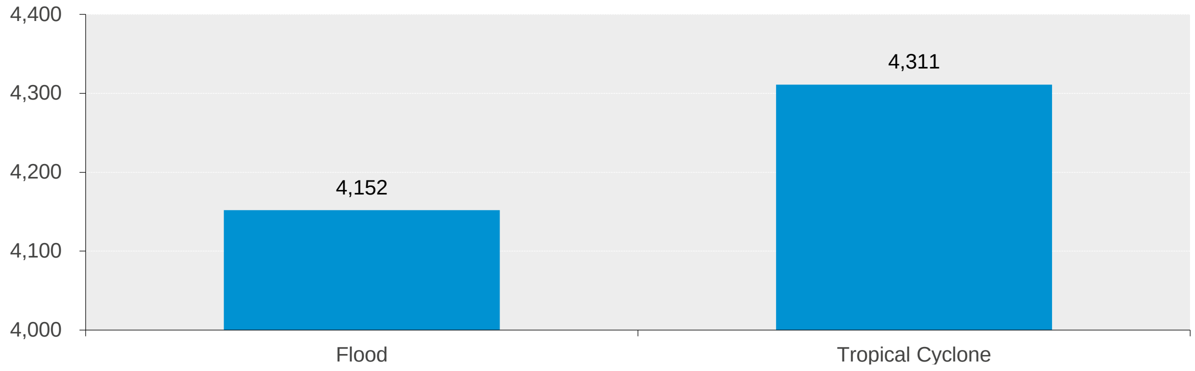
Tropical cyclones are a frequent occurrence along the north east coast of Australia, particularly in North Queensland. The east coast of Australia is one of the most cyclone prone regions in Australia, affected by an average of 4.7 tropical cyclones per year, with more than one a year causing an impact on land (BOM, 2015c).

Risk compared to other natural hazards

Cyclones have historically been the most damaging natural hazard risk facing North Queensland, based on House Equivalent (HE) losses (Queensland Department of Community Safety (QDCS) 2012). The QDCS report records historical losses attributed to different forms of natural disasters, using HE losses. Each single HE lost is equivalent to the loss of a single median-sized residential home, allowing loss comparisons over time as housing sizes and prices change. This measure also takes into account non-residential buildings including hospitals, schools etc. However, it does not include damage to building contents and agriculture.

In the region spanning from Mackay to the northern most point of Queensland, the largest HE losses from natural hazards since 1950 are from tropical cyclones, at 4,311 HE losses. Flood damage, from both cyclone-related storm surges and other flooding, is the second largest cause of HE losses.

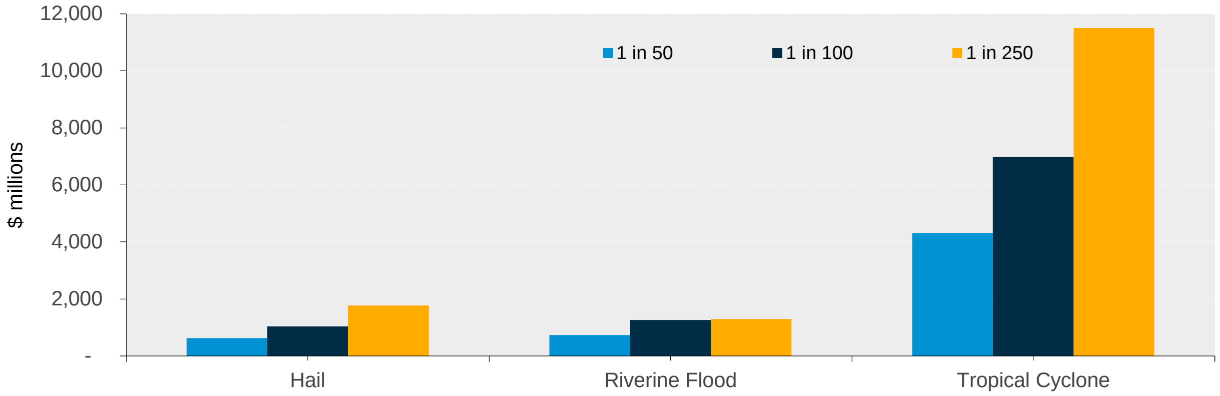
CHART 1-1 – NORTH QUEENSLAND HOUSING EQUIVALENT NATURAL HAZARD LOSSES 1950-2011



Source: (QDCS, 2012)

When compared to other natural hazards, a major source of damage from tropical cyclones is to residential property. Modelling undertaken by Risk Frontiers on behalf of QDCS estimated the insured losses to residential property for all of Queensland from 1 in 50 year, 1 in 100 year and 1 in 250 year natural hazards.

CHART 1-2 -ESTIMATED LOSSES FOR INSURED RESIDENTIAL PROPERTY FROM NATURAL HAZARDS, QUEENSLAND



Source: (QDCS, 2011)

The outcomes modelled, as shown above, demonstrate the scale of potential insured losses that tropical cyclones pose to Queensland. A once in 50 year tropical cyclone would on average cause $4.3 billion in insured losses to residential property. A once in 100 year event would have on average $7 billion in insured losses, while a once in 250 year event would have average insured losses of $11.5 billion. For comparison, a 1 in 250 year flood event would have insured losses of $1.3 billion (QDCS, 2011).

Damage to residential property in Tropical Cyclone (TC) Yasi came predominately from roofing damage, window damage and water ingress (Smith & Henderson, 2015).

The scope of insured losses to residential property from tropical cyclones provides a strong case to investigate opportunities to minimise losses. The opportunities should focus on creating a more resilient housing stock.

Scope of damage from tropical cyclones

Not all tropical cyclones make landfall or cause serious damage. However those that do have the potential to cause significant damage: to property, infrastructure and agricultural land.

Five out of the ten largest natural hazard events (based on insured loss) in Queensland since 1900 have been tropical cyclones, with all five occurring in North Queensland. Four of the cyclones occurred since 1970. Insured losses are listed below, adjusted for if the events had occurred in 2011 (i.e. changes in demographics, housing stock, inflation) (QDCS, 2012):

TABLE 1-2 – IMPACT OF TROPICAL CYCLONES

CYCLONE	YEAR	CATEGORY	INSURED LOSSES*	GOVERNMENT DAMAGE BILL
Ada	1970	4	$1,001m	N/A
Althea	1971	4	$648m	N/A
Larry	2006	4	$609m	$480m**
Yasi	2011	5	$1,405m	$800m

*Note: 2011 prices. *adjusted for if the event occurred in 2011. **includes damage from Cyclone Monica.*

Source: (Queensland Government, 2014), (BOM, 2015c)

It is worth noting the wider effects of cyclone damage. As a result of TC Yasi agricultural production (particularly banana and sugarcane crops), mining and local government losses were in the region of $2 billion. Total economic loss from Yasi was estimated at $3.5 billion (Deloitte Access Economics, 2011)

Significantly, neither Yasi nor Larry made landfall over major regional centres such as Cairns and Townsville. Had a major regional centre been the worst hit region, the damage bill could have been significantly larger.

The changing nature of natural disaster risks

Changing demographics within cyclone prone regions, such as the expansion and consolidation of town centres, and development of the built environment, influence the scale of impacts on people, property and local as well as national economies.

Looking forward, climate change could compound the risks of disruption through more intense cyclones. A key implication is that any increase in underlying natural disaster risks in the decades ahead would increase the returns from mitigation investments made today.

1.3 THE ECONOMIC AND SOCIAL IMPACT OF CYCLONES

Insured costs represent only a portion of total costs associated with cyclones. Losses to residential property are often only 50% of total insured losses, and 25% of the total economic loss (QDCS, 2011).

Other costs that must be considered in line with insured costs include (Walker, Mason, Crompton, & Musulin, 2015):

- damage to household contents
- death and injuries (including psychological) to occupants due to structural failure or consequences such as fire
- loss of recreational, cultural and leisure time facilities
- dealing with insurance issues in relation to personal property, including making decisions about home damage, repairs and relocation
- dislocation of population due to buildings being made uninhabitable for safety or health reasons
- community disruption due to failures of essential services such as water, electricity and gas supply, and transport and communication networks
- business interruption due to damage to buildings and facilities and disruption to employees.

Further indirect costs found in the wake of the 2010 Canterbury Earthquakes (Deloitte Access Economics, 2015), but can apply to cyclonic events and disasters more broadly, include:

- higher crime rates post natural disasters
- pressure on temporary accommodation resulting in increased rental prices due to lower availability (from losses due to cyclone damage) and increased demand for temporary accommodation from displaced households and temporary workforce coming to area to rebuild.

Other costs can be difficult to measure directly in the aftermath of natural disasters, yet can have large impacts. For example, mental health issues have been strongly correlated to large natural disaster events. The World Health Organisation estimates that severe mental health disorders across the population can increase by around one percentage point following a large natural disaster (Deloitte Access Economics, 2015). Impacts such as these need to be considered when assessing the total costs of cyclone, or other natural disasters.

Household contents are treated separately and are estimated from Suncorp data to be on average 20% of insured property loss.

Other costs have been estimated in a number of studies (for example see Walker et al, 2015) at between 20% (minor flooding) and 200% (Hurricanes Sandy and Katrina) of insured property damage.

Estimating these other losses that result from damage to housing structures is more problematic and is not available from a literature review.

Urbis has estimated the impact at 10% of insured damage, based on the relative damage costs associated with previous cyclone events, using Suncorp data.

This report includes estimates on the cost of losses through both direct damage to housing as well as indirect social and economic costs.

2 Opportunities for cyclone mitigation

Given North Queensland's recurring history with cyclones and the large damage bills often associated with them, mitigation opportunities are worth investigating

Disaster mitigation measure can work in three key ways: (Geosciences Australia, 2015)

- hazard reduction
- reducing community vulnerability
- changing the environment in which hazards and communities interact.

In the case of cyclones, neither hazard nor environment can be altered, so focus must be on options to reduce community vulnerability. A potential means of reducing vulnerability is through actions to improve building resilience, for older housing stock in particular.

CURRENT GOVERNMENT POLICY

There are a number of government policies at state and federal level addressing disaster management in Queensland and Australia more broadly. These range from educational campaigns on cyclone and disaster preparedness to post-disaster relief funds.

The *Natural Disaster Resilience Program* is a $24 million competitive grant program targeting disaster mitigation and community resilience, jointly run by the Queensland and Federal Governments. Mitigation and resilience projects targeting any natural disaster are eligible (Queensland Government, 2015c).

Get Ready Queensland is an educational campaign aimed at improving community preparedness for extreme weather events in general. A fund of $1 million is available for local councils to conduct community events raising awareness. The program also provides information online for household emergency plans including information specific to preparing homes for tropical cyclones (Queensland Government, 2015a). Given the extent of minor damage claims from TC Yasi, it would appear that this program could be better targeted.

However, disaster relief funding is the main policy tool, providing post-disaster assistance to affected communities. The *Natural Disaster Relief and Recovery Arrangement* (NDRRA) is a joint state and federal relief fund, whereby recovery costs are shared between the Queensland and Federal Governments. Services include grants at a household level to restore essential services and improve safety, restoration of public assets, and loans to businesses to assist in disaster recovery (Queensland Government, 2015b).

In the 2015-16 Queensland State budget, $40 million was allocated to the *Community Resilience Fund,* designed to assist local councils mitigate against natural disasters. A further $23 million was provided through the *Local Government Grants and Subsidies program* to fund community infrastructure (Queensland Government, 2015d).

There is currently limited policy specifically aimed at retrofitting mitigation programs at either a state or federal level; the Insurance Premiums Taskforce has the capacity to support implementation of mitigation strategies (such as retrofitting houses) that have a demonstrated, cost-effective benefit.

TYPES OF CYCLONE MITIGATION

The existing literature on cyclone mitigation identifies a number of retrofitting strategies that are most effective in reducing loss. These include a variety of roofing upgrades, opening protection, and structural upgrades.

Findings from Queensland (Smith & Henderson, 2015) and Florida (Malik, Brown, & York, 2012) both identified roofing and damage through openings as key drivers of insured losses.

Smith & Henderson (2015) also identified that minor claims (e.g. fencing, shade sails and minor water damage) constituted the majority of total claims and were a significant driver of the total cost. JCU recommended that simple education/awareness campaigns to improve cyclone preparedness could be the most effective way to reduce the number of minor claims.

ARGUMENTS FOR MITIGATION

Any proposed mitigation policy must display value for money. If the cost of the mitigation, such as retrofitting housing, is prohibitively expensive it is unlikely to be undertaken regardless of potential avoided costs to property, individuals or community.

Mitigation through retrofitting has two benefits that are most apparent – avoided costs of damage to the household, and the resulting reduction in insurance premiums. Other policy options such as a reinsurance pool solely address the cost of insurance premiums; the potential damage remains unchanged.

Reducing insurance premiums is a significant issue for North Queensland households. Over the period 2006 to 2013, North Queensland home and contents insurance premiums increased by 80% (Martin, 2014). In comparison, insurance premiums increased by around 12% in Sydney and Melbourne (Martin, 2014). The increase in premiums has been attributed to increased losses caused by natural disasters, and the increasing prevalence of these disasters. North Queensland premiums were historically under-priced with expenses (including insured losses) around 30% above revenue over the period 2007-2012 (Australian Government Actuary, 2014), thus increasing the magnitude of premium price increases as prices adjusted. Cyclone claim costs are the largest drivers of claim costs, at about 55% of total claims (Martin, 2014). Retrofitting mitigation can limit losses to homes, with the potential to in turn lower insurance premiums.

While some retrofitting mitigation measures can be costly, there are modest and inexpensive improvements to buildings that can be cost effective (CSIRO, 2014). For example, upgrading roof ties for old buildings can deliver significant protection against cyclone damage at low cost.

By appraising different retrofitting measures and applying the most cost-effective, a greater number of residential properties can avoid loss at a reasonable cost.

Retrofitting mitigation evidence in international literature

Though there are many natural hazard mitigation programs in operation internationally – especially in the developing world – there are few examples of rigorous investigation into the cost and benefits of such programs. The existing literature is further diluted by the sheer diversity of mitigation measures, implementation strategies and targeted natural hazards. Despite this there are some studies which have specifically modelled the effects of retro-fitting property against cyclone damage in the developed world.

An analysis of four states in the US has shown that hurricane damage would be significantly reduced if all residential homes were fitted according to building standards (Kunreuther & Michel-Kerjan, 2011). Particularly, were all homes to comply with building standards, there would be a 50% reduction in resultant losses in the event of a once in 500 year storm.

In the US, the Institute for Business Home and Safety (IBHS) *FORTIFIED Home Hurricane Program* aims to incrementally retrofit older housing in hurricane-prone areas up to current building standards, which have been found to perform considerably better under hurricane and storm conditions (Malik, Brown, & York, 2012). Using claim data from Hurricane Charley in Florida, the most frequent type of damage to all homes was roof damage, while damage to openings and windows was also common.

Targeted retrofitting options from the IBHS program include improvements to roofing, reducing water intrusion, protecting openings and strengthening elements of the house structure. It was found that simple roofing upgrades alone could improve the performance of existing housing, in terms of losses avoided, to around 40% of that of a new home. Further incremental upgrades to homes saw avoided losses almost identical to a new home built to current building standards (Malik, Brown, & York, 2012). However, the IBHS report did not detail the cost of implementing upgrades.

Other methods to reduce insurance premiums such reinsurance pools and mutual insurers for cyclones may not be feasible long term. In the US, the National Flood Insurance Program (NFIP) was designed to provide affordable insurance for disaster-prone areas, underwritten by government. As the NFIP has expanded, and disaster frequency increased, the program has become exposed to unsustainable risk. The subsidised insurance provides perverse incentives that create more risk and reduce the uptake of resilience measures, as households can afford to stay in high-risk areas without needing to invest in mitigation measures (Cleetus, 2014). By interfering with the price signal, the NFIP has grown from covering 2.1 million homes in 1980 to 5.6 million in 2013 (Insurance Information Agency, 2015) and currently holds US$23 billion in debt (U.S. Government Accountability Office, 2015). While the issues here relate to flood insurance, many of the lessons around perverse incentives and price signals can be applied to cyclone insurance.

Similar lessons can be found in New Zealand, where a government backed insurance pool, the Natural Disaster Fund, is operated by the Earthquake Commission (EQC). The EQC has paid out NZ$6.5 billion in insurance costs following the Canterbury earthquakes in 2010. Due to claims associated with the Canterbury earthquakes, the Natural Disaster Fund is expected to be fully exhausted (EQC, 2013), with any further liabilities needed to be backed by the New Zealand Government.

Retrofitting mitigation evidence in Australia

The avoided costs of cyclone damage resulting from the construction of more resilient housing in South East Queensland (Brisbane and the Gold Coast) has also been modelled (Deloitte Access Economics, 2013). The BCRs of constructing more resilient housing varied greatly. Using the lowest-cost resilience measures, new houses in the highest risk areas had BCRs up to 3.1. However, if the highest-cost resilience measures were implemented on existing houses in low risk inland areas, the BCR was as low as 0.06. No existing houses, regardless of the cost of resilience measures and presence in high risk area, had a BCR above 1. This modelling demonstrates the importance of **targeted** mitigation strategies.

Research undertaken by JCU on the significant drivers of insured losses to residential property from TC Yasi (Smith & Henderson, 2015) provides evidence in favour of mitigation. The main drivers of loss were from roofing damage, window damage and water ingress, with older homes (pre-1981) at most risk. If mitigation measures were targeted at roofing and opening protection (e.g. windows, doors) upgrades for the most at risk houses alone, a significant portion of insured losses could be avoided.

As previously noted, the Productivity Commission has also reported potential low cost mitigation options such as roof tie upgrades could prove cost effective (Productivity Commission, 2014).

Broader economic benefits of mitigation

Research undertaken by KPMG estimated the wider economic benefits of mitigation strategies against all natural disasters, and compared these to a government-backed insurance pool and the business-as-usual system of insurance coverage (KPMG, 2014). Compared to the current system of coverage, a mitigation strategy leads to a 0.05% increase in GDP after a one-in-ten year disaster event, while a pooled insurance model led to a 0.02% *decrease* in GDP.

It is likely that any widespread roll-out of retrofitting mitigation options would have a positive impact on employment opportunities, in particular creating demand for high-skilled construction jobs.

The KPMG findings suggest that, over the long term, government investment in mitigation strategies can have the greatest economic value, rather than post disaster assistance and/or insurance pools.

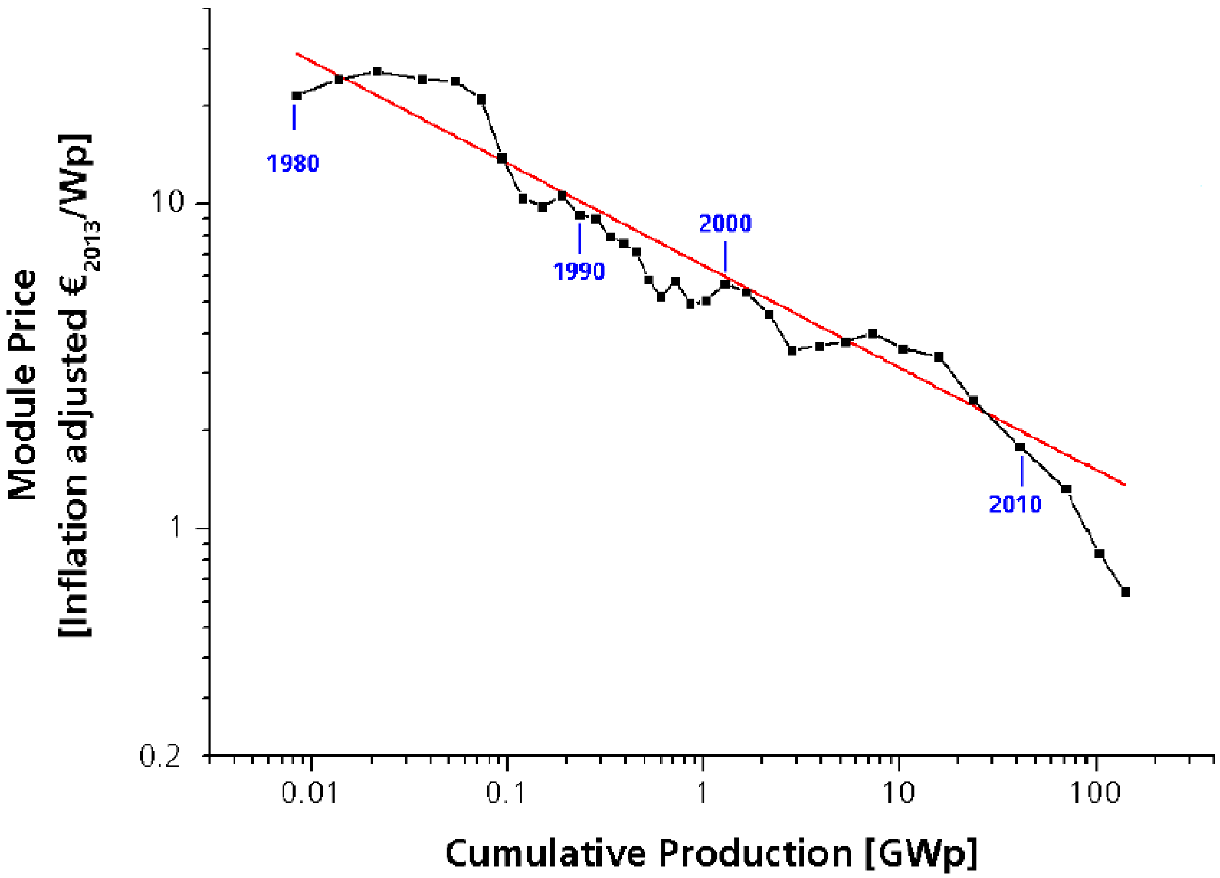
Creation of a retrofitting mitigation market

Benefit-cost outcomes and attractiveness to households of mitigation options will naturally be enhanced by reductions in cost. Such cost reduction can occur through the development of a mitigation market that assists in:

- development of new lower-cost options, through enhanced techniques and innovation (Hearps & McConnell, 2011)
- economies of scale

The former will occur through both research and development and increased experience. Experience curves for other products, notably solar panels, but also for energy-efficiency innovations in the building sector more generally, demonstrate the potential for mitigation options to improve pricing outcomes over time. The capital expenses for solar are forecast to fall in Australia by over 40%, between 2010 and 2030, as the use of solar becomes more widespread (Hearps & McConnell, 2011). In Europe, since 1980 each time the total production of solar doubled (measured in Gigawatt-peak), the price of solar decreased by 20% (Fraunhofer Institute, 2014) (See Table 2-1).

TABLE 2-1 – PRICE LEARNING CURVE ALL BULK SOLAR TECHOLOGIES, EUROPE



NB: Cumulative Production measured in Gigawatt-peak (GWp). Learning rate: over the period 1980-2013, each time the cumulative production doubled, the price decreased by 20%
Source: (Fraunhofer Institute, 2014)

Price gains will vary, according to the type of mitigation product, its design complexity and the materials used as well as the rate of take-up. While households have an infinite range of designs that can make product standardisation challenging, there are some offerings, such as impact-resistant glass, that will lend themselves well to cost reduction over time.

With government and industry body backing, there is potential for a broad-based rollout of cyclone mitigation strategies across Northern Australia, creating a significant market for mitigation. This market could be augmented by exports to other cyclone-prone regions globally.

3 Cost benefit modelling

This chapter details the methodology used to estimate the impact of various mitigation strategies to minimise cyclone impacts on housing in North Queensland.

3.1 MITIGATION OPTIONS

The JCU report identified the most common drivers of loss from TC Yasi as roofing damage, openings damage and water ingress

PICTURE 3-1 – ROOFING DAMAGE

Source: JCU 2011, Tropical Cyclone Yasi Structural damage to buildings

PICTURE 3-2 – OPENINGS DAMAGE

Source: JCU 2011, Tropical Cyclone Yasi Structural damage to buildings

As such, three mitigation options were identified by JCU as the most likely to prevent damage to households from cyclones.

1. Structural roof upgrading
2. Opening protection for doors and windows
3. Community preparedness and awareness campaign – assumed to avoid the large quantity of small claims from untied shade cloths, loose debris in garden, water ingress etc.

The three mitigation options were applied over three different house types:

- House Type A: Pre-1960
- House Type B: 1960-1980
- House Type C: Post-1980

Due to the introduction of stricter building codes in 1981, structural roof upgrading was not considered appropriate for post-1980 houses. Only Mitigation Options 2 and 3 were modelled for post-1980 houses. Further detail on house types is examined in Section 3.2

The Mitigation Options 1 and 2 were costed by JCU under three different scenarios: high cost, low cost and medium cost. Each mitigation option was assumed to perform to the same standard, regardless of cost.

The community preparedness and awareness campaign was costed by Urbis, based on funding for the *Get Ready Queensland* program, which targets disaster prone houses in Queensland. The cost was based on additional annual funding of $1 million (on top of already funded awareness programs) over the 50 year period. This is equivalent to $15 million in Net Present Value (NPV). This was spread proportionally over House Type A, House Type B and post 1980s houses.

TABLE 3-1 – SCENARIO 1 – HIGH COST

MITIGATION TYPE	COST	DETAIL
1. Structural roof upgrading	▪ House Type A: $30,000 (per house) ▪ House Type B: $27,000 (per house)	Complete roof replacement and strapping upgrades
2. Openings protection for windows and doors	$3,500 (per house)	Aftermarket roller door support upgrade ($300) with commercial window covering ($3,200)
3. Community preparedness/awareness campaign	▪ House Type A: $3.1m ▪ House Type B: $3.5m ▪ House Type C: $8.4m	Implement widespread community awareness program; costing based on *Get Ready Queensland* program.

TABLE 3-2 – SCENARIO 2 – LOW COST

MITIGATION TYPE	COST	DETAIL
1. Structural roof upgrading	▪ House Type A and B: $3,000 (per house)	The additional cost of strapping upgrades, assuming house owner is replacing roof for other reasons
2. Openings protection for windows and doors	$1,660 (per house)	Aftermarket roller door support upgrade ($300) with plywood window covering ($1,360); assumed DIY
3. Community preparedness/awareness campaign	Same as Scenario 1	

TABLE 3-3 – SCENARIO 3 – MEDIUM COST

MITIGATION TYPE	COST	DETAIL
1. Structural roof upgrading	▪ House Type A and B: $12,000 (per house)	Roof and strapping upgrades, using over-batten system
2. Openings protection for windows and doors	Same as Scenario 2	
3. Community preparedness/awareness campaign	Same as Scenario 1	

3.2 ESTIMATING BENEFITS

KEY ASSUMPTIONS

Geographical area

The area being modelled is the north-east coast of Queensland that falls into Wind Region C from the Australian/New Zealand wind loading standard 1170.2 (Yang, Nadimpalli, & Cechet, 2014). Of this area, Suncorp Group claims data was available for 71 of a possible 87 postcodes. These 71 postcodes will be the focus of the model.

Housing type

Damage to housing was taken from claims data post TC Yasi supplied by Suncorp Group. Analysis of claims data by JCU found that housing constructed before 1981 performed particularly poorly in terms of cyclone damage against those built after the introduction of stricter building codes in 1981. Looking at pre-1981 houses in more detail, similar levels of housing damage could be attributed to houses of similar design. There are three different housing age groups.

- House Type A: Pre-1960. Houses in this age bracket saw the greatest proportion of houses suffering damage over 10% of the insured value of the house.
- House Type B: 1960-1980. These houses saw a large number of claims, particularly small claims between 0% - 10% of the insured value.
- House Type C: Post-1980. These houses were the best performing age group, due to the introduction of stricter building codes in 1981

TABLE 3-4 – HOUSING STOCK BY AGE BRACKET

TOTAL HOUSING STOCK	HOUSE TYPE A (PRE-1960)	HOUSE TYPE B (1960-1980)	HOUSE TYPE C (POST – 1980)
271,207	52,861	61,867	156,379

Source: RP Data, Suncorp Group
Note: Number of House Type A, B and C are estimates extrapolated using the ratio of house ages in Suncorp Group insured housing stock applied to RP Data on total housing stock.

Uptake of mitigation

For all mitigation options, it was assumed that the uptake rate of mitigation for all houses was 50%. The rate of uptake does not affect the Benefit Cost Ratio of each measure, but does say something about the aggregate level of damage likely to be sustained or avoided.

Wind speeds

Wind speeds were modelled to represent events ranging from a one in five year cyclonic event up to a one in one-thousand year cyclonic event. Each of these events had an associated wind speed, which was risk-adjusted to reflect the probability of such a wind speed occurring in any one year. For example, the wind speed associated with a one in five year event has a 20% chance of occurring in any one year.

Due to the inherent uncertainty with forecasting wind speeds, four different reputable catastrophe models were used in this analysis. Given the range in wind speeds forecast under the different models, outcomes from the two models falling in the middle of the range are presented in detail. The highest and lowest wind speed models are treated as extremes.

The lower of the two middle models will be referred to as Model 1, while the higher will be referred to as Model 2.

Under Model 1 wind speeds, BCRs were effective for the $12,000 roofing upgrade in 39 of 71 postcodes. These 39 postcodes are in high-risk coastal areas.

Results reported for Model 1 include the 39 cost-effective postcodes

Prices

All prices are in 2015 prices.

BENEFIT TYPES

The benefits of the mitigation options were recorded as the difference in avoided damage between the business-as-usual case and the mitigation case.

Avoided damage falls under three categories:

- Housing – this was modelled using JCU fragility matrices, which apportion housing damage through loss as a proportion of total insured value, based on a given house type and wind speed. This is approximately 77% of total benefit of mitigation (avoided loss).
- Contents – this is an additional cost above housing damage. It is assumed to be 20% of housing damage, based on Suncorp claims data. Avoided contents damage accounts for 15% of total benefits.
- Community damage (indirect economic costs) – this is the additional costs over and above housing damage. It includes collateral damage to community and public infrastructure caused by damage to houses as well as broader loss categories such as death and injury, dislocation and service and business disruption. In this modelling, it has been assumed to be 10% of housing damage. This is a conservative estimate based on research by (Walker, Mason, Crompton, & Musulin, 2015). Avoided community damage accounts for 8% of total benefits.

There are a number of other benefits not included in the model, but are important to consider qualitatively such as avoided death and injury (included psychological), avoided dislocation of population and avoided business interruption

The avoided damages flow to different beneficiaries:

- Households through reduced premiums, avoided loss of life and avoided psychological trauma
- Insurers through reduced insured losses (some of which is passed on to households through reduced premiums)
- Community/government through reduced collateral damage to community and public infrastructure.

CALCULATION OF BENEFITS (AVOIDED DAMAGE COSTS)

Avoided damage costs were recorded for a single house of each House Type at a postcode level, and built up to cover the total model area, i.e. the 71 postcodes on the North Queensland coast.

The JCU fragility matrix assigns a probability to each house type of falling into a specific loss-ratio bin, for a given mitigation option in place and the wind speed with which it is hit. The JCU fragility matrix measures damages from wind speeds between 75 and 250 kph. There are wind speeds below 75kph from both cyclonic and non-cyclonic events that are not captured in this matrix but that have the potential to cause damage. Similarly,, wind speeds over 250kph are assumed to inflict the same damage level as 250kph winds; while rare, such winds can and do occur, implying a conservative bias to the estimates presented here. Capturing these wind speeds would increase the BCR estimates presented in this report.

For each postcode, there are specific probabilities for different wind speeds occurring.

House Type A and House Type B are initially assumed to have no mitigation options in place. House Type C is assumed to already have roofing upgrades in place, in line with newer building code standards.

Using wind speed probabilities and probabilities of loss from the JCU fragility matrix, a probability associated loss is assigned at a single house level in each postcode – for a house with no mitigation, Mitigation Option 1, Mitigation Option 2 and Mitigation Option 3.

To find the avoided damage cost for each Mitigation Option, the damage cost to a house with no mitigation is compared to the damage cost of a house with a specific Mitigation Option. The difference between the two damage costs is the avoided damage assigned to that Mitigation Option.

The avoided damage for each Mitigation Option for each House Type is recorded for a single house across each postcode. This is then built up, based on housing stock data, to find the avoided cost for each Mitigation Option and each House Type over the total model area, i.e. the 71 postcodes on the North Queensland coast. A 50% uptake for all mitigation options is assumed. The take-up rate does not affect the benefit cost ratio outcomes for any individual household.

Case Study: Tropical Cyclone Yasi

Using Suncorp Group claims data and fragility matrices provided by JCU, Urbis modelled the change in outcomes that would have occurred for houses damaged by TC Yasi, had proposed mitigation strategies been put in place. This was for Suncorp Group insured houses only.

The community awareness program performed best. It had a BCR well above one for both House Type A, B and C in part due to its low implementation cost.

Other than the community awareness program, outcomes using the low cost mitigation options had the highest BCRs. In particular, the low cost roof strapping upgrade, at $3,000, achieved a BCR above one for both House Type A and House Type B. For House Type A, the roofing upgrade had a BCR of 1.5, while House Type B recorded a BCR of 1.4 for the roofing upgrade.

The openings protection, did not have a BCR above one for either the low or high cost alternatives, for any house type.

TABLE 3-5 – MITIGATION OPTION BCRs, TC YASI

MITIGATION OPTION:	ROOFING	OPENING	COMMUNITY	ROOFING	OPENING	COMMUNITY	OPENING	COMMUNITY
	HOUSE TYPE A (PRE 1960)			HOUSE TYPE B (1960-1980)			HOUSE TYPE C (POST 1980)	
High cost	0.1	0.2	**4.5**	0.2	0.2	**7.7**	0.1	**3.5**
Low cost	**1.5**	0.5	**4.5**	**1.4**	0.4	**7.7**	0.2	**3.5**
Medium cost	0.4	0.5	**4.5**	0.9	0.4	**7.7**	0.2	**3.5**

Source: Urbis modelling, JCU, Suncorp Group

It is important to note that the above results were based on mitigation against a **single** cyclonic event. All mitigation options have considerable lifespans, so it is likely that houses with these mitigation options in place will experience a number of cyclonic events over the course of their effective lifetime. There is therefore scope that the more expensive costings for roofing upgrades and opening protection have a chance of achieving a BCR above one over a longer time period that includes more than one event, particularly the $12,000 over-batten roofing upgrade.

It is also worth noting that TC Yasi did not make landfall over a major regional centre such as Townsville or Cairns. Had a major regional centre been the worst hit region, while the BCRs would not change, the aggregate damage bill would have been considerably larger.

3.3 LOOKING FORWARD

To understand the potential gains over a longer period of time, Urbis modelled the impact of mitigation options on different house types over a 50-year period. Given the conservative nature of the lower bound of the middle catastrophe model wind speeds (Model 1), any mitigation options that return BCRs above one under this model should be considered significant from a policy standpoint.

Mitigation options that return BCRs above one under all four catastrophe models are most likely to be cost-effective.

It is important to note the way the benefits fall. 77% of benefits are avoided cost to the house, 15% of benefits are avoided cost to contents, and 8% of benefits are avoided cost to community.

The outcomes were modelled across North Queensland only. To outline the impact mitigation would have on other cyclone prone regions in Northern Australia differences in cyclone risk, population density, and age of housing stock need to be considered.

3.3.1 OUTCOMES – MITIGATION OPTION 1: ROOFING UPGRADES

Under Scenario 3 (medium cost) the $12,000 roof replacement and strapping upgrades using an over-batten system was considered the most realistic costing option for Mitigation Option 1. A $27,000-$30,000 roofing upgrade was considered too expensive for most households. The $3,000 strapping upgrade in (low cost), while affordable, assumes the owner is replacing the roof already. As such, the modelling results for the medium cost $12,000 Mitigation Option 1 are considered to be optimal for future policy considerations.

For the $12,000 roofing upgrade, Model 1 outcomes produced a BCR of close to 1, while Model 2 BCR outcomes were around four times higher than Model 1. The payback period[2] for House Type A was between 4 and 24 years, while for House Type B it was between 3 and 37 years.

Under all four catastrophe models the $3,000 strapping upgrade returned a BCR above one.

Given the $12,000 roofing upgrade had BCRs above one for both house types, it should be considered as a potentially viable mitigation option.

There is an opportunity for government to mandate roof strapping at the point of any substantive roofing renovation, thus reducing installation costs associated with mitigation.

Suncorp Group has indicated a willingness to run a resilience rating program for households. Older homes would be eligible for premium reductions based on reported mitigation work (Suncorp Group, 2015).

3.3.2 OUTCOMES – MITIGATION OPTION 2: OPENING PROTECTION

Mitigation Option 2 under the $3,500 (high cost) opening protection option, is unlikely to be a viable option. The $1,660 (low cost) option, however, is more affordable and achieved positive outcomes.

The $3,500 option only achieved BCRs above one for either house type under Model 2.

Mitigation Option 2 ($1,660) reduced costs through using a plywood window covering, as opposed to a commercial window covering, and assumed that the protection was self-installed. Significantly, the lower cost option achieved BCRs above one for both house types under both Model 1 and 2. However, payback periods were up to 20 years for each. Under Model 1, a BCR above one was not returned for post-1980 houses.

Given the above findings, the low cost, self-installed $1,660 option appears the most viable.

3.3.3 OUTCOMES – MITIGATION OPTION 3: COMMUNITY AWARENESS PROGRAM

Mitigation Option 3, the community awareness program, is the most cost effective mitigation option presented. The low cost of implementation means only a small level of avoided costs are required to produce a BCR above one.

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[2] Payback period refers to the number of years required for the value of the benefit to outweigh the cost of the mitigation option. As benefits accrue over time, the larger the benefit the shorter the payback period will be. The payback is spread between the bearers of cost; that is the household, insurers and government.

The community awareness program addresses low-hanging fruit such as fencing damage, loose shade cloths, unfixed objects in gardens and minor water ingress. The JCU report found that 86% of total claims for TC Yasi were minor claims, compromising 29% of the total cost.

For all house types, the avoided costs were at least three times the cost of implementation. Furthermore, the cost of implementation was returned in six years or less for all situations.

The community awareness program was cost effective under all four catastrophe models.

It is highly likely that a targeted and effective community education/awareness campaign would also be cost-effective across other cyclone regions of Northern Australia.

4 Implications, recommendations and next steps

It is important to acknowledge that there is inherit variability and uncertainty in forecasting cyclone behaviour, particularly over a lengthy period. For this reason, four separate Wind Models were used to sensitivity test the results and to provide indicative results with a lower and upper bound for BCRs.

The cost benefit modelling for mitigation strategies demonstrates that these can be cost-effective at the right price points in high-risk areas. Implementation of these options can therefore lead to lower premiums for households.

However, households will only undertake mitigation if the reduction in premiums is at least equal to the cost of mitigation. In other words, the lower payout and recovery costs for insurance companies and government that result from mitigation implementation need to be at least in part transferred to households so that they do not bear all the cost of mitigation without any monetary benefit.

A combination of government rebate and lower insurance premiums are likely to be necessary, but can be achieved cost-effectively. The scope of cost-effectiveness may be further increased if a bulk rollout of mitigation options can create economies of scale in a locality. This has been demonstrated with solar panel installation.

The cost of rebates in some instances exceeds the estimated benefit to government via community losses. In these instances, a benefit cost analysis of alternative options needs to be considered to ensure this represents the best outcome. In addition, it is worth exploring further ways to reduce mitigation costs through further detailed research including of enhanced, lower cost product options and large scale roll-outs to achieve economies of scale.

Further research funding

Further funding for research at centres of excellence could help drive improved outcomes – particularly into two key areas.

- Understanding markets and consumers. There is a gap in the understanding of the full range of house types and mitigation options appropriate to each, as well as the drivers of uptake of mitigation measures.

  Households also have other incentives to implement mitigation options, beyond monetary considerations. These include: safety and peace of mind, “keeping up with the Jones'”, and, in some cases, a potential increase in the value of the house.

  Evidence from Florida provides a broad range of reasons behind choosing mitigation (Carson, McCullough, & Pooser, 2013). Regression analysis found that financial reasons such as income, cost of mitigation, value of the house, and price of and potential reductions in insurance premiums are all key drivers. However, non-financial factors influence the decision to mitigate, notably the number of openings the house has (reflecting potential vulnerability), whether children live in the house, and whether other homes in the neighbourhood are undertaking mitigation measures.

  There are other simple factors influencing the uptake of mitigation. Empirical evidence in Australia suggests that a major stumbling block for homes to undertake mitigation is aesthetics. Effective, yet visually unappealing mitigation measures are unlikely to see widespread implementation.

- Developing optimal mitigation products. Specifically, mitigation methods that are both effective and popular with homeowners and can drive lower prices though economies of scale and continuation along experience curves.

These two areas are complementary. In Florida, a range of mitigation products have been developed, yet the level of uptake has varied as the understanding of the market – much broader than in Queensland – is still incomplete. There is an opportunity for research to help optimise the market in North Queensland and globally.

Certification of mitigation

Insurance companies need assurances that mitigation work done, whether installed professionally or by the homeowner, is of an acceptable standard. There are two potential certification programs to address this issue, as outlined by JCU (Smith & Henderson, 2015).

Formal assessment of property risk undertaken by a qualified inspector. Should the property pass assessment, reduced premiums can be passed on to the homeowner. Benefits are wide ranging, including increasing awareness in the wider community, in addition to building resilience through higher standards of building. Although the estimated cost is $500-$1,000 per household, certification is likely to produce enhanced outcomes for retrofits and damage avoidance .

Self-assessment system, potentially online or through a mobile application, supported by some level of auditing. This provides a more affordable option than a formal assessment. The key difficulty is for the homeowner to provide reliable information. Auditing, undertaken by the insurer – potentially on an ad hoc basis – can help to educate and support homeowners in providing information.

A combination of the approaches outlined above may prove to be the most effective. Further research is required to determine the optimal approach, including a cost-benefit analysis to compare cost of certification against the benefits of enhanced standards of retrofitting.

Potential premium reductions

Undertaking mitigation reduces the risk and magnitude of damage to a household. Furthermore, mitigation strategies such as the community awareness campaign can reduce the large number of minor claims that typically result from a cyclone which are also administratively burdensome for householders and insurance companies. These improved outcomes provide scope for potential reductions in insurance premiums.

There may be a case for introducing substantial rebates, at least in the initial stages of roll out, if further analysis can demonstrate that mitigation is a more cost-effective strategy for the Federal Government than the reinsurance pool or mutual insurance options. Unlike a reinsurance pool or mutual insurance, mitigation strategies address actual damage, rather than shifting the costs from households (premium prices) and insurers (insured losses) to government.

Mitigation efforts can result in lower premium outcomes. They are therefore worth consideration by the Taskforce, alongside other potential measures.

Appendix A Detailed cost benefit modelling results

The following appendix includes detailed cost breakdowns, benefits, BCRs and payback periods[3] for two different models (Model 1 and Model 2) – assuming 50% take-up of each mitigation option – as well as for the TC Yasi modelling.

3 Payback period refers to the number of years required for the value of benefit to outweigh cost of mitigation option

MODEL 1– 39 OF 71 POSTCODES

TABLE A-1 – HIGH COST

MITIGATION OPTION	COSTS[1]	NET BENEFIT[1]				BCR	PAYBACK PERIOD
		TOTAL	HOUSES	CONTENTS	COMMUNITY		
HOUSE TYPE A (PRE 1960)							
Roofing option – Complete roof replacement and strapping upgrade	$327 m	- $156 m	- $120 m	- $24 m	- $12 m	0.5	> 50 years
Opening protection	$38 m	- $14 m	- $11 m	- $2.1 m	- $1.1 m	0.6	> 50 years
Community preparedness/awareness campaign	$3.1 m	$7.3 m	$5.6 m	$1.1 m	$0.6 m	3.3	6 years
HOUSE TYPE B (1960 - 1980)							
Roofing option – Complete roof replacement and strapping upgrade	$310 m	- $154 m	- $118 m	- $24 m	- $12 m	0.5	> 50 years
Opening protection	$40 m	- $17 m	- $13 m	- $2.7 m	- $1.3 m	0.6	> 50 years
Community preparedness/awareness campaign	$3.5 m	$8.9 m	$6.8 m	$1.4 m	$0.7 m	3.5	6 years
HOUSE TYPE C (POST 1980)							
Community preparedness/awareness campaign	$4.2 m	$17 m	$13 m	$2.7 m	$1.3 m	3.1	6 years

[1] NPV over 50 years
** Columns may not add due to rounding*

Source: Urbis modelling, JCU, Suncorp Group

TABLE A-2 – LOW COST

MITIGATION OPTION	COSTS[1]	NET BENEFIT[1]				BCR	PAYBACK PERIOD
		TOTAL	HOUSES	CONTENTS	COMMUNITY		
HOUSE TYPE A (PRE 1960)							
Roofing option – strapping upgrade only	$33 m	$118 m	$91 m	$18 m	$9.1 m	4.6	4 years
Opening protection	$18 m	$5.0 m	$3.9 m	$0.8 m	$0.4 m	1.3	21 years
Community preparedness/awareness campaign	Same as high cost scenario						
HOUSE TYPE B (1960 - 1980)							
Roofing option –strapping upgrade only	$34 m	$104 m	$80 m	$16 m	$7.9 m	4.0	4 years
Opening protection	$19 m	$2.3 m	$1.8 m	$0.4 m	$0.2 m	1.1	29 years
Community preparedness/awareness campaign	Same as high cost scenario						
HOUSE TYPE C (POST 1980)							
Community preparedness/awareness campaign	Same as low cost scenario						

[1] NPV over 50 years
** Columns may not add due to rounding*
Source: Urbis modelling, JCU, Suncorp Group

TABLE A-3 – MEDIUM COST

MITIGATION OPTION	COSTS[1]	NET BENEFIT[1]				BCR	PAYBACK PERIOD
		TOTAL	HOUSES	CONTENTS	COMMUNITY		
HOUSE TYPE A (PRE 1960)							
Roofing option – over-batten system	$131 m	$27 m	$21 m	$4.1 m	$2.1 m	1.2	24 years
Opening protection	Same as low cost scenario						
Community preparedness/awareness campaign	Same as high cost scenario						
HOUSE TYPE B (1960 - 1980)							
Roofing option – over-batten system	$138 m	$7.0 m	$5.4 m	$1.1 m	$0.5 m	1.05	37 years
Opening protection	Same as low cost scenario						
Community preparedness/awareness campaign	Same as high cost scenario						
HOUSE TYPE C (POST 1980)							
Community preparedness/awareness campaign	Same as high cost scenario						

[1] NPV over 50 years
** Columns may not add due to rounding*

Source: Urbis modelling, JCU, Suncorp Group

MODEL 1 – ALL 71 POSTCODES

TABLE A-4 – HIGH COST

MITIGATION OPTION	COSTS[1]	NET BENEFIT[1]				BCR	PAYBACK PERIOD
		TOTAL	HOUSES	CONTENTS	COMMUNITY		
HOUSE TYPE A (PRE 1960)							
Roofing option – Complete roof replacement and strapping upgrade	$793 m	- $503 m	- $387 m	- $77 m	- $39 m	0.4	> 50 years
Opening protection	$93 m	- $52 m	- $40 m	- $8 m	- $4.0 m	0.4	> 50 years
Community preparedness/awareness campaign	$3.1 m	$14 m	$11 m	$2.2 m	$1.1 m	5.5	4 years
HOUSE TYPE B (1960 - 1980)							
Roofing option – Complete roof replacement and strapping upgrade	$835 m	- $529 m	- $407 m	- $81 m	- $41 m	0.4	> 50 years
Opening protection	$108 m	- $64 m	- $49 m	- $10 m	- $4.9 m	0.4	> 50 years
Community preparedness/awareness campaign	$3.5m	$20 m	$16 m	$3.1 m	$1.6 m	6.8	4 years
HOUSE TYPE C (POST 1980)							
Community preparedness/awareness campaign	$8.4 m	$36 m	$28 m	$5.5 m	$2.8 m	5.3	4 years

[1] NPV over 50 years
** Columns may not add due to rounding*

Source: Urbis modelling, JCU, Suncorp Group

TABLE A-5 – LOW COST

MITIGATION OPTION	COSTS[1]	NET BENEFIT[1]				BCR	PAYBACK PERIOD
		TOTAL	HOUSES	CONTENTS	COMMUNITY		
HOUSE TYPE A (PRE 1960)							
Roofing option –strapping upgrade only	$79 m	$164 m	$126 m	$25 m	$13 m	3.1	6 years
Opening protection	$44 m	-$6.8 m	- $5.2 m	- $1.0 m	- $0.5 m	0.8	> 50 years
Community preparedness/awareness campaign	Same as high cost scenario						
HOUSE TYPE B (1960 - 1980)							
Roofing option – strapping upgrade only	$93 m	$165 m	$127 m	$25 m	$13 m	2.8	6 years
Opening protection	$51 m	- $11 m	- $8.2 m	- $1.6 m	- $0.8 m	0.8	> 50 years
Community preparedness/awareness campaign	Same as high cost scenario						
HOUSE TYPE C (POST 1980)							
Community preparedness/awareness campaign	Same as high cost scenario						

[1] *NPV over 50 years*
** Columns may not add due to rounding*

Source: Urbis modelling, JCU, Suncorp Group

TABLE A-6 – MEDIUM COST

MITIGATION OPTION	COSTS[1]	NET BENEFIT[1]				BCR	PAYBACK PERIOD
		TOTAL	HOUSES	CONTENTS	COMMUNITY		
HOUSE TYPE A (PRE 1960)							
Roofing option – over-batten system	$317 m	- $58 m	- $45 m	- $8.9 m	- $4.5 m	0.8	> 50 years
Opening protection	Same as low cost scenario						
Community preparedness/awareness campaign	Same as high cost scenario						
HOUSE TYPE B (1960 - 1980)							
Roofing option – over-batten system	$371 m	- $96 m	- $74 m	- $15 m	- $7.4 m	0.7	> 50 years
Opening protection	Same as low cost scenario						
Community preparedness/awareness campaign	Same as high cost scenario						
HOUSE TYPE C (POST 1980)							
Community preparedness/awareness campaign	Same as high cost scenario						

[1] NPV over 50 years
** Columns may not add due to rounding*

Source: Urbis modelling, JCU, Suncorp Group

MODEL 2 – ALL 71 POSTCODES

TABLE A-7 – HIGH COST

MITIGATION OPTION	COSTS[1]	NET BENEFIT[1]				BCR	PAYBACK PERIOD
		TOTAL	HOUSES	CONTENTS	COMMUNITY		
HOUSE TYPE A (PRE 1960)							
Roofing option – Complete roof replacement and strapping upgrade	$793 m	$295 m	$227 m	$45 m	$23 m	1.4	18 years
Opening protection	$93 m	$91 m	$70 m	$14 m	$7 m	2.0	10 years
Community preparedness/awareness campaign	$3.1 m	$41 m	$31 m	$6.2 m	$3.1 m	13.6	<1 year
HOUSE TYPE B (1960 - 1980)							
Roofing option – Complete roof replacement and strapping upgrade	$835 m	$398 m	$306 m	$61 m	$31 m	1.5	16 years
Opening protection	$108 m	$83 m	$64 m	$13 m	$6.4 m	1.8	12 years
Community preparedness/awareness campaign	$3.5 m	$55 m	$42 m	$8.5 m	$4.2 m	16.3	<1 year
HOUSE TYPE C (POST 1980)							
Community preparedness/awareness campaign	$8.4 m	$111 m	$86 m	$17 m	$6.9 m	13.7	<1 year

[1] NPV over 50 years
** Columns may not add due to rounding*

Source: Urbis modelling, JCU, Suncorp Group

TABLE A-8 – LOW COST

MITIGATION OPTION	COSTS[1]	NET BENEFIT[1]				BCR	PAYBACK PERIOD
		TOTAL	HOUSES	CONTENTS	COMMUNITY		
HOUSE TYPE A (PRE 1960)							
Roofing option –strapping upgrade only	$79 m	$962 m	$740 m	$148 m	$74 m	13.1	2 years
Opening protection	$44 m	$136 m	$105 m	$21 m	$10 m	4.1	4 years
Community preparedness/awareness campaign	Sa me as high cost scenario						
HOUSE TYPE B (1960 - 1980)							
Roofing option – strapping upgrade only	$93 m	$1,092 m	$840 m	$168 m	$84 m	12.8	2 years
Opening protection	$51 m	$137 m	$105 m	$21 m	$11 m	3.7	5 years
Community preparedness/awareness campaign	Same as high cost scenario						
HOUSE TYPE C (POST 1980)							
Community preparedness/awareness campaign	Same as high cost scenario						

[1] NPV over 50 years
** Columns may not add due to rounding*
Source: Urbis modelling, JCU, Suncorp Group

TABLE A-9 – MEDIUM COST

MITIGATION OPTION	COSTS[1]	NET BENEFIT[1]				BCR	PAYBACK PERIOD
		TOTAL	HOUSES	CONTENTS	COMMUNITY		
HOUSE TYPE A (PRE 1960)							
Roofing option – over-batten system	$317 m	$740 m	$569 m	$114 m	$57 m	3.3	5 years
Opening protection	Sa me as low cost scenario						
Community preparedness/awareness campaign	Sa me as high cost scenario						
HOUSE TYPE B (1960 - 1980)							
Roofing option – over-batten system	$371 m	$832 m	$640 m	$128 m	$64 m	3.2	5 years
Opening protection	Same as low cost scenario						
Community preparedness/awareness campaign	Same as high cost scenario						
HOUSE TYPE C (POST 1980)							
Community preparedness/awareness campaign	Same as high cost scenario						

[1]NPV over 50 years
** Columns may not add due to rounding*
Source: Urbis modelling, JCU, Suncorp Group

TC YASI CASE STUDY

TABLE A-10– HIGH COST

MITIGATION OPTION	COST	AVOIDED COST	BCR
HOUSE TYPE A (PRE 1960)			
Roofing option – Complete roof replacement and strapping upgrade	$129 m	$19 m	0.15
Opening protection	$14 m	$3.2 m	0.23
Community preparedness/awareness campaign	$0.2 m	$0.9 m	4.5
HOUSE TYPE B (1960 - 1980)			
Roofing option – Complete roof replacement and strapping upgrade	$192 m	$31 m	0.16
Opening protection	$25 m	$4.9 m	0.20
Community preparedness/awareness campaign	$0.2 m	$1.8 m	7.72
HOUSE TYPE C (POST 1980)			
Community preparedness/awareness campaign	$0.6 m	$2.6 m	4.59

** Columns may not add due to rounding*

Source: Urbis modelling, JCU, Suncorp Group

TABLE A-11 – LOW COST

MITIGATION OPTION	COST	AVOIDED COST	BCR
HOUSE TYPE A (PRE 1960)			
Roofing option –strapping upgrade only	$12 m	$19 m	1.55
Opening protection	$6.7 m	$3.2 m	0.48
Community preparedness/awareness campaign	Same as high cost scenario		
HOUSE TYPE B (1960 - 1980)			
Roofing option –strapping upgrade only	$21 m	$31 m	1.44
Opening protection	$12 m	$4.9 m	0.42
Community preparedness/awareness campaign	Same as high cost scenario		
HOUSE TYPE C (POST 1980)			
Community preparedness/awareness campaign	Same as high cost scenario		

** Columns may not add due to rounding*
Source: Urbis modelling, JCU, Suncorp Group

TABLE A-12 – MEDIUM COST

MITIGATION OPTION	COST	AVOIDED COST	BCR
HOUSE TYPE A (PRE 1960)			
Roofing option – over-batten system	$48 m	$19 m	0.39
Opening protection	Same as low cost scenario		
Community preparedness/awareness campaign	Same as high cost scenario		
HOUSE TYPE B (1960 - 1980)			
Roofing option – over-batten system	$36 m	$31 m	0.86
Opening protection	Same as low cost scenario		
Community preparedness/awareness campaign	Same as high cost scenario		
HOUSE TYPE C (POST 1980)			
Community preparedness/awareness campaign	Same as high cost scenario		

** Columns may not add due to rounding*

Source: Urbis modelling, JCU, Suncorp Group

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